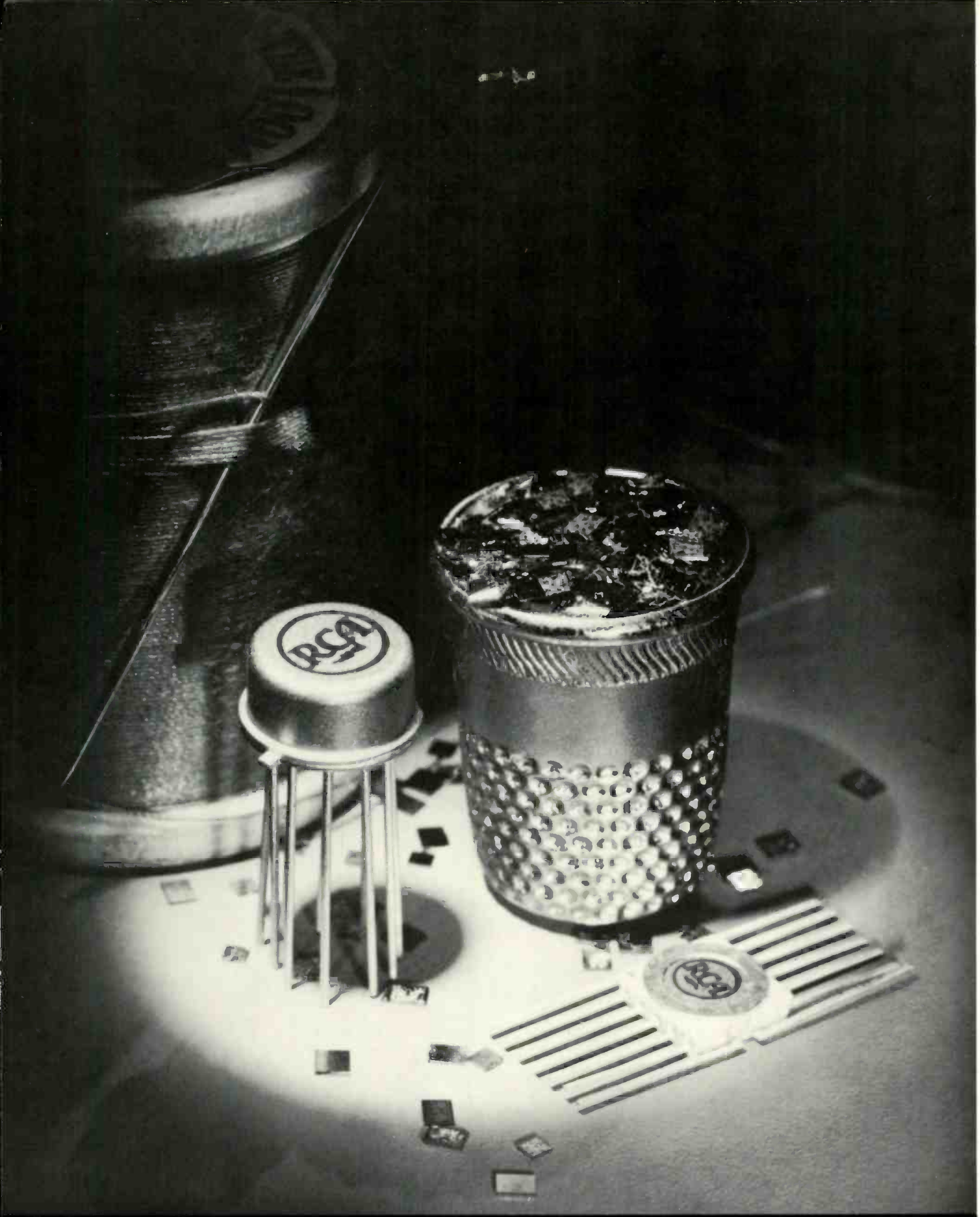
ELECTRONIC AGE

RCA

Spring 1966



Small enough to slip through the eye of a needle, tiny enough to fit by the thousands into a thimble, minuscule integrated circuits are making possible a new generation of lightweight devices in communications, instrumentation, and aerospace and military systems. The paper-thin chips of silicon carry as many as 40 discrete electronic components. A further refinement in the technology that developed the electron tube and the solid-state transistor, they promise ultimately to make possible pocket-size and thin-screen wall TV sets no more than two or three inches thick.

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Cover: An array of television screens illustrates the variety of color TV programs on NBC. The gamut includes news programs, continuing shows, and "specials" that have been shown and may be rerun. Mark of the medium's growth is the switch to color telecasting at all networks. NBC viewers, for instance, will enjoy 100 per cent color programming during prime evening time, next fall. An article on color TV begins on page 2.

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RCA Vol. 25/No. 2 Spring 1966

The Coming of the All-Color Era

Color television reaches maturity as all nighttime network programs for 1966-67 are scheduled for color.

by Domenick J. Giofre

On March 9, 1965, a new era began in the history of color television.

That day, NBC-TV announced its "Full Color Network" schedule for the 1965-66 season — 96 per cent of its nighttime schedule (27 of 29 programs) in color — to top every prior record, dating back to 1954 when a total of 68 color hours were broadcast. It was a dramatic announcement, accelerating the all-color era by as much as 10 years, according to industry experts.

NBC color steamrolled. In subsequent months, CBS increased its color programming to 51 per cent of the nighttime schedule. ABC blossomed to a full-fledged 50 per cent nighttime color network.

Virtually every program of major importance in the 1965-66 season was broadcast in color. Most news programs, once believed to be bastions of black-and-white, surmounted numerous production problems and made the switch to color; one result being the tremendous growth in the use of color film in the coverage of the news.

Since the 1965-66 season was the year of the color breakthrough, when the time came to plan the 1966-67 network schedules, color was almost taken for granted. Programmers accepted the fact that color was no longer an underlying added ingredient for consideration. It was, instead, as vital to a program as a producer or a writer.

Thus, when the three networks announced their 1966-67 nighttime schedules, *every* program was in color.

DOMENICK J. GIOFRE is Assistant Trade News Editor at NBC.

It took, however, more than one network's efforts to bring color TV to its current peak. Its development since 1953 — when current color standards were approved by the FCC — was not without a struggle.

In its infancy, color TV faced one of the most complex marketing problems in industry — explained by Wall Street pessimists as a "vicious cycle." To sell color sets, dealers required more programming. To justify more programming, broadcasters needed more sets in use.

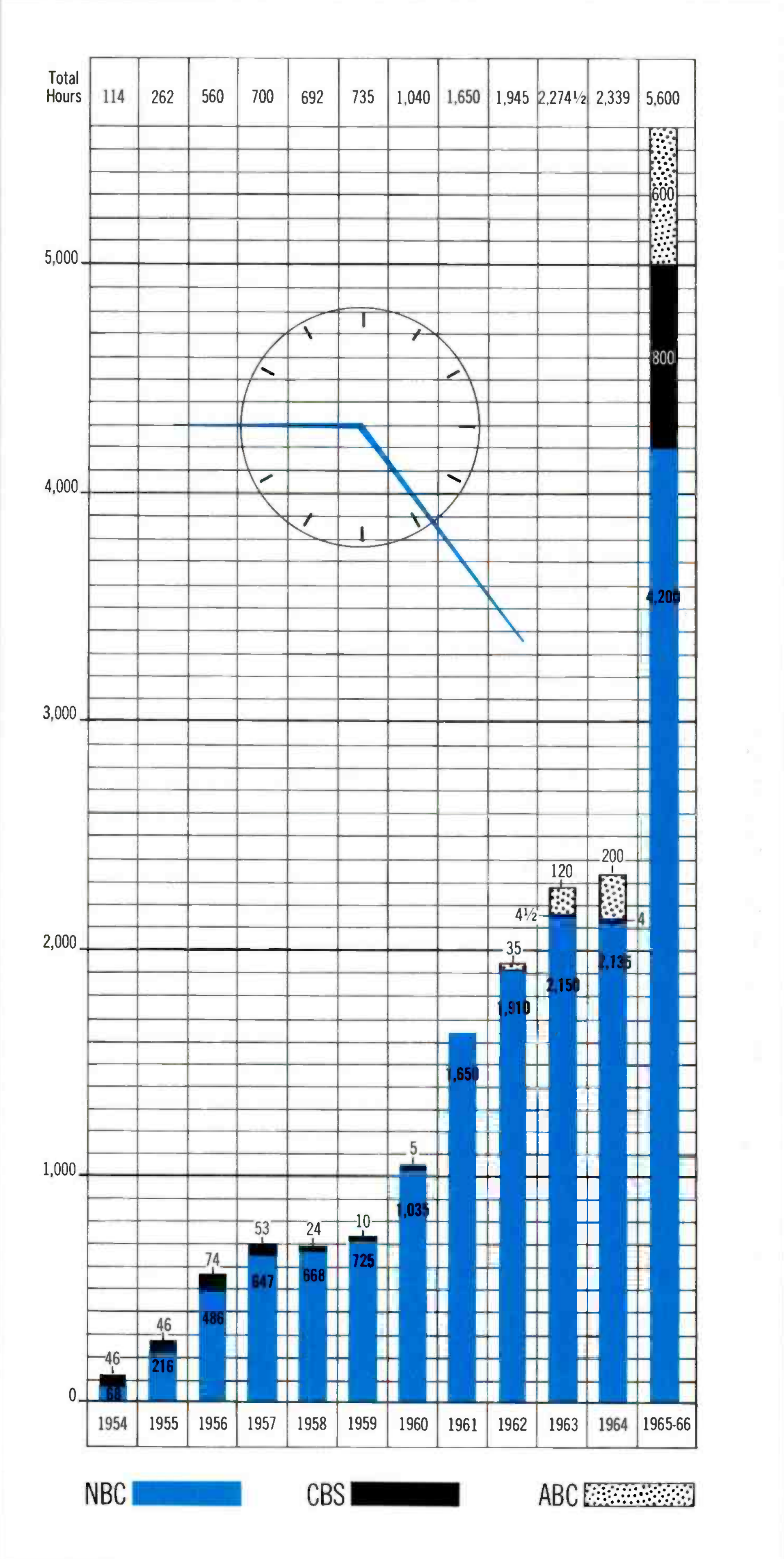
The "vicious cycle," however, proved to be a "growth cycle." Dealers *did* sell more sets, networks *did* program more color, and advertisers *did* sponsor more colorcasts.

In 1960, only six years after the birth of commercial color TV, the new industry grossed $100 million. By comparison, it took the automobile industry 12 years to reach the $100-million mark, the aircraft industry 25 years, and the petroleum industry 40 years. Although color blossomed in an era of the smaller dollar, the $100-million mark is a notable milestone sought by every industry.

The rapid development of color broadcasting and the steady annual increases in color hours broadcast since 1954 were possible also because local broadcasters entered color production.

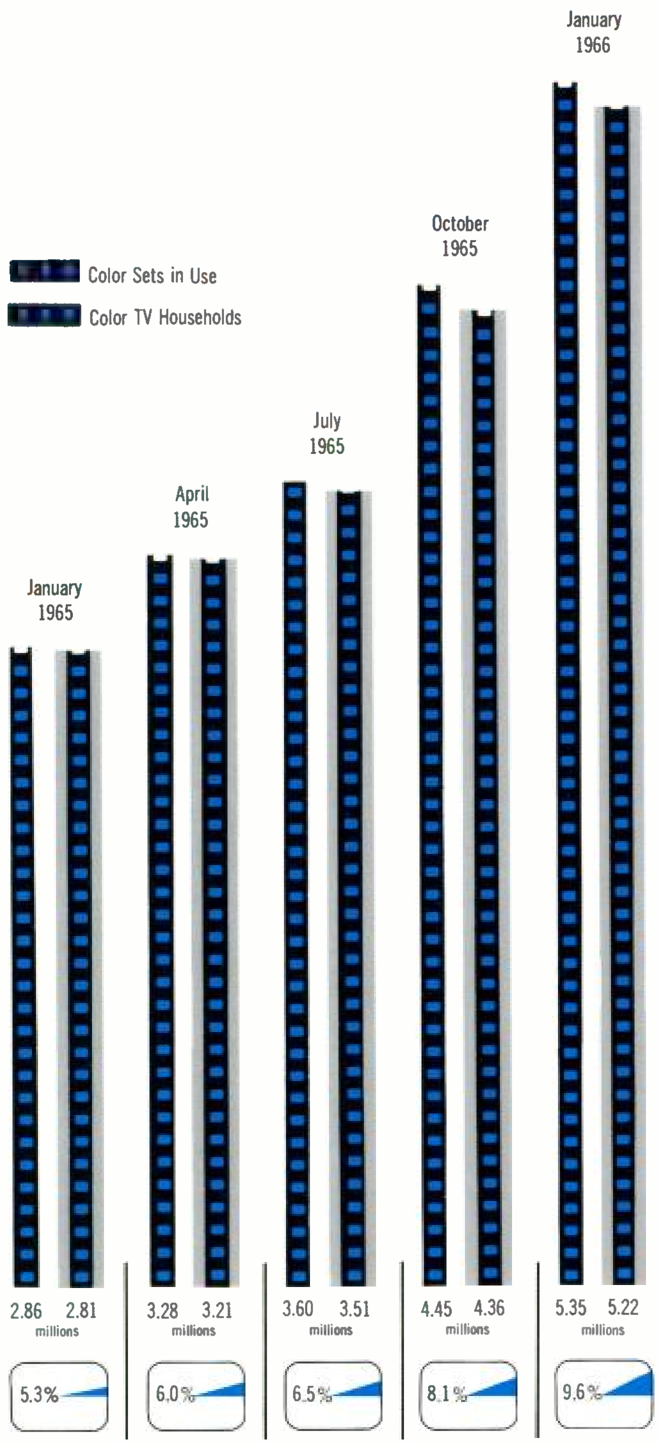
Stations experimented with color several years before network color programming started. As early as 1955, two years after the FCC's approval of compatible color TV, stations were constructed for color.

These pioneer stations were convinced of the capability of color. Not only did they equip themselves for color broad-



Growth of network Color TV programming hours 1954-65.

Growth in 1965 of Color TV sets in use and Color TV households.



Color Households As Per Cent of All TV Households

casting but they also promoted the new medium — to consumers, sponsors, prospective advertisers, advertising agencies, retail television dealers, and any one person or group that would lend an ear or an eye.

Color was essential to stations for many important reasons:

First, color brought added prestige and identified the station with this major advance in mass communications.

Second, color attracted new clients and sponsors because advertisers recognized it as an exceptional tool for merchandising. Stations reported increases in sales volume directly attributable to the addition of color.

Third, higher program ratings resulted from color programs.

Fourth, the impact of color commercials was shown to be 55 per cent greater than the impact of black-and-white commercials.

Fifth, local retail promotions of color helped build a strong viewer image of a progressive station and also created excellent relations with merchants, which in turn developed new business.

Sixth, TV stations, like other businesses, could not stand still and color represented the future of TV programming.

The efforts of the color pioneers were fruitful. By the close of 1965, nine out of 10 commercial TV stations had some form of color capability. According to a recent survey, 519 of the 585 stations broadcast color. Of the 519 stations, a total of 505 transmit network color, 320 air color slides, 76 broadcast live color, 327 are equipped to show color film, and 167 have color video tape recorders.

The rapid growth of color TV has made it difficult for manufacturers to keep up with the demand for color sets. In 1965, color TV was the biggest individual item in retail dollar value among the major household appliances, accounting for $1.5 billion in retail sales. And at the close of 1965, the total of U.S. color television households was estimated at 5,220,000. This was an increase of 2,410,000 color TV households, a gain of more than 85 per cent over the color households figure of 2,810,000 at the start of 1965. The number of color homes added during 1965 was double the increase in color home circulation during 1964.

The prospects are great for an expanded color audience during the current year as a result of the vastly enlarged capacity of tube and receiver manufacturers to meet the continued strong consumer demand in 1966. On the basis of these factors, one reliable industry source predicts that by the end of 1966 color home circulation will approach the 10-million mark.

One unusual pattern in color's growth was noted in statistics released by the Electronic Industries Association. Figures over the past two years showed that the second half of the year accounted for more than twice as many color set sales as the first half. A total sales volume of nearly 2 million sets was achieved in the second half of 1965, a gain of 110 per cent over sets sold to retailers in the comparable period during 1964.

Consumer demand and production capacity have increased to such a degree that the Radio Corporation of America has raised its forecast of 1966 industry color television set sales by 1 million sets to a total of 5.5 million units.

The new estimate, double last year's sales total, will result in retail sales of nearly $3 billion, thus equaling for the first time the total consumer dollar volume of all other home entertainment products.

As an example of the speed with which the industry is building new facilities to meet the booming consumer demand, RCA's new television receiver plant in Memphis, Tenn., is expected to start turning out black-and-white receivers in May, less than five months from the start of construction. The $20-million Memphis facility will free space at RCA's Bloomington, Ind., plant for more color production.

Prior to the opening of the new Memphis plant, all of RCA's home instrument operations had been concentrated in Indiana, where approximately 15,000 employees are engaged in the production, design, and marketing of RCA Victor color and black-and-white television sets, "Victrola" phonographs and stereo units, radios, and tape recorders.

RCA spent more than $130 million to establish color as a new industry before realizing a profit from the venture. Now color TV is closely retracing the phenomenal growth curve of black-and-white television in the early 1950s and has become the fastest-growing new product in the world.

This growth mirrors a combination of factors: steadily declining retail prices; sharply increasing color programming at both local and network levels; the broadest selection of color receivers in history; and a growing awareness of the new dimension color adds to television.

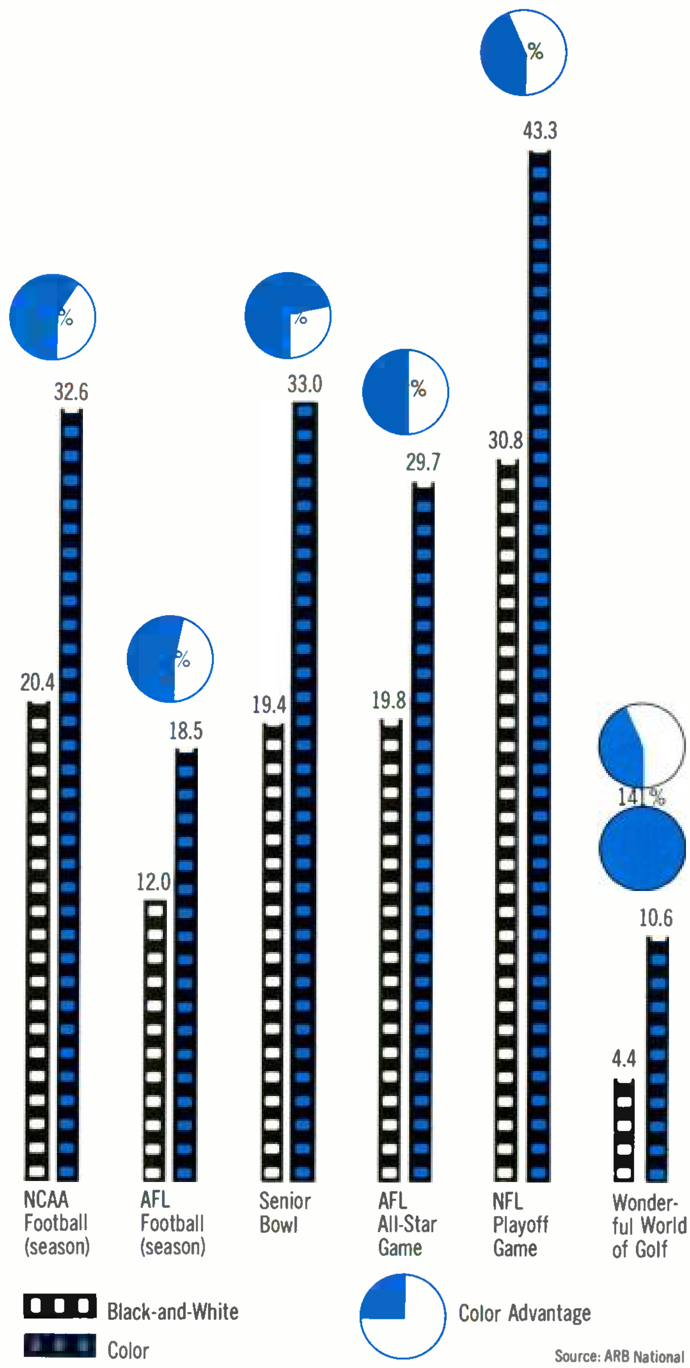
Although black-and-white television sets are continuing to sell at an all-time-high rate (in terms of units), the industry's color television retail dollar volume in 1965 for the first time exceeded that of black-and-white.

In 1963, for example, the retail volume of color sets was only $450 million. Within the next five years, the volume of retail dollar sales is expected to more than triple the 1965 figure. Aiding immensely in this growth will be an area of TV programming directed at a somewhat exclusive audience.

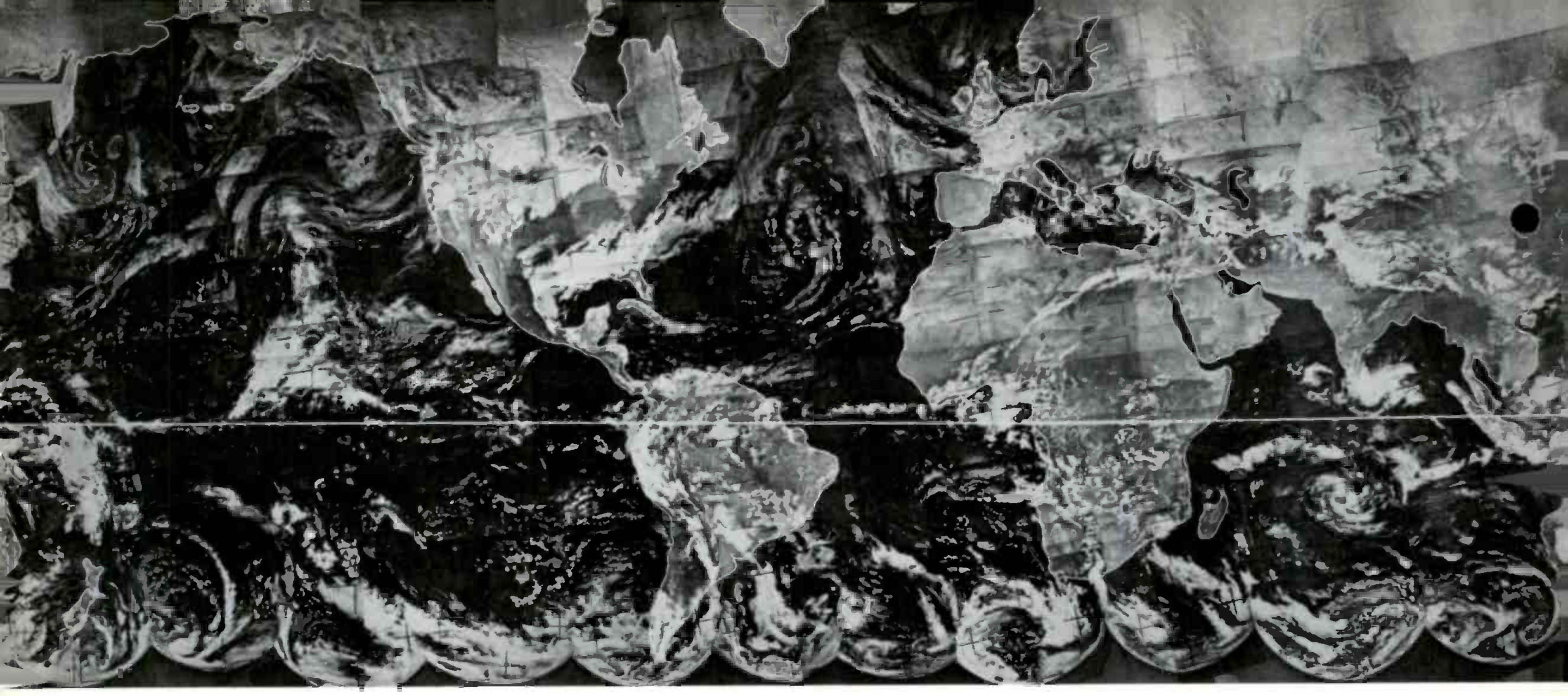
Color has had a tremendous impact on television sports, and has added a new dimension to the armchair sports fan's viewing. Be it a Saturday or Sunday in May or December, with the addition of color the fan is all but sitting in the ball park or the stadium.

With network color programming now pushing the 100 per cent mark, with local programmers turning more and more to color, with the continuing rapid growth in the number of U.S. color households, and with the record retail dollar volume being rung up in color set sales, the boundaries of color television seem limitless. ■

Major TV sports viewing in Color compared with Black-and-White.



(Figures above represent percentage of TV households.)



Weather conditions prevailing over the earth's entire surface are seen in this mosaic of photographs taken by TIROS 9 on February 13, 1965.

Pictures from Space

by Irwin M. Krittman

The youthful art of space flight is more heavily populated than any other field of technology with "firsts" that stir the emotions and memories of all who took part in their achievement.

To a group of us at RCA's Space Center in Princeton, New Jersey, no experience is likely to match in its sense of excitement and triumph an event that occurred just six years ago, on April 1, 1960. On that morning the National Aeronautics and Space Administration launched from Cape Canaveral (now Cape Kennedy) the world's first television weather satellite, TIROS 1.

As part of the team that had developed and built the TIROS system, we watched in suspense at our backup ground station as the countdown was delayed seconds before launch by a leak in the fuel supply of the Thor-Able rocket. The mishap was remedied quickly, and TIROS 1 left the earth in a perfect launch.

Several hours later, the ground stations began receiving the first televised pictures from more than 400 miles above the earth. Although the camera's initial angle was poor and there was some evidence of lens distortion, the pictures clearly showed the earth and its curvature. An exciting new era of space photography was born.

On that spring morning in 1960, space technology was still in its infancy. Sputnik 1, the first artificial satellite, had been placed in orbit by the Soviet Union only two and a half years before, on October 4, 1957. A few months later, the United States launched its first successful satellite — Explorer 1 — and the first space probe to prove the existence of trapped radiation belts about the earth. In October, 1959, the Soviet spacecraft Lunik 3 transmitted the first pictures of the far side of the moon.

TIROS 1 was soon followed by a number of other important space "firsts." Telstar 1, the first active-repeater communications satellite, was launched on July 10, 1962. Ranger 7 sent back to earth the first close-up pictures of the moon's surface 68 hours after its launch on July 28, 1964. On July 14, 1965, Mariner 4, after a flight of 228 days and 325 million miles, successfully transmitted the first pictures of the surface of Mars. This past February 3, Russia's Luna 9 made the first soft landing on the moon. With the launching of ESSA 1 on February 3 and ESSA 2 on February 28 of this year — both of them operational models of the TIROS series — the United States initiated the first comprehensive program of world weather observation. And then there are those equally significant milestones in space established by the manned spacecraft programs of Vostok, Voskhod, Mercury, and Gemini.

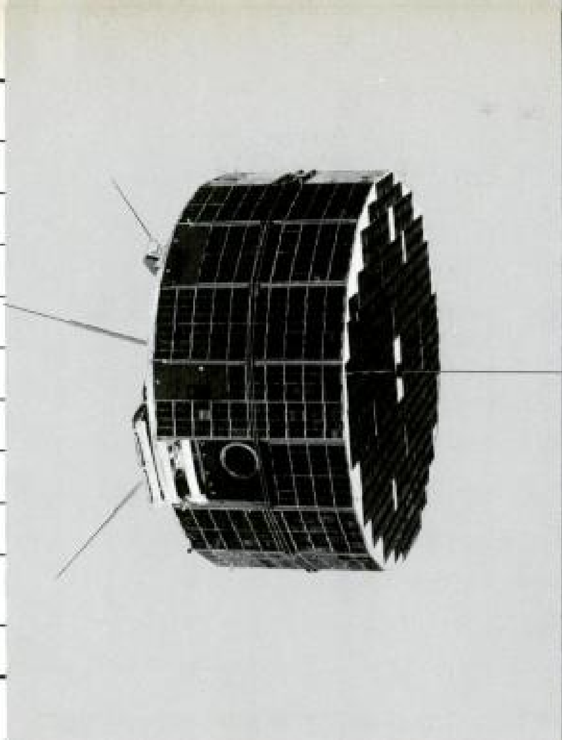
But for those of us at RCA's Astro-Electronics Division who worked on the program, TIROS 1 will remain our personal space "first" and the one that brings that special glow of pride felt by all who have contributed to the advancement of man's knowledge through space technology.

IRWIN M. KRITTMAN is a project systems engineer in the Physical Research Group of RCA's Astro-Electronics Division.

TIROS HIGHLIGHTS

TIROS SATELLITE	USEFUL LIFE (DAYS)	TOTAL TV PICTURES	PERFORMANCE
I 4-1-60	89	23,000	• PROVED TV OPERATION IN SPACE FEASIBLE
II 1[illegible]0	376	36,100	• ICE FLOES • MAGNETIC ATTITUDE CONTROL
III 7-12-61	230	35,000	• FIRST HURRICANE OBSERVATION • ADVANCE STORM WARNING
IV 2-8-62	161	32,600	• INTERNATIONAL USE OF DATA • PROJECT TIREC
V 6-19-62	321	58,200	• BROADER COVERAGE • HURRICANE WATCH
VI 9-18-62	389	66,600	• HURRICANE WATCH • MERCURY MA-8, MA-9
VII 6-19-63	928*	122,500	• PROJECT BRIGHT CLOUD • INDIAN OCEAN EXPEDITION
VIII 12-21-63	743*	97,200/4,100	• WORLD-WIDE USE OF DIRECT-READOUT APT SYSTEM
IX 1-22-65	345*	67,900	• WHEEL CONFIGURATION • NEAR-POLAR ORBIT • DAILY GLOBAL COVERAGE
X 7-1-65	185*	56,900	• HURRICANE WATCH • NEAR-POLAR ORBIT
TOTAL	3,767	600,100	* STILL OPERATIONAL AS OF 1-1-66

Launching dates and achievements of the RCA-built TIROS series of weather satellites.



Cameras aboard the ESSA 1 satellite are taking cloud pictures and transmitting them to ground stations.

The Persian Gulf area is outlined in this photo taken by ESSA 1 during one of its orbits.

In only six years the art of space photography has proved itself an invaluable tool in space exploration programs.

Six years and more than 650,000 pictures later, the science of space photography initiated by TIROS 1 is still a most important and fascinating aspect of space technology. Space mission planners in both the United States and the Soviet Union recognized at the outset that photography could make a significant contribution to our limited knowledge of the space environment. More than a dozen missions involving scores of satellites have centered about or at least included space cameras. These missions can be classified as follows:

— Earth weather and mapping (TIROS 1 through 10 and ESSA 1 and 2).

— Lunar and deep space probes (Lunik 3, Ranger 7 through 9, Mariner 4, and Luna 9).

— Spacecraft monitoring (Faith 7 and Voskhod 1 and 2).

— Astronomy (Stratoscope 1 and 2, which were balloon-borne telescopes).

— General surveillance.

The space cameras that have been sent aloft are generally of two types: photochemical and electrical. All cameras, of course, are devices for sensing and storing brightness variations in a scene. They use various materials and processes for converting light into electron energy.

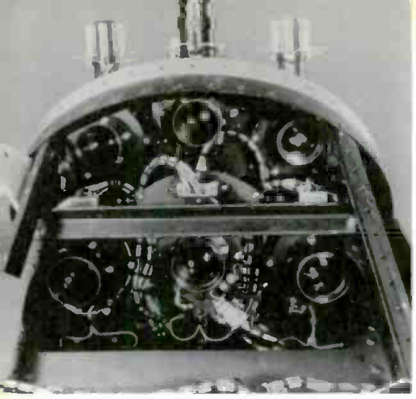
In chemical photography, the process is the familiar one of light acting upon a photographic emulsion of silver halide to produce visible silver grains, creating a pattern that forms an image of the scene photographed.

In electrical photography, light is concentrated upon a special photoconductive or photoemissive material that forms an electron-charge image of the scene. This image is scanned by an electron beam that translates the stored electron information into a picture signal.

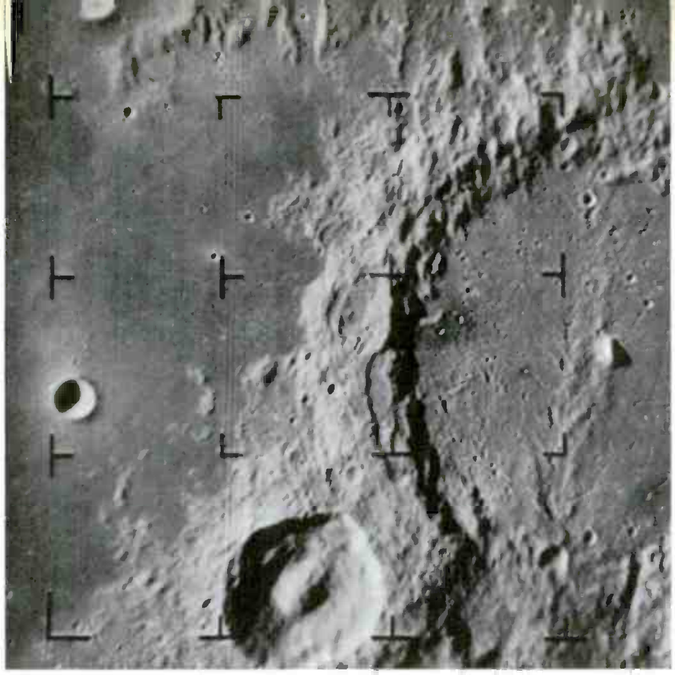
Pictures of extremely high resolution can be obtained through chemical photography. They can thus serve as the basis for precise scientific measurements and observations. Photographic film systems used in the Gemini program, for instance, successfully obtained precise photographic information on the earth's weather and terrain, the definition of the earth's outer edge, the spectrography of cloud tops, airglow, and zodiacal light.

But photographic film systems cannot provide "real time" pictures, showing events as they occur. Film exposed in space must either be physically returned to the ground for processing or developed automatically on board the spacecraft and then scanned for transmission to the ground. Chemical photography in space, with the exception of the pictures taken by Col. Edward White during his brief space walk, has been performed within the shelter of the capsule. Cameras and film have not yet had to withstand prolonged exposure to the rigors of outer space.

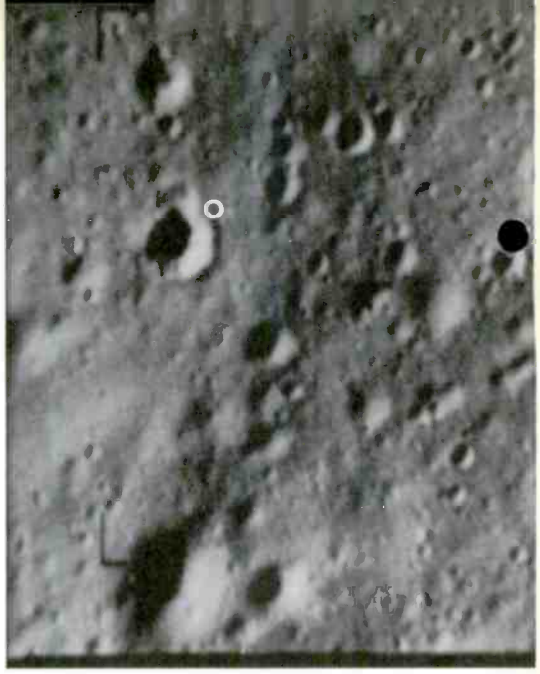
Electronic camera systems, on the other hand, produce an image in real time and in a form that can be readily transmitted back to earth. They have been adapted to withstand the temperature extremes, high vacuum conditions, and intense radiation of the space environment. They are



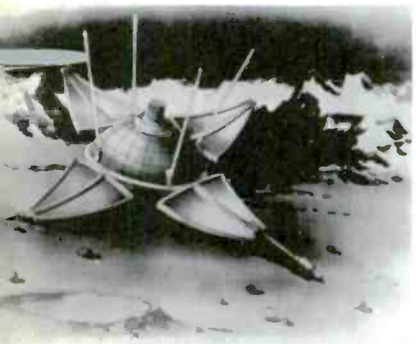
Above, close-up of the six RCA vidicon cameras carried by Ranger 9.



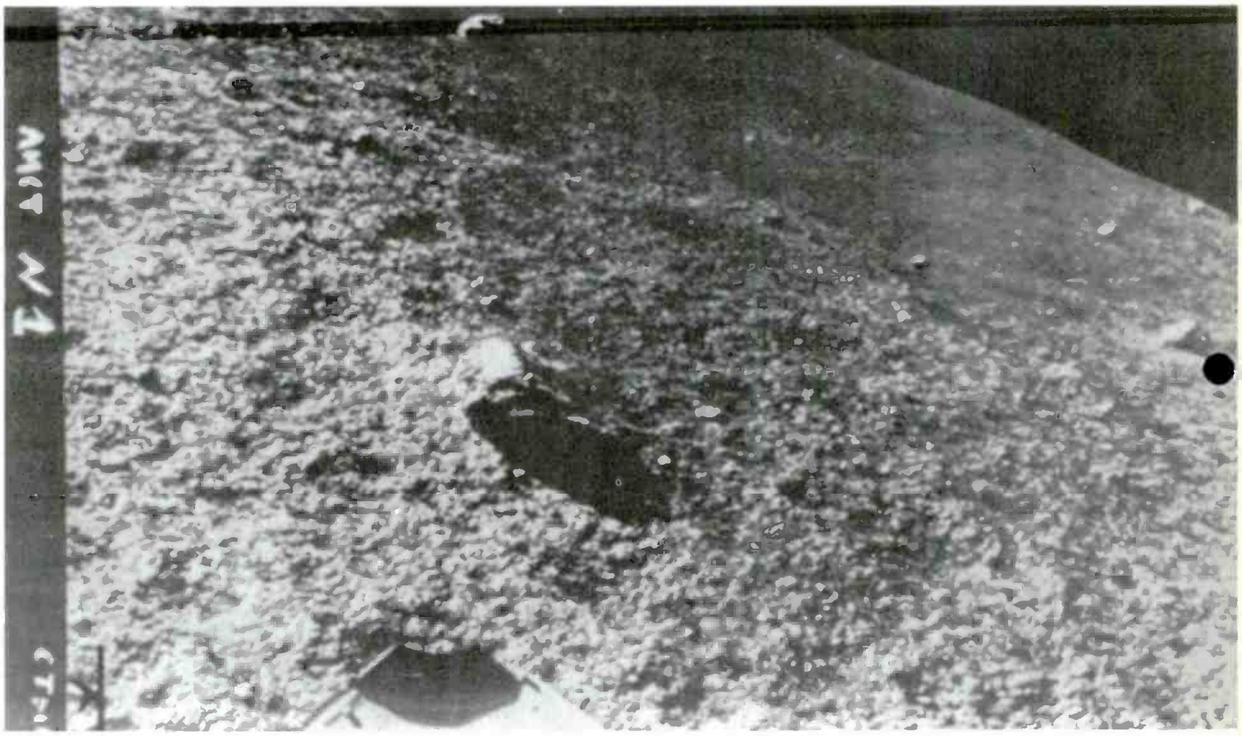
Right, a television picture taken of the moon by Ranger 9 two minutes and 50 seconds before impact.



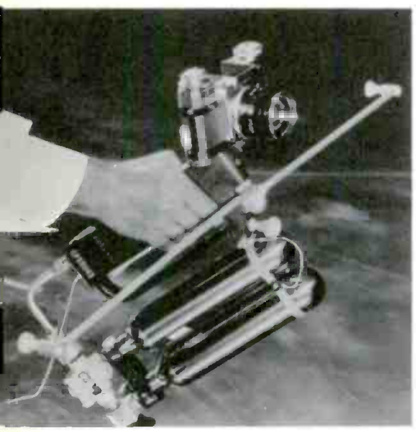
Far right, last photograph taken by Ranger 9. Point of impact is shown by a small white circle.



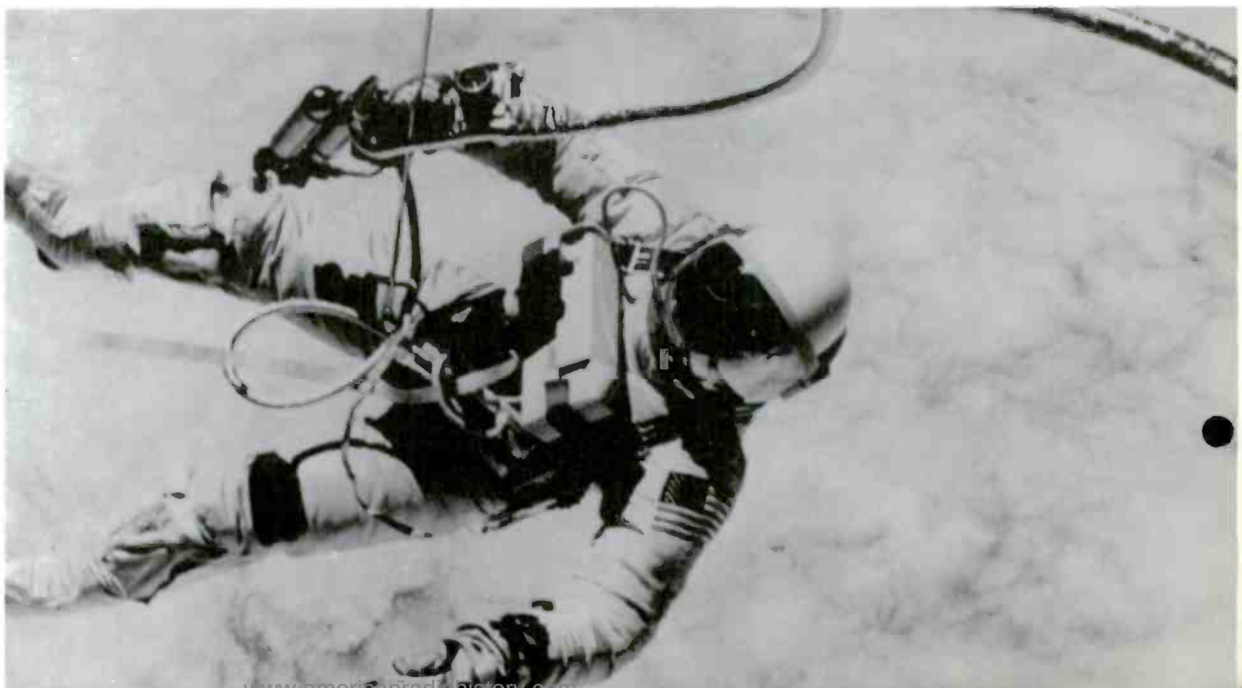
Above, an artist's rendering of the Soviet Union's Luna 9, which made the first soft landing on the moon.



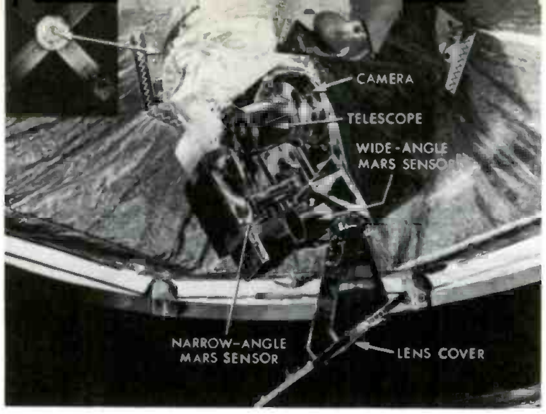
Right, picture from Luna indicates a lava-like lunar surface.



Above, the self-maneuvering unit with camera attached used by Gemini Astronaut Edward H. White II during his walk in space.

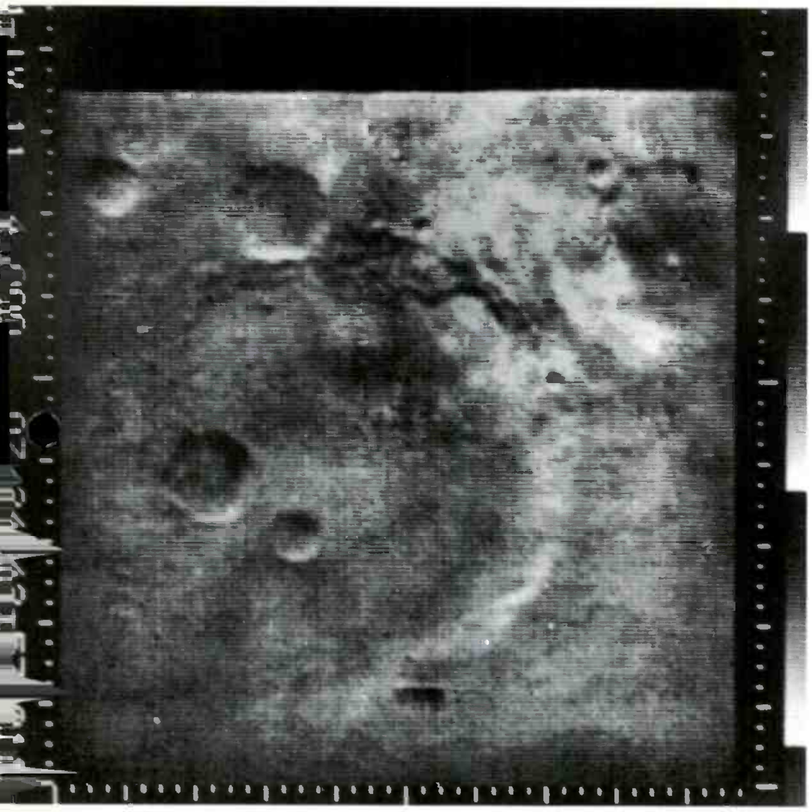


Right, Astronaut White as he appeared outside the Gemini spacecraft.



Above, Mariner 4 television camera system that photographed Mars on July 14, 1965. The photos were stored on magnetic tape for later playback to earth.

Below, Mars as seen by Mariner's camera from about 6,000 miles.



Below, a spacecraft engineer assists Astronaut Gordon Cooper with the placement of a television camera that was used to photograph him during his orbital flight.

more efficient light-energy converters than are film systems. And in terms of picture resolution, they are beginning to rival photographic film cameras.

As young as it is, the art of space photography already has achieved many important objectives.

The 600,000 or more pictures of the TIROS series have demonstrated that cloud formations create patterns on a global scale and that these patterns are sufficiently meaningful to permit reliable weather forecasting. They have shown that cyclones, in the tropics and elsewhere in the world, are characterized by a vortex or spiral-cloud pattern about their centers. These patterns can be recognized and plotted by space photography before the storms are detectable on earth.

TIROS pictures also have assisted basic theoretical investigations of meteorological phenomena. For example, TIROS 2 provided good views of ice pack in the Gulf of St. Lawrence; TIROS 3 returned the first photographs of Atlantic hurricanes; and TIROS 6 detected sandstorms.

The ESSA 1 satellite, with its two advanced vidicon camera systems, is taking and storing global cloud pictures and transmitting them to two ground stations. The automatic picture-transmission cameras aboard ESSA 2 are providing pictures on a continuous "read-out" basis to ground stations in many parts of the world.

The achievements of the camera-laden lunar and space probes have been equally impressive. Lunik 3 photographed 70 per cent of the surface of the far side of the moon in 40 minutes, transmitting at least nine pictures through space. Lunik's 35-millimeter film was exposed and developed on board the spacecraft.

Rangers 7, 8, and 9 took 17,259 high-resolution television pictures that completely satisfied the primary mission objectives of returning photographs of the lunar surface with sufficient detail to answer many questions concerning the lunar topography that would bear upon the success of a soft landing.

The highly successful Mariner 4 photographic mission gave an intriguing first look at Mars, our nearest planetary neighbor. The 21 pictures transmitted by Mariner indicate that, in terms of evolution, Mars is more moonlike than earthlike. Scientists have also been able to estimate that the planet's surface is from two to five billion years old. The remarkable state of preservation of the heavily cratered surface leads to the inference that Mars has had almost no atmosphere nor sufficient free water to form streams or fill oceans. However, the photographs neither demonstrate nor preclude the possible existence of life on Mars.

The soft landing of Luna 9 on the moon gave us additional data on the composition of the lunar surface. Luna's cameras indicated a lava-like surface, although some scientists still argue that it is covered with dust. The successful landing also enabled scientists to make a bearing strength estimate of the lunar surface of approximately one ton per square foot, more than adequate to support projected manned landing vehicles.

Conventional photographic cameras have accompanied the astronauts and cosmonauts aboard their spacecraft.

Television pictures were taken of Gordon Cooper in the Faith 7 Gemini capsule. Aboard the Soviet Vostok spacecraft, television photos taken of the cosmonauts were scan-converted and transmitted for observation on network television. Continuous television transmissions were received from the Soviet Voskhod 2 during its roll maneuvers and of Cosmonaut Alexei Leonov floating outside the spacecraft.

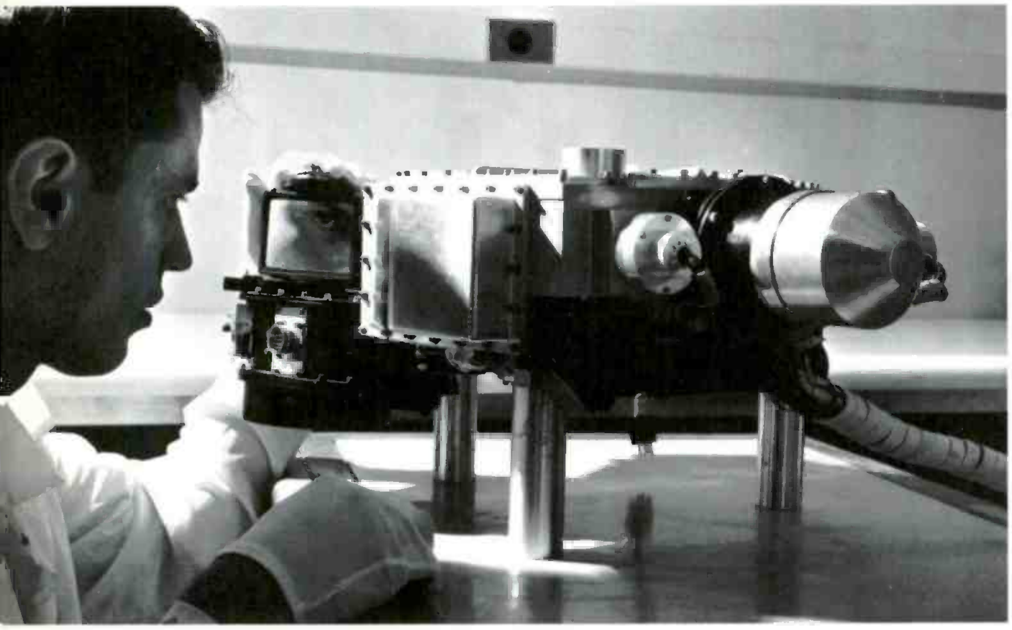
The Stratoscope high-altitude balloons have used television in their guidance system for the precise pointing of the large astronomical telescopes suspended from them. General surveillance applications of space photography have been included in some civilian and military programs.

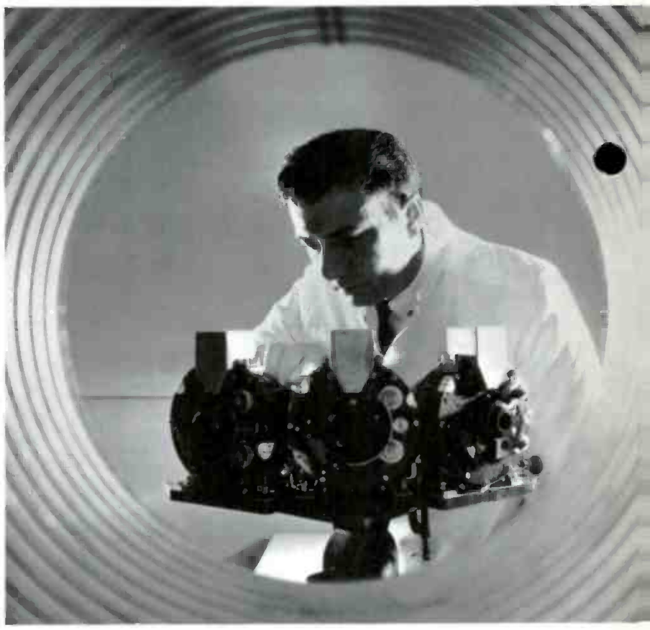
Space photography — both electronic and chemical — is destined to play an important role in future space missions. Photographic equipment of one kind or another will be aboard the Apollo spacecraft and its accompanying lunar excursion vehicle. Surveyor, America's unmanned soft-landing lunar vehicle, and the Lunar Orbiter spacecraft will both depend heavily on photography for the success of their missions.

Future camera systems will be more sensitive and compact and will be combined with other spacecraft systems to improve observation and control. Improvements in chemical photographic systems will permit their use outside of the spacecraft.

Future space television systems will make use of improved photoconductor materials for converting light into electrical energy. Systems of higher resolution and greater sensitivity will be developed employing rugged versions of the Image Orthicon tube used in broadcast television, as well as other new types of sensitive imaging devices. New photographic systems will come into use, such as the dielectric tape camera which combines an electronic equivalent of film photography and the functions of a television tape recorder in a single instrument.

Space photography has become an invaluable tool in space exploration since TIROS 1 was launched from Cape Kennedy. For those of us privileged to work in this field, the past six years have been most exciting, challenging, and rewarding. ■



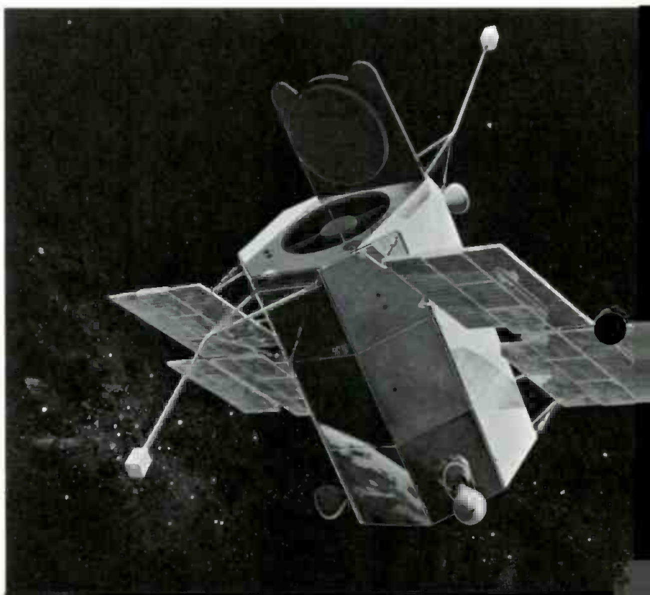


Above left, RCA's new dielectric tape camera system that has been developed for use in mapping distant planets, weather surveillance, and other space missions.

Above right, an advanced vidicon camera system built by RCA for Nimbus II, a weather observation satellite that will take pictures of the entire surface of the earth.

Below left, the RCA camera designed to permit live TV viewing of Apollo astronauts on their lunar mission.

Below right, NASA's Orbiting Astronomical Observatory. RCA camera system aboard will study ultraviolet, X-ray, and gamma-ray regions outside earth's atmosphere.



"Electronic" Furniture

Today's color TV boom is creating an unprecedented demand for finely crafted cabinets of wood.

by David Lachenbruch

Like other consumer products in America's affluent economy, furniture sales are booming. But it may surprise many persons to learn that the fastest-growing category is "electronic" furniture.

Sales of console cabinets — the type used for floor-model television, stereo, and TV-stereo combinations — increased last year by 15 per cent over the total for 1964. In 1966, the growth is at the amazing rate of 27 per cent. Last year, the public purchased nearly 5.6 million home entertainment instruments housed in furniture cabinets. This year, the figure is expected to exceed 7 million.

This upsurge is straining the cabinet plants that serve the electronics industry — those owned by the end-product manufacturers as well as independent facilities that specialize in television and stereo cabinets. But numbers tell only part of the story. The American homemaker, far more selective today than she was 10 years ago, is demanding — and getting — fine wood and workmanship of top quality and authenticity.

The quantitative aspects of this "cabinet explosion" can be attributed directly to the soaring popularity of color television. Last year, the market absorbed 2.4 million furniture-styled color sets, exactly double the 1964 record. This year, it is estimated that black-and-white television will require a little more than 1 million console cabinets, stereo phonographs nearly 2 million — and almost 5 million color TV.

In some ways, color is retracing the history of black-and-white television. TV's first surge of popularity in the early 1950s was a theater-in-the-living-room, and television sets were primarily console instruments. But the portable began to take over in the mid-1950s, and today it accounts for more than 80 per cent of black-and-white TV sales.

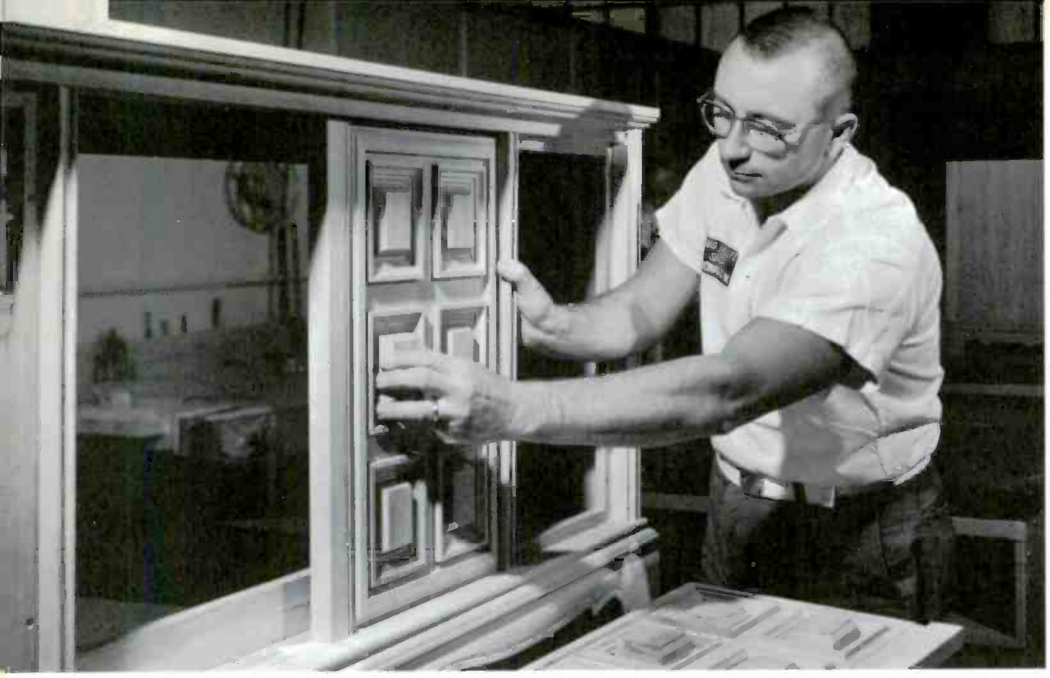
For those persons who remember the console cabinets of the early 1950s, it will not be difficult to understand one reason why the public so eagerly embraced the so-called "portable." The consoles usually were available in two styles — "mahogany" and "blonde," the latter being limed oak. Generally, styling was along the lines known as "borax" or "Grand Rapids Modern," and those cabinets can best be described as a sort of mass-produced box designed to keep the components from spilling onto the floor.

Since the heyday of the black-and-white console, American taste and design have undergone a major change. The implications have been felt in the clothes we wear, the cars we drive, and the furnishings in our homes. Contributions to this revolution have been made by the women's magazines, which stress good taste and decor; by higher educational levels of the population; by television itself, which has taken Americans on tour through such temples of taste as the White House and the Louvre; and by top-level designers, who have often led, rather than followed, that elusive mandate known as "public taste."

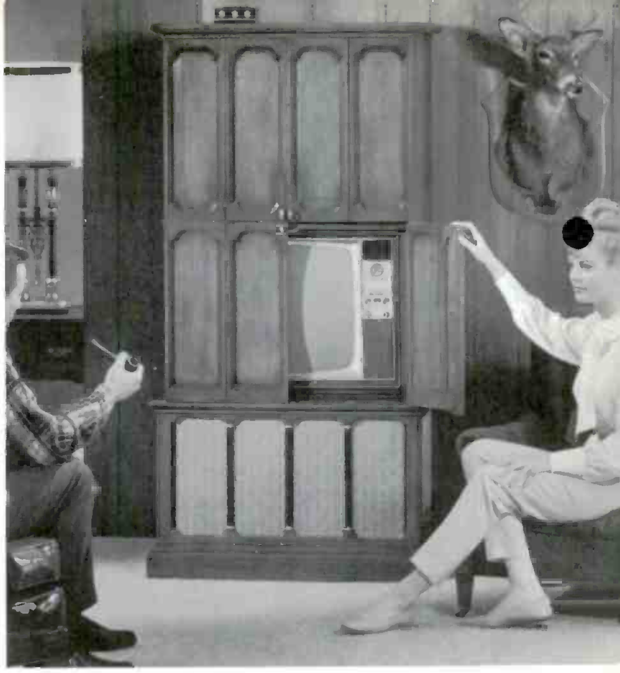
A color television set is a carefully considered investment. After the home and the car, it is the biggest purchase made by the average family. Market surveys show that the idea of buying a color set usually is initiated by the husband, but it is the wife who seals the actual choice of model. In other words, after the man of the family proposes a color set, the little woman sees to it that she gets an attractive piece of furniture in the bargain.

Not only does the color set go into the living room, it goes into the place of honor, and often establishes the key-

DAVID LACHENBRUCH is editorial director of *Television Digest*.

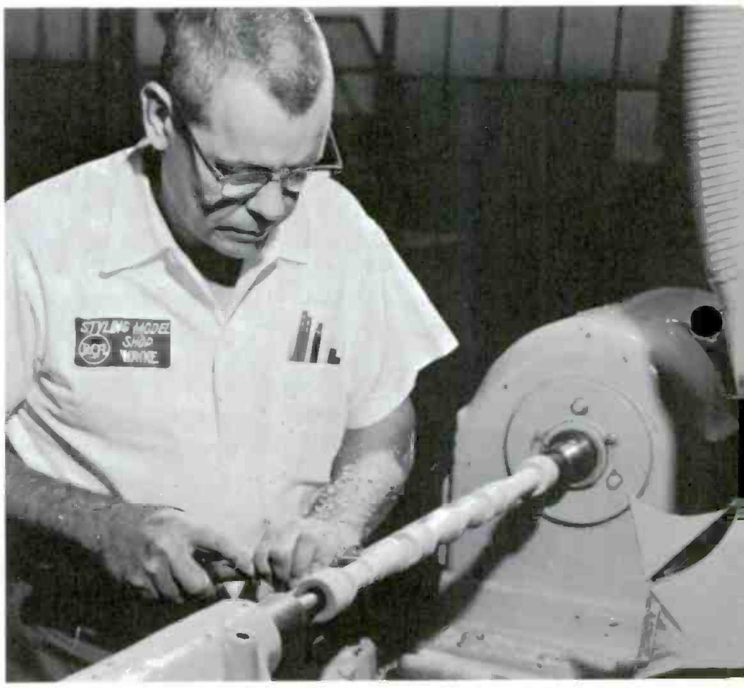


Modelmaker assembles handmade mock-up of possible new stereo cabinet for management review.



Its design inspired by medieval cabinets for storing knightly armor, the "Armoire" combines color TV and stereo.

RCA Victor "Campobello" typifies styling innovations in console stereo cabinets.



Spindle being shaped by RCA craftsman will later become part of a console cabinet.

Fine wood and workmanship mark today's "electronic" furniture. An RCA craftsman fits panel for a stereo-TV prototype cabinet.

note for the decor of the room. Many a living room has been completely refurnished to be compatible with the new color console.

For many years, black-and-white television has been largely a "price" business, in which lower-priced sets have usually been the best sellers. Not so with color. Despite the increasing availability of lower-priced models, the vast majority of the buying public is insisting on furniture-styled pieces well up on the price ladder.

In 1965, the average purchaser bought a set that had a manufacturer's optional retail price of $525, even though most major television manufacturers offered models with an optional retail price of $349.95 — some even lower. Although the demand for all color sets is brisk, the "low-end" models have been proportionately less sought after than the "middle-of-the-line" sets and even some very high-priced models. Each year, the styling and workmanship in any given price category are improved — yet the average price paid by consumers actually is increasing.

RCA Victor's "Armoire" model, introduced last year, is a case in point. It was a top-of-the-line showpiece, quite possibly designed to produce admiration and excitement as much as sales. This five-foot-high vertical piece combines a 25-inch color receiver with component-type stereo phonograph and AM and FM stereo radio. At an optional retail list price of $1,500, it is RCA's most expensive consumer product. The demand for the Armoire was so great that there have already been three production runs — in short, the demand was triple the original projection for an item whose price would not generally be considered "popular."

The American public is expected to spend $3 billion on color television receivers this year — the same amount it spent on all types of electronic entertainment instruments in 1964. It will spend another $3 billion on black-and-white television, radios, stereo, tape recorders, and automobile music systems and similar products. And it is insisting on the best. As in the purchase of an automobile, the American now is spurning the "stripped-down model" in his entertainment equipment.

In color television, in stereo, and even in portable TV and the table radio, "the best" now has the connotation of "wood."

The wood cabinet seems to be an anomaly in this age of synthetics, particularly when it surrounds a complex electronic system. The clothes we wear are increasingly made of synthetic fibers. The materials in our upholstery, our carpets, our draperies often come neither from the lamb nor from the land but from chemicals developed in laboratories. Flooring increasingly is made of plastic materials. Even the very paint on our walls now has a man-made base.

Yet the major symbol of our advanced consumer technology — color television — is housed in a material that once was a tree of the forest. This is not necessarily paradoxical. In this age of plastics, wood has become a bridge with the past. It has the warmth of nature. It connotes tranquillity in a hectic era. It is a known value, a familiar material, sometimes with memories of the well-worn patina of age on the schoolhouse desk or the old pine chest that Grandma kept in the attic.

That wood fulfills this desire for a "bridge with the past" is plainly evident in the public's choice of cabinets. The four popular major categories now are Early American, French, Regency or Traditional, and Mediterranean or Moorish. Such nontraditional styles as Scandinavian Modern or Contemporary are losing in popularity, and the American homemaker is following the decorator's advice to use period furniture as an accent piece even among the most starkly modern furnishings. Because of this preoccupation with the past, the scope of authentic electronic cabinets now covers such styles as Jacobean, English Regency, Spanish, Elizabethan, and Hepplewhite.

Consumer electronics thus has become an important part of the furniture business and as a result employs some of the nation's ablest furniture designers. The increasing demand for console cabinets is creating problems virtually unheard of in the traditional furniture industry. The "lead time" for cabinet orders has increased from the normal few months to as much as a year or more. This means the designer today must be somewhat of a clairvoyant, anticipating the ever-changing public preferences in cabinet styling — or leading them.

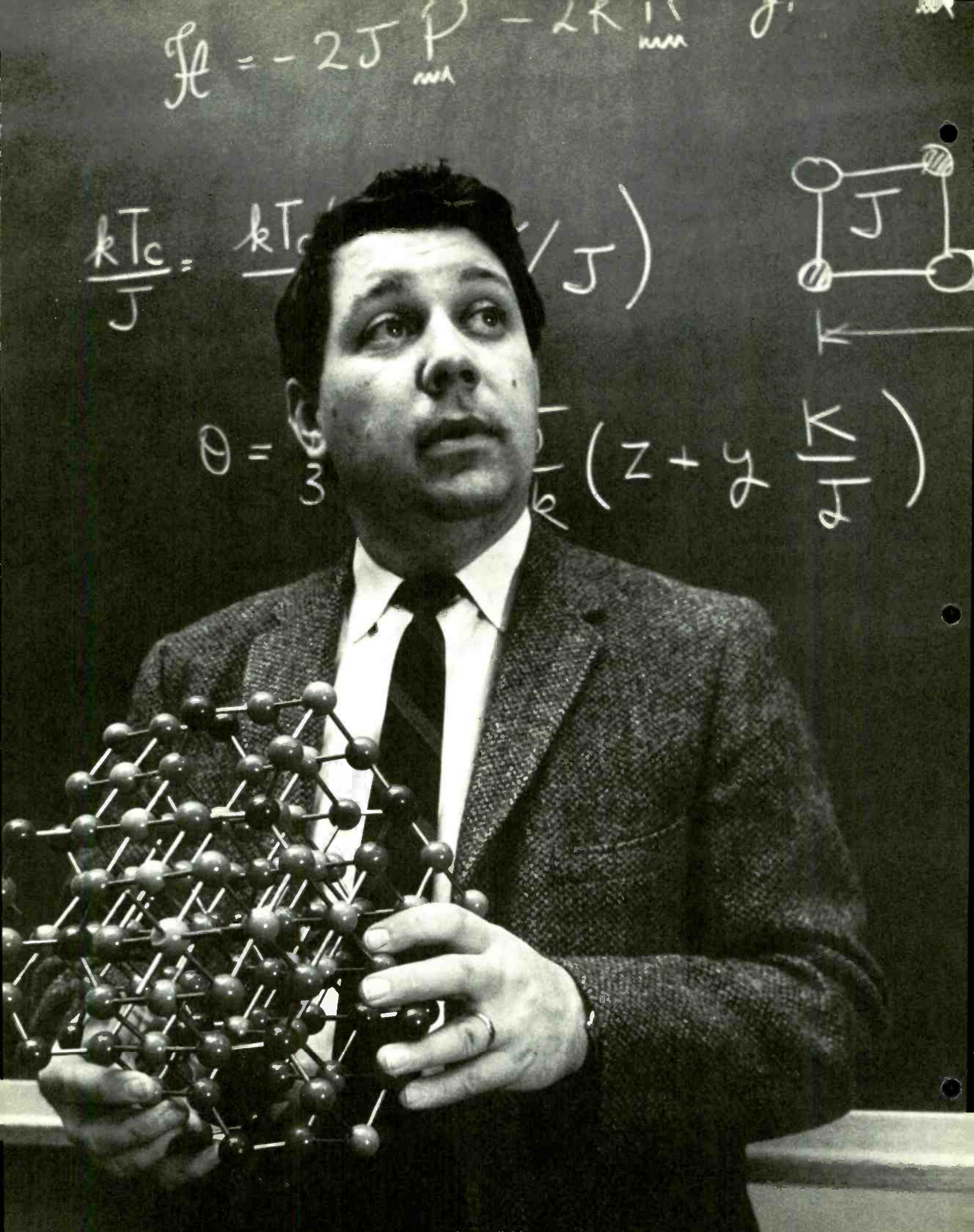
To create an authentic reproduction of a historic design, adapted for an electronic cabinet, requires some compromises. After all, there were no color TV sets nor color TV cabinets in the days of Louis XVI. Therefore, an adaptation of a Louis XVI breakfront into electronic furniture does not result in a breakfront at all but a color TV cabinet built to look like something it is not.

Thus, we have television cabinets with simulated drawers that don't pull out, and stereos, also with simulated doors, that can't be opened. No matter how authentic in appearance, they are not truly functional — or at least they do not accomplish the purpose for which the original piece was designed.

But even this last barrier to authenticity will soon be overcome. And, not so strangely, it is a new electronic development that will make possible more faithful reproduction of period furniture for home entertainment. The integrated circuit — a tiny chip of semiconductor material that can replace several dozen bulky components — already is being used in the sound systems of some RCA Victor television receivers. When further microcircuitry is developed for other consumer electronic functions, the bulk of a TV or stereo chassis will shrink dramatically. This will make possible a whole new generation of furniture that combines utility with entertainment.

A stereo cabinet must have width for proper spacing between the speakers, but in the near future it will be possible to use the space in between to store a record collection or even good china. A big screen may be a necessity for a color TV console, but eventually the drawers under the picture tube will slide open, as any drawer should, to bring added usefulness to the cabinet.

America's growing sophistication — in both electronics and home furnishings — is expressed in the popular choice of a color television set "as modern as tomorrow," housed in a warm-looking and graceful cabinet that reflects the cherished heritage of yesterday. ■



The Magnetic Personality of Matter

After centuries as a curiosity, magnetism is now vital to a host of new electronic products.

by Bruce Shore

To the uninitiated, scientists discussing the magnetic personality of matter may sound like a crowd at a rummage sale. Their conversation is larded with enthusiastic references to bottles, mirrors, tapes, saws, loudspeakers, cores, yokes, door fasteners, and a mélange of other seemingly drab and half-forgotten clutter to be found in any well-seasoned attic or basement. Such common terms take on uncommon meaning, however, when employed by specialists in the newly awakened field of magnetics — a field whose growth and diversification recently has propelled it into the vanguard of modern electronics research.

The "bottles" and "mirrors," however, are not physical objects but magnetic fields so powerful they will contain the hot electron-proton plasmas currently used by scientists in their determined effort to achieve controlled thermonuclear fusion. If they succeed, man will have a new and virtually inexhaustible energy source at his command.

The tapes are also magnetic — iron oxides bound in synthetic resins and gathered on reels. Stored on these tapes are the color and black-and-white images of much of current television programming, the symphonies and chorales of modern stereophonic sound systems, and the staccato "ones" and "zeros" of new computers and data processing equipment.

The "saws" are a new wrinkle — pulsed magnetic fields so intense they literally drive atoms from the materials set before them, leaving behind ragged fissures much as a saw would do.

Loudspeakers for reproducing sound, ferrite cores for storing information in the memories of digital computers, ferrite yokes for guiding the electron beams that sketch the pictures on your television screen, the alnico fasteners that pull your cupboard doors shut — these too are magnetic. So are key parts of the doorbell and the telephone, the electric motor and the dynamo, the radio and the electron microscope. Everywhere, in fact, magnetism and magnetic devices are enriching people's lives on a rising scale.

There are two principal reasons for this. First, the success of modern atomic theory in explaining the sources and consequences of magnetism in matter has given man the means to produce and apply this protean phenomenon in a growing variety of ways.

Second, because of the little-known labors of J. L. Snoek and a team of Dutch scientists who managed in the early 1940s to conduct a series of investigations into the nature and magnetic behavior of ferrites, there now exists a chemistry that enables scientists to produce a class of substances whose magnetic properties are almost completely controllable.

Not that magnetism was unknown or unused until this time. Recognition of its existence goes back at least 3,000 years to ancient China and to the vanished kingdom of Magnesia, formerly in Asia Minor, from whose name the term "magnetism" is probably derived.

The first instrument known to employ magnetism — the compass — was in use by navigators on the China Sea in the 11th century and, on the other side of the world, was first described by the French crusader Peter Peregrinus of Maricourt in 1269. Peregrinus also fathered the concept of magnetic poles.

Still later, in 1600, Sir William Gilbert, physician to Queen Elizabeth, published a famous treatise on magnetism in which he suggested for the first time that the earth itself is a huge bar magnet.

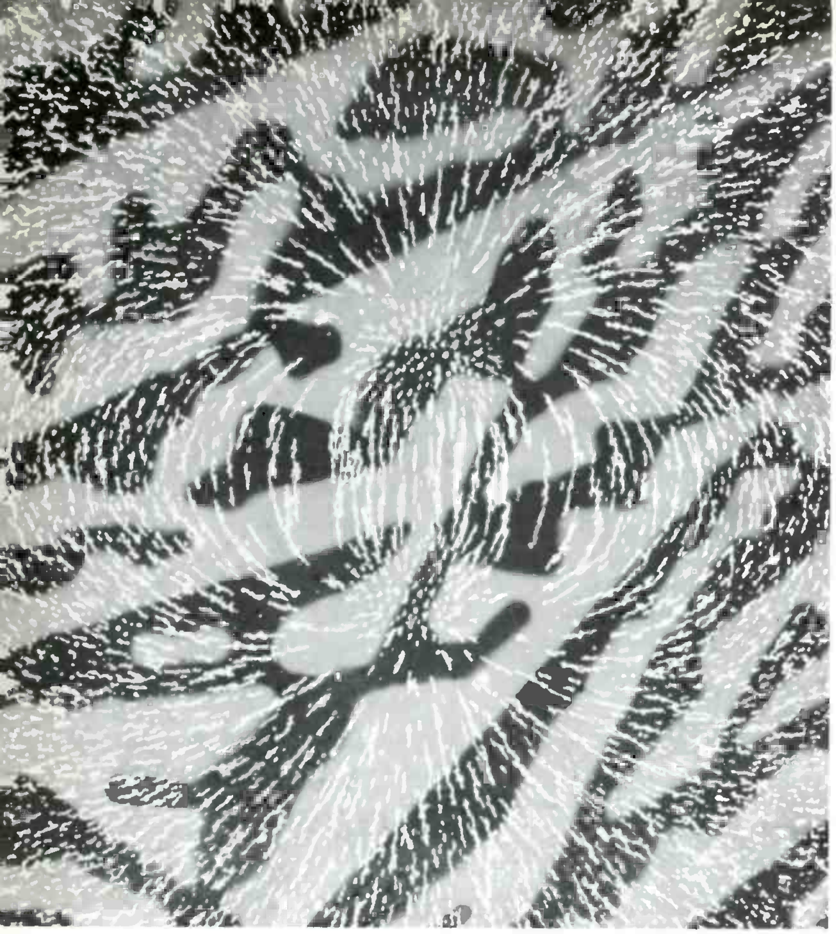
In short, the magnetic effects of attraction, repulsion, and orientation (the compass) were well known and in limited use by the end of the 16th century. None of this helped to explain what magnetism is or how it is produced, however. Even the discovery by Michael Faraday, in 1831, of electromagnetic induction — the principle by which a varying magnetic field can be made to initiate an electric current in a conductor or vice versa — only succeeded in producing still another, albeit profoundly valuable, effect.

It is only in the past 100 years, with the recognition of the electromagnetic nature of light, the formulation of modern atomic theory, the discovery of the electron, and the development of quantum mechanics, that scientists have begun to unravel this mystery.

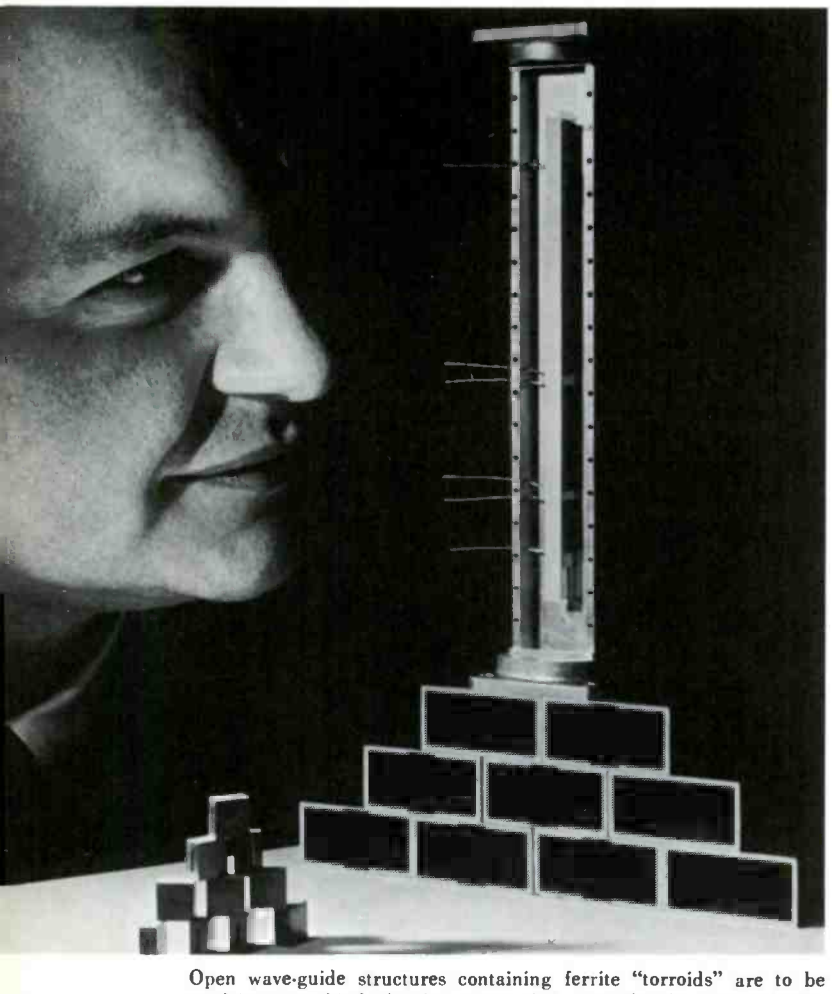
It turns out that magnetism is as fundamental to the fabric of the universe as the quantities of mass, electric charge, and gravitation. All the basic building blocks of

BRUCE SHORE is the staff writer at RCA Laboratories.

Dr. Peter Wojtowicz, a magnetics theorist at RCA Laboratories, holds a model of a "spinel structure," the atomic pattern peculiar to many ferrimagnetic materials.



Looking like camouflage markings, magnetic domains in a garnet crystal are actually microscopic clusters of magnetic atoms.



Open wave-guide structures containing ferrite "torroids" are to be used in a new kind of radar system that scans the sky electronically.

matter — the electron, the proton, and the neutron — have magnetic poles and join magnetically (as well as other ways) to form the atomic elements from hydrogen to uranium. In doing so, furthermore, they usually join in such a way that the north pole of one is opposite the south pole of the other in an inverted or antiferromagnetic posture that causes their tiny magnetic fields or "moments" to cancel completely. Virtually all atomic matter is bound this way, as is all molecular matter including that composing plants, animals, and man himself.

The reason for the "anti" designation is that a handful of metallic elements — iron, nickel, cobalt, and the rare earths dysprosium and gadolinium — were the first substances to be classified according to their magnetic properties, and their atoms all proved to be exceptions to the above rule; that is, they combine "ferromagnetically" with north pole opposite north pole and south pole opposite south pole. Thus, instead of canceling, their magnetic moments add together cumulatively. Though few in number, these materials or combinations of them make the strongest magnets. For a long time, these were the only materials thought to display magnetic behavior.

In the early 1930s, however, a new class of magnetically active materials called ferrites came under investigation at the research laboratories of the Phillips' Gloeilampenfabrieken in Holland, one of the world's largest electronics companies. It was as part of this effort that J. L. Snoek and his co-workers made their momentous findings during World War II.

Ferrites are "ferrimagnetic" substances; that is, they contain several atoms of unequal magnetism coupled antiferromagnetically in a distinctive pattern — called a spinel structure. This pattern repeats as the volume of the material grows, just as in the case of the metal links that make up a piece of mesh or chain mail.

Since the magnetic atoms of such patterns or "links" do not completely cancel, because of their uneven magnetism, the "links" have a net moment and, therefore, so does the material as a whole.

Without qualification, it is these and similar materials — iron oxide compounds, in general — that have kindled today's much publicized electronics revolution. Lacking these materials, the development of television, computer memories, audio and video tape, radar, and VHF, UHF, and microwave radio communications would have been greatly hampered, if not prevented.

There are several reasons for this. For one, ferrites are electrical insulators. They can be used to sense and process radio waves oscillating at up to 100 million cycles per second without sustaining the prohibitive electrical losses associated with the only other materials that have been tried in this job — the ferromagnetic metals. For another reason, even in bulk form, their north and south poles can be reversed easily and completely by the application of very small outside magnetic fields. This is what gives them the ability to store and process computer information in binary form.

In microscopic, needlelike particles, too, ferrites can be frozen into plastic binders where they will still respond

Video tape is drawn symbolically from powdered ferrite, a magnetic substance that makes possible the recording of TV pictures.

magnetically to the application of an outside field by altering the direction of their internal fields. This is the basis for their use in magnetic tapes.

In yet another form, they make good permanent magnets, light enough to hold papers or other items to an upright metal surface without falling of their own weight. Also, because ferrites are really ceramics and are derived from abundant materials in the earth's surface, they are extremely cheap to manufacture.

The differences between ferro- and ferrimagnetism are not intrinsic but originate in the divergent atomic mechanisms by which each is produced.

All atomic magnetism arises from the existence, in certain atomic orbits, of electrons whose inherent magnetism is not canceled by antiferromagnetic coupling to other electrons. There are approximately 25 elements in nature whose atoms incorporate such unpaired electrons.

Since none of these atoms is able to neutralize its magnetism or magnetic moment internally, for reasons implicit in the quantum mechanical building codes that govern their fabrication, they attempt to do so by going outside.

The ferromagnets are crystals built from atoms of equal magnetism assembled into tiny magnetic cadres or "domains" like soldiers in a parade square. Since all the members of the domain "face" in the same direction, magnetically speaking, their moments add together to give the domain a cumulative moment.

Like a parade square, too, such a domain cannot keep adding "atomic soldiers" forever. Eventually, it reaches an optimum size, stops growing, and a new one is started. The members of the new one will "face" in a different direction, however, and those of the next in yet another until, as a result, all domain moments will effectively cancel each other. Thus, iron, fresh from the mine, seems nonmagnetic.

Ferrimagnets, on the other hand, are crystals built from atoms of unequal magnetism assembled into domains in an antiferromagnetic pattern — again like a parade square, but this time with columns of atomic soldiers facing alternately front, rear, front, rear. Ordinarily, this arrangement would cause all atomic moments to cancel. However, those columns facing front have greater magnetism than those facing to the rear, so a net moment for each domain develops and adds to that of every other domain. To neutralize such moments, ferrimagnetic materials such as ferrites arrange to balance them off against each other just as the ferromagnets do.

The instant either ferromagnets or ferrimagnets are subjected to an outside magnetic field, though, the magnetic moments of all their domains fall immediately into line and their true magnetic character manifests itself by the appearance of a collective moment for the material as a whole. When the outside field is removed, however, the domains reassert their independence and this collective moment begins gradually to decline.

There are many more forms of magnetism, of course. For example:

- Nuclear magnetism, which has led to such devices as proton magnetometers used by archaeologists to detect the presence of buried civilizations.

Pins adhere to this cadmium-chromium selenide slug, which becomes a powerful ferromagnet when cooled to minus 321 degrees F.

• Paramagnetism, a dilute kind of ferromagnetism that has been used to help cool materials to within a few thousandths of a degree of absolute zero.

• Metamagnetism, exhibited by a few substances that are antiferromagnetic at one temperature and ferromagnetic at another.

• Diamagnetism, which derives from the orbital motion of the electron and not its internal nature.

• Electromagnetism, which is created by the flow of electrons in a conductor or superconductor.

But, to the electronics scientist, it is ferrimagnetism that holds the greatest fascination. This preference springs largely from the fact that in ferrimagnetism several different atoms arranged in a distinct and repeating pattern are involved. Therefore, it is possible chemically to shift them around within the pattern, to substitute other atoms for them, to isolate them one from another, and, in a word, to "tailor" the magnetism of the pattern with precision.

Because of such finger-tip control, RCA has been able to devise some wondrous ferrites at its laboratories in Princeton, N.J., and at its electronic components plants in Indianapolis, Ind., and Needham, Mass., where they are presently manufactured for use in television yokes, radio and radar systems, and computer memories.

In fact, under the leadership of Dr. Philip Baltzer, Dr. Peter Wojtowicz, Dr. Irwin Gordon, Robert Harvey, and others at RCA Laboratories, new families of lithium ferrites for computer memories, barium ferrites for audio loudspeakers, manganese ferrites for use in phased-array radar systems, and still other varieties for application in magnetic tape have been developed recently and promise to advance these fields dramatically in the years ahead.

From knowledge gained in his painstaking studies of ferrites, Dr. Baltzer has also succeeded in developing a new class of materials that are true ferromagnets, though they will not conduct electricity. At present, they operate only at very low temperatures. Eventually, however, they might well provide the basis for a family of new electronic components that includes magnetically activated transistors, diodes, oscillators, and some radically different devices such as "spin-wave" amplifiers for boosting radio, microwave, and even millimeter wave transmissions.

Spin waves are generated in certain materials by electromagnetic waves. They result from the field of one magnetic atom being pushed by the magnetic component of an incoming radio wave. This push is passed on immediately to the next magnetic atom and so on down the line like a pail of water being handed along a bucket brigade. Thus, the energy of the radio wave oscillating in space is converted to a magnetic disturbance propagating through a solid. In this latter form, it is believed, such energy should be subject to amplification by a number of sophisticated techniques.

From curiosity to compass to computer memory, magnetism has moved irresistibly through the centuries from the periphery of human affairs to the center of some of our subtlest scientific and finest technological achievements. ■

Music Takes to the Open Road

Stereo 8 tape cartridge systems for use in automobiles are revolutionizing the recording industry.

by Jan Syrjala

If a large and highly developed country were suddenly to annex rich, open territory that virtually doubled its size, that would be a revolutionary event. Something like this has just happened in the recording industry. Recorded music for more than a decade has held firm sway in the living rooms of much of the world, *alongside* radio and television, a climax to the phonograph's more than 75 years of up-and-down history. About 50 million homes in the United States alone have one or more phonographs or tape players apiece, and last year Americans spent more than $600 million for disks and tapes to play on these machines, the largest yearly total ever.

Now, as a result of some technical advances and a dramatic series of industry alignments, recorded music is about to move in force into new territory — the nearly 70 million cars on American roads. The agent of this advance is a "stereo tape cartridge system," an utterly simple way of playing stereo tape recordings. A reel of tape is enclosed in a small, flat, plastic box — the "cartridge" — and you push the cartridge into a slot in the player to hear the music. The player is mounted in the dashboard of your car, or hung below it. Loudspeakers are mounted in the two front doors, the left one for left-channel sounds, the right one for the right channel; or even better, you can have four speakers, with the second pair in the rear doors or in the rear deck of the car.

When you push the cartridge into the slot, the player automatically picks up the tape and moves it past the head at 3¾ inches per second; there is no threading to do. The tape is an endless loop; when you come to the end, you are at the beginning ready to start again, so there is no rewinding.

Sound somewhat familiar? Yes — the idea of a tape cartridge is so persuasive that a number of attempts have been made to launch cartridges of various designs. For a variety of reasons, none was adopted by a large enough segment of the recording industry to become a basic method for hearing recorded music. A large proportion of listeners today want a machine that, sooner or later, will let them hear music put out by a good cross-section of the industry. And a recording firm, for its part, naturally would like to sell recordings that a major proportion of the market can use, or will be able to use within some foreseeable period.

What made this particular recorded tape cartridge a success when all previous ones had had, at most, a limited run? First, the new system is "8-track," that is, there are four complete stereo programs on each reel of tape. The

JAN SYRJALA is an engineer who has frequently written on sound reproduction for the *New York Times* and other publications.

earlier 4-track systems had half as much music on a given length of tape. The cost of a given amount of music is necessarily higher in the 4-track than in the 8-track form. One of the basic stumbling blocks for tape cartridges in the past has been the fact that listeners felt they paid an excessive premium for the convenience of recorded music in cartridges. With the equivalent of two 12-inch LP disks encased in a small cartridge, the price comes down considerably. Of course, this particular system is not directly competitive with stereo disks, since the latter can't be played in a car. But the cost of the cartridges is a weighty factor in success, nevertheless. The opinion of recording companies that many people would be willing to pay the price of the cartridges was basic to their acceptance of the system.

Then, why weren't 8 tracks used before, in the cartridges aimed at home use? Mostly because, up until a couple of years ago, the technique of tape recording was not refined enough for good fidelity with 8 tracks narrow enough to go side by side on the quarter-inch tape. And duplication of the tapes would have been extremely difficult. But the art has been moving ahead fast. Low-noise tapes, excellent, low-cost playing heads, and other recent developments now give tape a dazzling potential for higher fidelity in very compact forms. This potential is one of the aspects that makes the car cartridge system so exciting.

Another basic reason for the way the system has zoomed in is one that most old hands in the recording industry did not anticipate. It is simply that people love the way stereo music sounds in a car. Stereo in the living room is a splendid thing, at its best creating a powerful sense of "concert hall space" around the music. Stereo in a car creates a "space" that is not so much like that of live music but is often very exciting on its own terms. There tends to be a marked separation of instruments, to left and right. The musicians may seem to be playing in a vast, echoing superhall. But they don't sound far away; the music can have intimacy and grandeur at the same time. Stereo headphones take the listener even farther into this somewhat odd but often highly pleasurable imaginary space.

Car owners began to hear this kind of stereo about three years ago when several smaller firms started making 4-track car systems, mostly on the West Coast. Specialist shops, much like auto-radio shops, sprang up to sell and install the machines and supply the cartridges. But no system at that time won support from the auto industry or from any sizable nucleus of important recording firms. The music in the cartridges came mostly from the smaller record "labels."

Enter, in 1963, the conjunction of forces that was to raise car stereo to the national scale. William Lear of Wichita, Kan., a restless man with success in making jet

Stereo 8 tape cartridge system is simple to operate.

Seated next to her father, the child selects what she wants to hear . . .

planes for businessmen — and more importantly, a long history of electronic innovations — heard car stereo and decided to give it the Lear treatment. He went to the RCA Victor Record Division with his ideas. A period of intensive parallel and joint development led to the announcement in early 1965 of the Lear-RCA 8-track system, machines combining the function of radio and tape player in a package no larger than a conventional car radio to be available from Lear and cartridges (initially) from RCA with music from its regular catalog. The system was demonstrated, to general applause.

But that was not the end of the beginning. Lear and RCA had made their plans known to the auto industry early.

The affair took on high drama when Ford announced that it would market players using the system, both as optional built-in equipment for the 1966 models and as "hang-on" units that could be installed in any car. It was obvious immediately that a tape-cartridge system had a chance for a fast sweep-in. When Chrysler, and then General Motors, joined, the chance turned to reality. All the important recording firms subsequently promised to come along with compatible 8-track cartridges. The immense marketing weight of the auto industry had made it likely that there would be a large market, and possibly a vast one, for recorded music in the 8-track form.

This industrial drama has a lot of meaning for us, the listeners. We will be able to get, in 8-track form, the music of any important recording firm. And we will know that tremendous resources of talent and money will be concentrated on the 8-track cartridge system. The nature of the technique is such that, within the confines of the system, there is large room for change and advance. The work of many different men and agencies will, over the long run, tend to improve the system for all users.

But this is interesting for the long-range future. What we have right now can be summed up along these lines: we can have the music we want to hear, on the road, in a way that is easy to use and exciting to hear. A lot of music is packed into a small space, up to 80 minutes of it in a flat box only 5½" x 4" x ⅞". Once this small box has been pushed into the player, which you can do without taking your eyes off the road, you can ignore it for the full 80 minutes, unless you want to stop it or skip from one selection to another. The recording will not get scratched or encrusted with dirt. The player is rugged and reasonably simple in construction, with solid-state electronics that should last virtually forever: there are no tubes to replace.

Ford started selling the players in the fall of 1965. Chrysler and General Motors will be selling them as hang-ons about the time this reaches print, or soon thereafter,

and then easily inserts the cartridge into the stereo tape player attached to the dashboard.

Up to 80 minutes of music are contained in each of these RCA Victor Stereo 8 tape cartridges. The tape is an endless loop and thus does not require rewinding.

with built-ins available for the 1967 models. Players using the system will also be sold by auto supply firms, auto-radio shops, electronics supply firms, mail-order and department stores (Sears, Roebuck and J. C. Penney Co. were already selling the players and cartridges when this was written). Record retailers will sell the cartridges like any other recorded music, and so will many department stores, car dealers, mail-order firms, auto supply firms, and perhaps eventually a sizable number of gasoline stations. Every kind of music will be in these cartridges, from pops to Palestrina and from westerns to Webern.

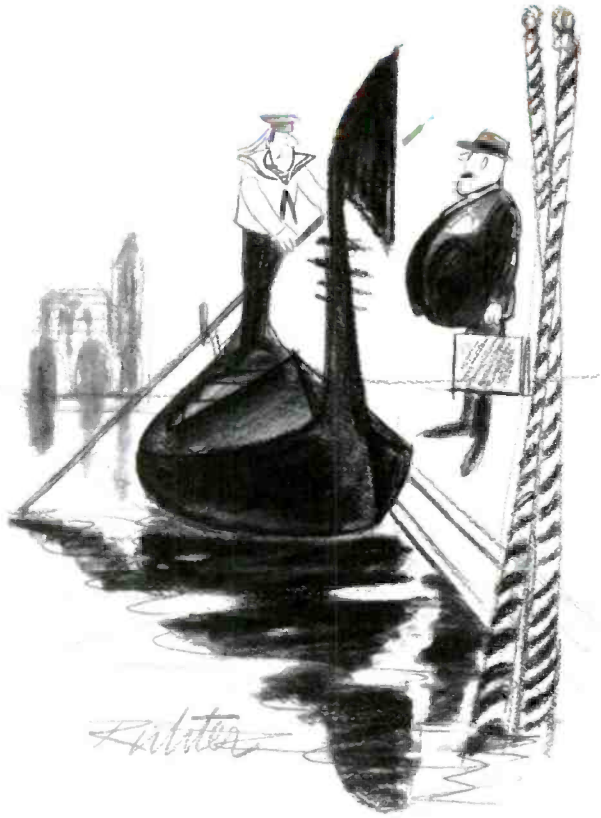
We have held off until now any discussion of what will interest audio fans: how does the fidelity of the car machines compare with that of high-grade home audio equipment? A system so easy to use, and so free from damage by dirt, scratches, or the hands of small children, could make tape welcome in millions of living rooms. Already, there are rumors that a number of firms are rushing to get home-style 8-track players on the market. By the time this article is in print, some of them will probably have made firm announcements. And there is a powerful logic in having a single system for car and home. You and I would buy more recorded music and get much more from our investment in it if we could buy it in only one form, a cartridge that we could play at home or in the car as the mood directs.

So the question is: can 8-track compete with the stereo disk, a glorious device now riding an enormous success wave? Assessments are treacherous in such a fast-moving field, and the writer wants to emphasize the phrase *as this is written* when he says that the 8-track car machines he has heard are not up to the best stereo disk systems. The cartridges are strongly "go" in cars, partly because the noise of the moving car masks noises from the tape system as well as because of the exciting character of car stereo, already described. The question is also to a large extent one of cost. Thousands of audio fans have put from two to 10 times as much into their home systems as these car machines cost.

And this gives us a clue to the probable future. It seems likely that 8-track equipment will appear from many sources and with a variety of cost and quality levels. For those who want to pay for it, there will almost certainly be 8-track players that aim at the ultimate in high fidelity.

But even if such equipment does soon appear, and does win large acceptance from the public, the 8-track tape and the stereo disk will undoubtedly coexist for a long time, each buyer deciding which he wants to use. A coexistence of this kind would have the blessing of the recording industry. Every important firm would issue its music in both forms: none could afford to abandon so large a market as that represented either by the disk players in homes or the cartridge players in cars. Recording firms are in the business of selling music, not particular systems for reproducing it, as George R. Marek, Vice President and General Manager of RCA Victor Record Division, has pointed out.

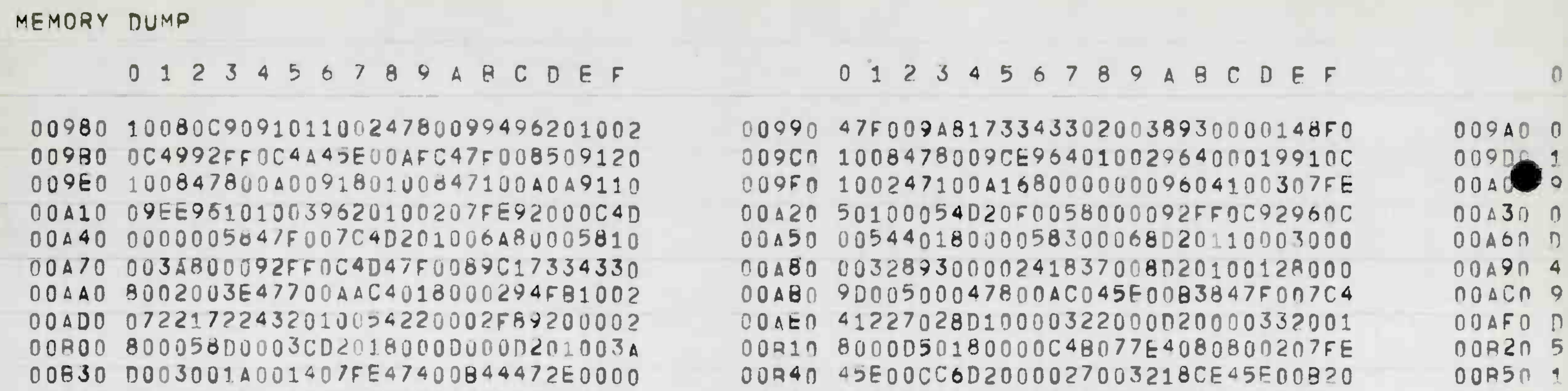
Over a long period, however, and by an orderly changeover process, the 8-track cartridge system just might dethrone the disk, taking over the top spot in the living room that the disk has occupied since the turn of the century. ■



"Do you have a ship-to-shore radio?"

THIS ELECTRONIC AGE...

"It's a small wine but it travels well."



The "memory dump," a series of printed-out numbers, enables the programmer to confirm the instructions he has fed into the computer.

Computer Programming

by Thomas I. Bradshaw

Time was when "hardware" meant only the merchandise carried by a neighborhood store — nuts and bolts, putty and clothesline, hinges and hammers.

Evolution of the modern business electronic data processing system brought with it a graphic vernacular. Key words in this idiom are "hardware" and "software."

In computer lingo, "hardware" means the machines that make up a data processing system: the central processor, magnetic tape stations, paper tape and punched card equipment, high-speed printers.

The business computer can do only what man tells it to do. Electronic data processors are designed to perform a variety of functions on command — human command.

Since man and the machine must communicate, a common language is essential — in the form of instructions or orders. An organized group of instructions constitutes a computer program. All rapport with the computer is by means of programming. This is the world of "software."

A definition of programming might be: "The art of arranging a sequence of operations so that they will produce the desired result in the most efficient manner."

THOMAS I. BRADSHAW is a staff writer at the EDP division of RCA.

Business data processing hardware has emerged since World War II, although today's electronic systems can trace their roots back to the abacus of the Orient and 19th century attempts — some successful and others fruitless — to produce mechanical calculating devices.

In eight swift years, there have been born second- and third-generation business data processing systems — the former employing transistors in place of the first-generation vacuum tube technology and the latter employing tiny integrated circuits and advanced logic wiring to pack many times the data-handling capacity into less cabinet space.

Until quite recently, the hardware of the computer world was designed and developed as a separate entity, and the programming to make the machine do its job, in effect, came as an afterthought. Things have changed. Today, we think in terms of total data processing systems. We are learning to breed the hardware of the machine and the software of its programs as an integrated product.

The concurrent development of hardware and software means that each has pronounced effects on the other. Good system design today calls for the ability to analyze adequately the "tradeoff" factor to achieve proper balance between the machine and its programming packages.

In the classroom, a computer program is written as a series of words and mathematical symbols.

This young lady prepares a flow chart showing the various program steps.

The modern business computer requires a blueprint of instructions prepared by a wide variety of programmers.

The systems designer has to tailor the hardware to the demands of the planned programming — and vice versa. The requirement is not unlike that which arises in many fields of systems planning. In the automotive industry, for example, the engineer has to know whether the eventual car owner would be more inclined to buy a car that sacrifices racing-car speed for increased fuel economy. In short, what does the consumer want for his money?

The total data processing system consists of four basic components — hardware, software, customer or user programs to fit a specific assignment, and last, the data base — the mass of information which needs processing.

In addition to the four basic components, there should be added a fifth — the persons who do the programming.

A common misconception today is that the modern electronic data processing system is a 20th century Ouija board — all you have to do is come up with a problem, push a few buttons, and you have the infallible answer.

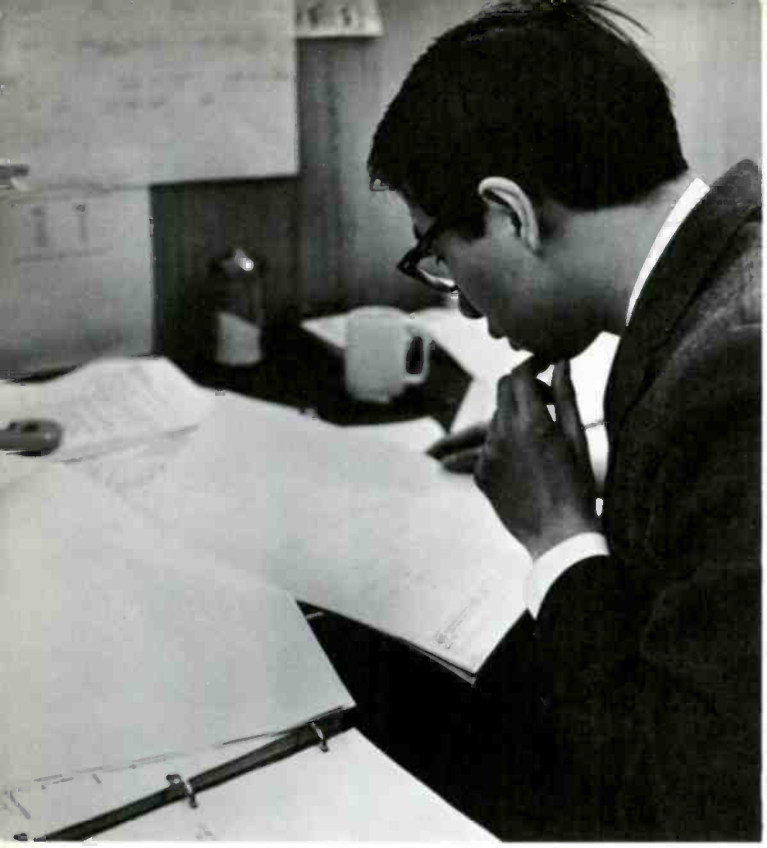
Today's computers can come up with the answers à la Ouija board; but they have to be fed a well-regulated diet of facts and figures, and a trained expert has to lay down in program format the sequence of moves that can well mean the success or failure of a business enterprise.

In keeping with the growing emphasis on the programming aspect of data processing, a "seller's market" has developed with more opportunities available than the number of embryo programmers.

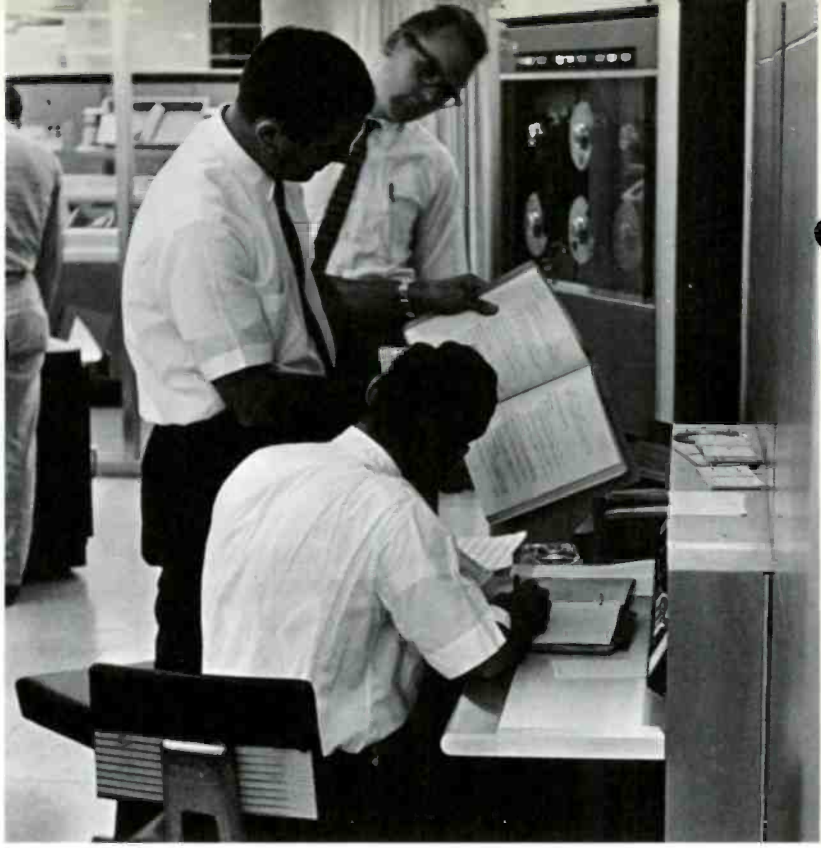
What sort of people go into computer programming? In the experience of one major computer manufacturer, top-grade programmers have been developed from a wide variety of educational and job experiences such as agriculture, physics and mathematics, and clerking in a retail shoe shop. The basic requirement is a logical approach to problem solving — and, of course, a knowledge of math is helpful.

One of the aspects of computer programming today is that it has an exceptional appeal to women, persons of foreign extraction, and members of various minority groups. The reason for this appeal is simple. Because of the tremendous shortage of programmers on all levels of achievement, there exists absolutely no prejudice. The present generation of computer trainees and programmers may perpetuate this attitude.

There has been, thus far, a dearth of formal recognition of the art of programming at the college and university level. Young men and women have more or less drifted into this phase of computer technology. There are signs, how-



A programmer translates the problem to be solved into computer language.



Programmers check to see that a program fed into the computer is performing correctly.

"Estimates of programmers needed by 1970 range from a half million to more than a million."

ever, that organizations in the data processing field and institutions of higher learning are aware of the problem.

There is a growing movement sponsored by such organizations as the Association for Computing Machinery to assist colleges and universities in this country — and to an increasing extent, high schools — to prepare students for work in the programming field. The ACM has established a Curriculum Committee on Computer Sciences that meets periodically with computer people and educators.

The spreading use of computers by colleges and universities is helping to further the over-all movement. Nine colleges and universities now have established departments of computer sciences. Doctorates can be sought in 15 universities, master's degrees at more than 30, baccalaureates in at least 17 colleges, and 10 colleges are planning or considering departments of computer sciences.

By and large, the various departments of computer sciences in such schools have been under control of the mathematics department. There is reason to believe that in the next few years separate departments devoted to the computer sciences will be established, with curricula including not only mathematics and physics but with a due emphasis on the humanities, social sciences, and economics.

It has been predicted that by the early 1970s most major colleges and universities will have such separate departments with graduate courses in the computer sciences. All of which might seem to indicate that a computer programmer has to be a cross between an Albert Einstein and a Louis Pasteur. This is far from the truth. There are almost as many levels of programming endeavor as there are branches of medicine. The graduate schools envisioned would prepare young men and women for the highly complex job of advanced computer programming, which is as far removed from basic programming as brain surgery is from a general medical practice.

At the apex of the programmers' pyramid are the specialists who develop entire systems of software — the basic instructions to get the machine to operate in a desired fashion and with the associated peripheral devices at its disposal. In a certain sense, these are the architects of the programming world. They prepare the master blueprints for computer systems operation.

From these blueprints, less advanced programmers put together the detailed lists of instructions to implement the assigned task. They are the carpenters, the bricklayers, and the stonemasons who come up with the "fleshed-out" program based on the master plan of the architect.

In the case of such advanced data processing systems as the RCA Spectra 70 Series, the systems specialists had to develop four basic programming systems to cover a wide range of hardware complement and application requirements. These are: (1) a primary operating system, (2) tape operation system, (3) tape disk operating system, and (4) disk operating system.

After the computer has been instructed, programmers await the results.

The first system is specially geared to minimize the time required and the transitional difficulties for a user making the step from a punched-card or small-tape system to full-scale data processing. The second permits the computer user to go on to random access and communications capabilities. The third and fourth levels move forward toward a demand for total information systems, real-time systems, and multiprocessor systems.

After the grass roots operating systems have been developed, the other programmers start working on system task "packages." A task package is a collection of programs that have a direct bearing on a specific type of application, such as banking, insurance, transportation, or manufacturing.

These package programs are a happy medium in the sense that they meet most of the needs of the average user in the field involved. However, most companies, like individuals, are a bit different from all others in their category.

So, the master blueprint that has been "fleshed out" in package form still needs refinement. One might say that the architect has done an excellent job and the artisans have put the bricks, stone, and lumber in place, but the future owner of the house wants a fireplace where none would ordinarily be called for.

At this stage, the customer programmers become all-important. These are the men and women employed by the user of the data processing system. They must, of necessity, have a working knowledge of both their own firm's business and computers.

Industry sources estimate there are in the United States today between 200,000 and 300,000 programmers, a major percentage of them employees of computer users. Estimates of the force of programmers needed by 1970 range from a half million to more than a million. The eventual figure probably lies somewhere between these two extremes.

The great bulk of employers seek personnel with experience in the data processing field or at least some degree of higher education in business administration, physics, and mathematics. So far, the market for inexperienced high school graduates is slim. A relatively few companies will accept programming hopefuls and train them in their own way of doing business, but even here there is normally a basic requirement of at least two years of mathematics.

The reasons behind the emphasis on computer experience or advanced education are obvious: such trainee applicants can be expected to achieve fairly quickly as much as five times the productivity as those who enter the field "cold."

Like their counterparts in the data processing manufacturing world, the user programmers become electronic linguists. They must learn to understand and work readily with such computer languages as COBOL (Common Business Oriented Language) and FORTRAN (Formula Translater), a mathematical-type language widely used in scientific electronic data processing.

The modern computer is basically a binary machine — which means simply that it works with and recognizes only "ones" and "zeros" to perform a given job. The programmer on a specific application prepares work sheets in a variety of computer "dialects." These work sheets are used by the operators of machines to turn out the necessary punched cards to feed the program into the computer's memory.

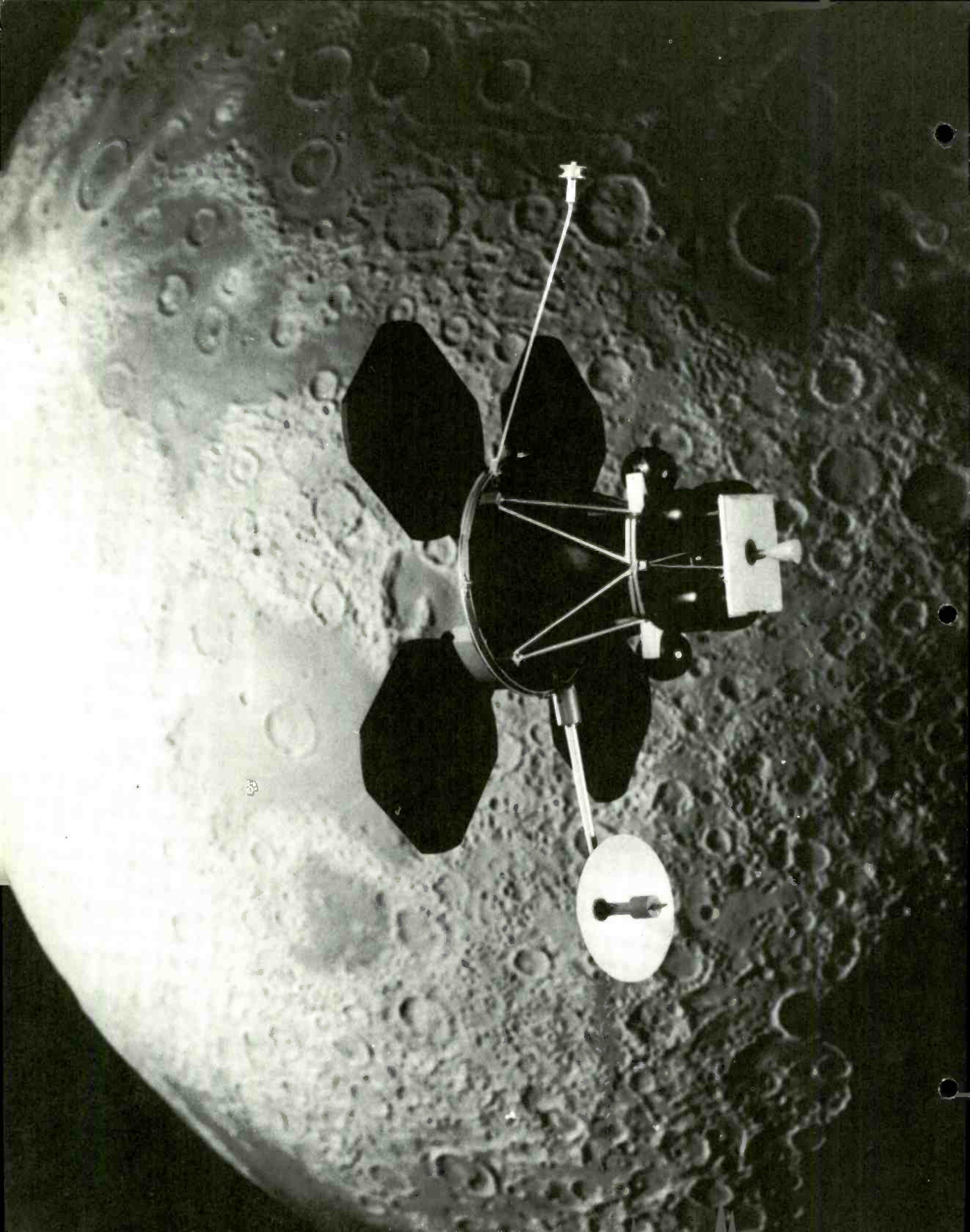
Through the magic of data processing electronics, the various steps to complete the task assigned are assembled in proper order. Once this has been done, and the computer duly loaded, the data processing problem can be solved in a matter of seconds by push button. The electronic circuitry built into the computer automatically calls in the various steps in the process and produces the processed information, whether it be a simple payroll application or a more complex chore.

The basic binary language used in computer operations today when printed out is a series of ones and zeros, representing the letter, numeral, or other data symbol involved. This basic language is used in several different variations, or dialects, one of which is EBCDIC (Extended Binary Coded Decimal Interchange Code).

In the EBCDIC dialect, a programmer might state:

11010111 11011001 11010110 11000111 11011001 11000001 11010100 11010100 11001001 11010101 11000111 01111101 11100010 01000000 11100011 11001000 11000101 01000000 11010010 11000101 11101000

For persons and computers who do not "speak" EBCDIC, this means: Programming's the key. ■



Lunar Orbiter: Prelude to a Landing

When Project Apollo astronauts reach the moon in a few years, they will land on a site preselected by the scanning eyes of lunar-orbiting cameras.

by Robert E. Tolles

Sometime this summer, an Atlas-Agena rocket will blast off from the National Aeronautics and Space Administration's launch facilities at Cape Kennedy to place a compact, camera-laden spacecraft into orbit around the earth and then into obit around the moon. The flight of this first American Lunar Orbiter will mark an important milestone in a lunar exploratory program that began with the taking of the first closeup pictures by Ranger 7 and will end before the close of this decade with the landing of the Project Apollo astronauts on the moon.

The Lunar Orbiter's primary mission will be to take sharp, detailed pictures of several areas of the moon's landscape where a manned spacecraft might land. These photos, together with data gleaned from the landing of the Surveyor spacecraft on the moon, will provide information vital to the success of the first manned lunar expedition.

The first Lunar Orbiter and its successors in a planned series of five missions will fly within 28 miles of the moon and take a series of high- and medium-resolution photographs of thousands of miles of surface. The detail of some of these photographs will be so precise as to enable scientists to identify objects as small as a yard square. By contrast, earth telescopes can identify objects only in excess of half a mile in diameter.

After the photographs are processed aboard the spacecraft, they will be scanned by a high-intensity electron beam and the corresponding electrical signals will be radioed back to earth. Other instruments will measure and transmit data on the presence of radiation and micrometeoroids.

An exacting set of mission, design, and contractual requirements has presented scientists and engineers on the Orbiter program with a formidable challenge. Among these requirements are:

— A flight pattern that places the Orbiter first into a parking orbit around the earth, then kicks it off on its three-day, 240,000-mile journey to the moon, and finally stations it in an elliptical orbit virtually brushing the lunar surface.

— Components that must withstand a variation in temperature from plus 100 to minus 100 degrees C. as the spacecraft passes in and out of the lunar shadow.

— An exhaustive test program consisting of the verification of six sets of hardware, often to specifications in excess of flight environment, before the first Orbiter is launched.

— An incentive contract that penalizes or rewards the prime contractor depending upon mission performance and his meeting of cost and delivery schedules.

Lunar Orbiter is the last of three unmanned spacecraft designed to scout the lunar environment and select a landing spot for Project Apollo.

The first of these was Ranger, which in three successful flights sent back to earth a total of 17,000 high-resolution photographs. RCA designed and built the television camera payload and its transmitting equipment for this spacecraft. Although the last Ranger photos before impact are about equal in detail to that expected from Lunar Orbiter, they do not cover a large enough area to permit the selection of the best landing sites.

The second lunar scouting spacecraft is Surveyor, a vehicle that will make a soft landing on the moon and physically determine the bearing strength of the surface. The recent successful landing of Luna 9, a Russian-built vehicle that sent back the first surface pictures of the moon, proved that the surface is capable of supporting considerable weight. However, Surveyor will have to determine more precisely what that strength is.

Surveyor will also take TV pictures of the area around the craft and assemble data on surface conditions. Scientists hope that Lunar Orbiter on one of its missions will be able to take a picture of a downed and operating Surveyor or even of Luna 9 so that pictures from the ground-level cameras may be related to those covered by Orbiter.

On a typical flight, Lunar Orbiter will go through a series of spatial high jinks. The Atlas rocket will boost the 850-pound spacecraft and Agena rocket to an altitude of 85 miles before separation. Then the Agena engine will ignite,

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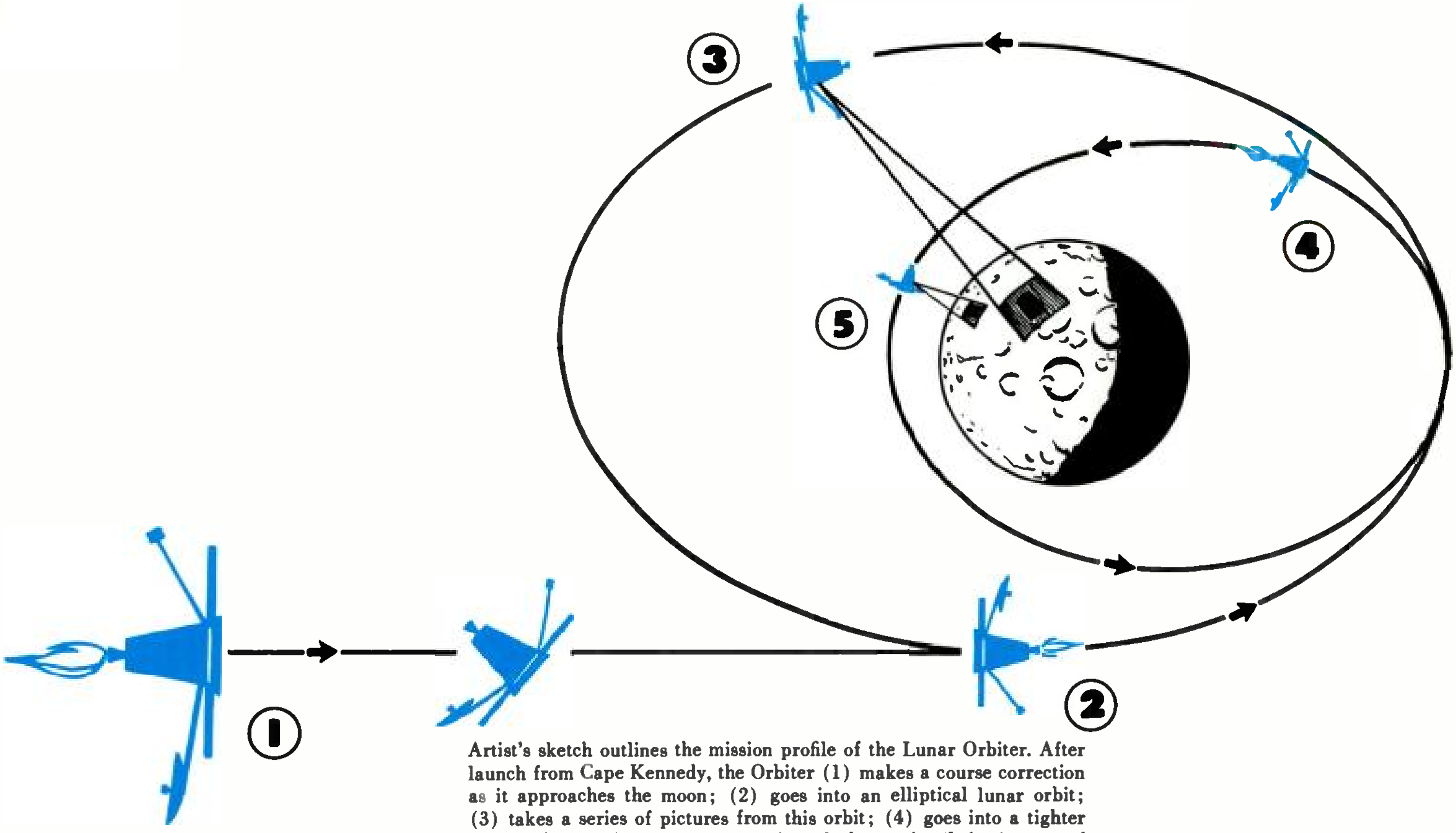
ROBERT E. TOLLES is on the RCA Public Affairs staff.

This is how the Lunar Orbiter will appear as it orbits the moon and photographs landing sites for Project Apollo.



Artist's sketch outlines the mission profile of the Lunar Orbiter. After launch from Cape Kennedy, the Orbiter (1) makes a course correction as it approaches the moon; (2) goes into an elliptical lunar orbit; (3) takes a series of pictures from this orbit; (4) goes into a tighter lunar orbit; and (5) takes a series of sharp, detailed pictures of suitable landing sites.

placing the vehicle into a 100-mile-high parking orbit above the earth.

After coasting for a distance, the Agena will reignite and push the spacecraft out of orbit and toward the moon. The Agena will drop off, and on signal the Orbiter's four solar panels and two antennas will extend. Small jets of nitrogen gas, acting on information supplied by sensing devices that obtain their reference from the sun and the bright Southern Hemisphere star, Canopus, will control the attitude of the spacecraft on its flight to the moon. These devices will also keep the solar panels facing the sun so that the spacecraft can derive the maximum amount of electric power for the operation of its communications and camera system.

One and possibly two mid-course corrections of the orbiter's trajectory will be made by a 100-pound-thrust rocket engine aboard the spacecraft. These corrections will be determined from tracking information obtained by deep space-tracking and communications stations located in California, Spain, and Australia.

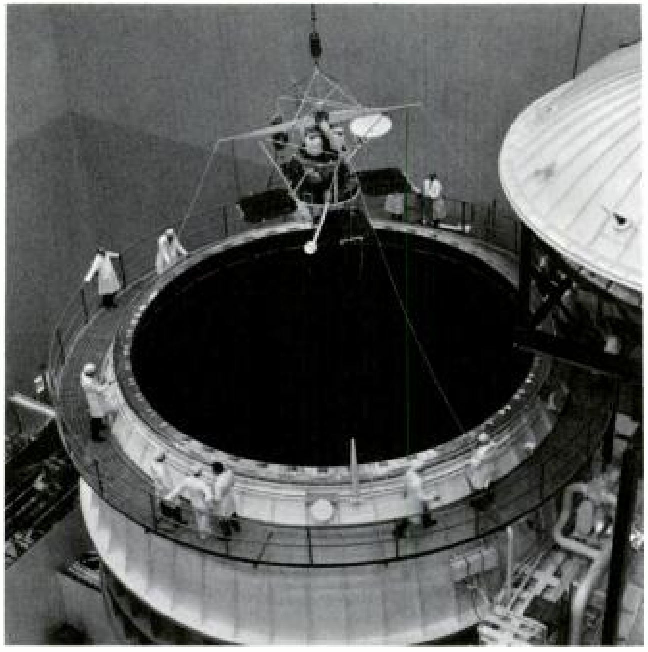
The on-board rocket will also place the Orbiter in lunar orbit. Acting on instructions from the ground, the spacecraft as it nears the moon will turn around, pointing the rocket against the direction of flight. The engine will ignite at the precise moment and slow the spacecraft so that it does not have sufficient velocity to proceed outward against the attraction of lunar gravity. The Orbiter then will become a satellite of the moon, circling at an altitude of 500 miles.

After the spacecraft has completed several orbits at this altitude, ground personnel will have sufficient tracking data to maneuver the Orbiter into its final elliptical orbit which at its closest point will pass at only 28 miles above the target area. An orbit this close to the surface is possible because of the slight gravitational pull exerted by the moon.

Pictures of the lunar surface will be taken by a camera package consisting of a high-resolution lens capable of picking out objects as small as a yard square and a medium-resolution lens covering an area four times as large and showing objects eight yards square. Scenes from both lenses will be exposed alternately on a strip of 70-mm.-wide film. The film will be automatically processed into negatives that will be "read" by a scanning tube. The resulting electrical impulses will be sent to earth where they will be converted back into light for display on the face of a picture tube. The image on the tube will then be reconstructed on film to duplicate the picture taken by the spacecraft camera.

The Orbiter will complete its photographic mission in 30 days, after which 14 days will be needed to send back all the picture data. The vehicle meanwhile will be performing other functions of great interest to scientists. Special instruments will measure radiation near the moon and detect meteoroid bombardment. Tracking of the spacecraft's lunar orbit as it is influenced by the moon's gravity will reveal the distribution of the lunar mass. This may give clues to the origin of the moon as well as help to improve the control and guidance of future spacecraft. The orbiter will continue to perform these secondary missions for a year or more after the photography is completed.

Prime contractor for the Orbiter is The Boeing Company, which will build eight spacecraft for NASA (three



At The Boeing Space Center near Seattle, a Lunar Orbiter is lowered into a chamber for testing under simulated space conditions.

for ground testing). The two principal subcontractors are Eastman Kodak, which has responsibility for the camera package, and the Radio Corporation of America, which is furnishing the power and communications equipment.

The widely fluctuating thermal environment through which the spacecraft will fly has confronted the engineers with a number of design problems. This environment varies from plus 100 degrees C. (212 degrees F.) on the sun side of the moon to minus 100 degrees C. (minus 148 degrees F.) on the shadow side. The power system, for instance, must be protected from sudden changes in voltage that will occur as the solar panels are exposed alternately to sunlight and darkness. This has been accomplished through an RCA-designed regulator that will not only protect against excessive voltage fluctuations but will dump excess power by means of a heat-dissipating element attached to the spacecraft.

During the day, the sun's rays striking the solar panels will generate close to 300 watts of electricity to power the spacecraft and also recharge the batteries that will operate the electrical system at night.

Sudden temperature changes could also distort the focus of the camera lenses and result in blurred pictures. A lens cover that will be removed only during picture-taking will guard against this.

Two particularly critical elements in the RCA-designed communications package are a modulation selector aboard the spacecraft and a frequency modulation feedback discriminator on the ground. The former borrows from commercial TV electronics theory to allow the transmission of pictures over the shortest possible period of time. The latter recovers a clear video signal from the spacecraft despite the presence of high-intensity interfering noise.

RCA engineers describe this latter device as unique to the industry and as using the latest "state of the art" design techniques. Its importance to the success of the Orbiter's mission is evident, since a spacecraft signal mixed with considerable noise interference would result in marred and useless pictures.

Lunar Orbiter's extensive preflight test program and incentive contract reflect NASA's determination to ensure that the spacecraft performs without slip-ups or delays that could be costly to the entire Apollo program.

Spacecraft components, both singly and together, have been tested to exhaustion in special environmental facilities duplicating the airlessness and extreme temperatures of deep space. Three complete spacecraft will be assembled and tested to differing specifications before the first vehicle is readied for flight.

Considerable aerospace industry interest has been stimulated by the NASA incentive contract, which uses a "carrot and stick" philosophy to ensure mission performance and meeting of cost and delivery schedules. For instance, the prime contractor will be penalized for late delivery up to $10,000 a day with a maximum penalty of $1 million. On the other hand, the contractor is permitted to keep 10 per cent of any savings below targeted cost. Good mission performance also is rewarded with a bonus.

NASA is currently planning on five missions for the Orbiter, but there is a possibility that more spacecraft will be built for further investigation of the lunar surface and environment. These additional flights could be used to photograph such areas of keen scientific interest as the back surface of the moon, the polar regions, or an area where mysterious red spots have been observed. Valuable information also could be obtained about surface properties and temperatures or the existence of a lunar magnetic field.

In any event, scientists are confident that this versatile spacecraft will enjoy a long and useful life in providing answers to many of the questions that have long plagued man concerning his closest celestial neighbor. ■

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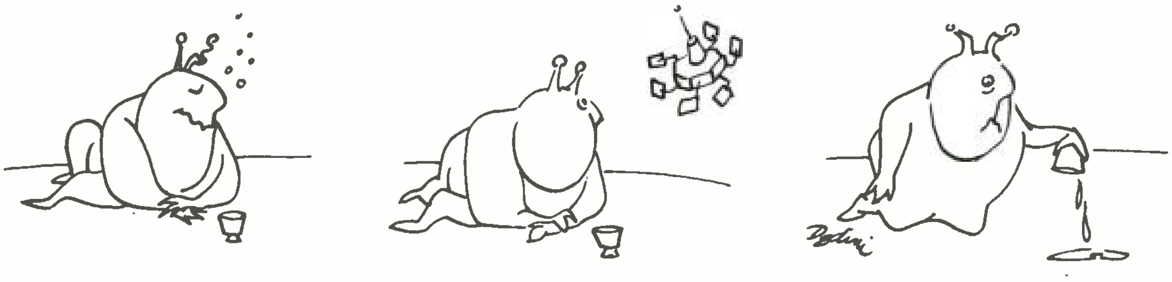


Aid for the Busy Telephone

RCA's automatic internal dial system is giving business and industry a new line on instant communications.

by Mitchel Levitas

In Philadelphia, engineers have plans for a telephone that can "talk" to a computer. In Miami, a busy executive can pick up his phone and with a flick of his forefinger — bypassing secretaries and switchboards — hold a five-way conference call with distant colleagues. And from any one of five department-store branches (soon to be six) in Manhattan, New Jersey, Long Island, Westchester, and Pennsylvania, thousands of employees can call for information over a private network of some 1,500 phones — again without a switchboard operator — providing instant service to often-impatient customers.

The old-fashioned telephone is, indeed, ringing with new flexibility these days. Developed into a fast-growing service for business and industry by the Technical Products Service of the RCA Service Company, an automatic internal dial telephone system is being applied in ways that Alexander Graham Bell could scarcely have imagined. The RCA system also cuts corporate phone bills by a hefty margin (depending on the existing equipment and local phone rates), which helps explain why it has expanded fivefold since the first contract was signed just over a year ago for a 400-phone hookup. Currently under negotiation are contracts for 3,000 additional telephones in retail and industrial firms in the East, Midwest, and South. The RCA "second network" also is tailormade for other large establishments such as banks, insurance companies, medical centers, and universities, says Bert F. Schroeder, Manager of RCA Service Company's Telephone Systems.

The automatic internal dial system is based on a two-track concept of handling telephone traffic that divides use into distinct categories: (1) internal calls, originating and terminating within the organization, and (2) external traffic between the company and callers beyond the premises. In the past, it has been customary for both types of traffic to be funneled along a single Bell system, even though between 25 and 50 per cent of the telephones in most retail firms do not require an outside connection.

MITCHEL LEVITAS is on the staff of the *New York Times Magazine.*

By separating traffic to flow on two tracks, installing a self-contained, completely automatic system for internal calls, RCA communications specialists have managed simultaneously to improve efficiency, attain greater flexibility, and sharply cut costs.

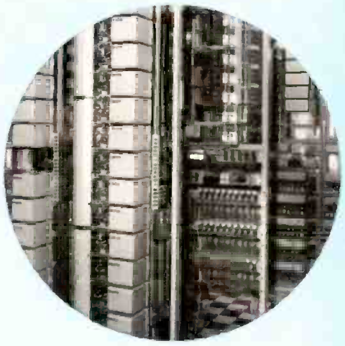
With the RCA system, internal calls can be made more quickly and privately. Since they occur on an independent phone network, outside trunk lines can operate more freely — a key consideration in department stores, for example. And engineered to the customer's needs by RCA experts, the internal dial system can also be fitted for a variety of special uses. Among them: five-party conference calls (the distance doesn't matter); area paging by connecting a dialed number to a speaker system; a code call service that can locate roving personnel with either an audio or visual signal; a dictation adapter, making dictation machines accessible to any dial phone in the system; and an executive right-of-way that sounds a soft warning signal, then allows the executive to cut in on a conversation in progress. One of the most sophisticated special needs filled by RCA's system was accomplished at the request of Mildred Pass, research director of City Stores, the parent company of 162 department stores (among them, Maison Blanche in New Orleans, Franklin Simon and W. & J. Sloane in New York, and Lit Bros. in Philadelphia).

The company's Richards chain of four stores in suburban Miami needed faster clearance of charge purchases from the sales floor. RCA's answer was a system that now permits credit authorization in less than 30 seconds. A sales person dials a number on the internal phone corresponding to the terminal digit of the customer's charge account; at that same moment one of 10 colored lights flashes on a built-in table-top panel in Richards centralized credit authorization section, enabling a clerk to pull out a coded list of appropriate customers even before she has answered the phone.

Savings are both immediate and long term. The largest, speediest economy results from smaller phone bills that come with the replacement of complicated, more expensive

Salesgirl at a suburban store of the Richards Department Store chain in Miami uses the internal telephone system to report on inventory.

Credit authorization begins with a call from this salesgirl in the lamp department of a suburban store to the main store's credit department.



Switching equipment of Richards internal telephone system is completely automatic and separate from the external system.

Questions concerning a customer's charge account are answered by a billing clerk in the credit authorization section.

A stock boy takes a call from a sales person who wants to know if a certain item of merchandise is available.

Light automatically flashes on a table-top panel in the credit authorization section corresponding to the terminal digit of a customer's charge account.

These employees in Richards main store can give a credit authorization for a charge account customer in less than 30 seconds.

equipment by the relatively simple RCA installation. The fast-growing Jefferson Stores chain of department stores in Florida, for example, plans a system of 400 RCA phones hooked up in three stores. With the addition of a fourth store in June and a fifth next year, says Milton Maronek, controller of the chain, the company expects to save more than $25,000 a year.

Jefferson's contract, like all other telephone-system agreements, is in the form of a 10-year lease, payable at a fixed monthly rate. It thus requires no capital investment by the client, guarantees against higher future costs of labor and material, and includes the cost of equipment, installation, and maintenance by the nationwide staff of RCA Service Company.

Another firm to adopt the system was B. Altman in New York, for whom another electronics company had installed a phone network in Manhattan with branches to stores in White Plains, N.Y.; Manhasset, L.I.; and Short Hills, N.J. RCA, which had been servicing the system, extended it under lease to a new branch store in St. Davids, Pa., near Philadelphia, and another to be completed in Paramus, N.J.

The first contract for a wholly new dial system was signed with Richards in February, 1965, and except for trying to keep up with the swelling volume of business, RCA Manager Schroeder's method of operation has not substantially changed since then.

RCA was invited to look over the Richards stores because, says Mrs. Pass, "telephone costs were increasing." A two-man team of communications specialists, sent down from RCA Service Company administrative headquarters at Cherry Hill, N.J., spent two weeks in the four Richards stores. They made a physical inventory of existing telephone equipment, traffic, personnel; they examined every phone location and observed how it was used; they examined and analyzed current telephone bills. On the basis of this study, the team roughed out a two-track system.

Back in Cherry Hill, the report was reviewed in detail by more technicians and geared to Richards particular needs. The RCA system was priced out, and after a month-long study — like the initial analysis, performed free of charge — the proposals were formally submitted to Richards. A contract was signed, and the operation swung into the final phase. It took six men four months to install the compact, rack-mounted equipment and connect the phones (Richards had selected beige phones out of the choice of 10 colors). All this time, Bell telephone men had worked side by side with RCA technicians setting up two parallel networks until one evening after the close of business the changeover was completed to a new, two-track system.

The system has worked so well that City Stores is negotiating for an RCA installation at its Lit Bros. store in Philadelphia. It will be a large network, about 1,400 phones, and is expected to result in substantial savings. For one thing, the parent company is building a computerized data processing center in Philadelphia, and says Mrs. Pass: "We're looking forward to the day when a clerk can dial a number and get instant, automatic on-line credit authorization. Except in special cases, the computer would do the talking." ■

Salesman in the shoe department of Richards main store calls a suburban store that is linked through the internal telephone system.

DONIZETTI: LUCIA DI LAMMERMOOR: *Anna Moffo, Soprano (RCA Victor LM/LSC 6170).* This *bel canto* masterpiece, composed by Donizetti in 1835, stars Anna Moffo, an acclaimed "Lucia." A half hour of the score that is traditionally cut in recordings has been restored, resulting in greater clarity in the story line. The French maestro Georges Prêtre conducts the RCA Italiana Opera Orchestra and Chorus on this Dynagroove recording, which is the newest version of this opera produced in more than four years.

TRUMAN CAPOTE READS FROM "IN COLD BLOOD": *(RCA Victor VDM 110).* An hour of material selected from *The New Yorker* serial, Book-of-the-Month selection, and current best-seller, read by the author. Included are descriptions of the scene of the multiple murder, the townspeople of Holcomb, Kan., the two murderers, their month-long wanderings before capture, and their execution more than five years later. Truman Capote spent six years working on the book. A multimillion-dollar movie version is planned.

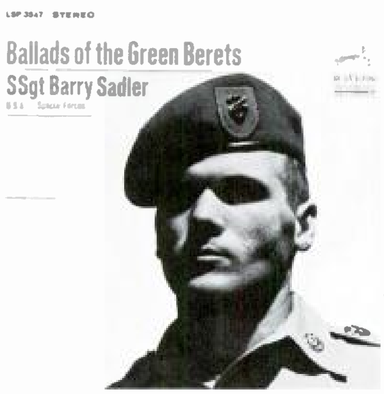
"CHOICE"—JOHN GARY *(RCA Victor LPM/LSP 3501).** One of America's reigning balladeers renders a dozen songs by as many top American composers. Each songwriter has made a special "choice" for Gary to sing in this album. Included are "Younger Than Springtime," "I'll Be Seeing You," "Don't Blame Me," "Love Is Here to Stay," "Tammy," "Charade," "Georgia on My Mind," "I'll Remember Her," "Luck Be a Lady," and "I Ain't Down Yet." Gary's silken-smooth interpretations are sure fan-pleasers.

For the Records...

NEWS OF RECENT OUTSTANDING RCA VICTOR RECORDINGS

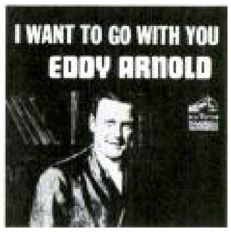
"THE TWO WORLDS OF KURT WEILL": *Morton Gould and His Orchestra (RCA Victor LM/LSC 2863).** A baker's dozen of songs from Kurt Weill's European and American composing careers, first in Berlin, then in New York during the 1930s. His Berlin compositions include "Mack the Knife" and "Polly's Song" from Brecht's "Three Penny Opera," played in the style of the 1920s. "Speak Low," "My Ship," "September Song," and others from the New York period are contemporary arrangements. Included with the album is a Living Liner record, "Recollections of Kurt Weill," which contains spoken tributes to Weill by Ira Gershwin, Ogden Nash, Langston Hughes, and Morton Gould.

THE TCHAIKOVSKY AND MENDELSSOHN VIOLIN CONCERTOS: *Erick Friedman, Violinist, with Seiji Ozawa conducting the London Symphony Orchestra (RCA Victor LM/LSC 2865).* Two of the world's most popular violin concertos, played by the "Golden Boy" of the violin in exciting, dramatic fashion, powerfully supported by the brilliant young Japanese conductor Seiji Ozawa. This Dynagroove recording and a companion album of the Robert Schumann "Concerto in A Minor" and Richard Strauss' "Burleske," featuring Leonard Pennario as pianist with the London Symphony Orchestra, mark Ozawa's debut with RCA Victor Red Seal records.



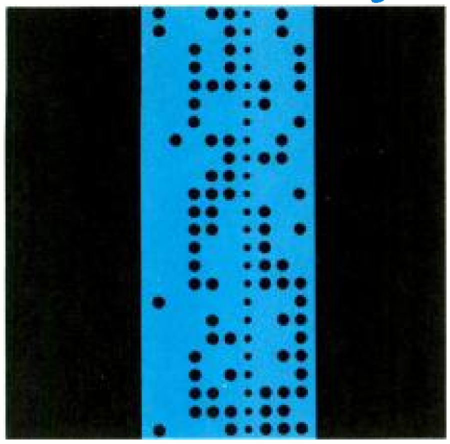
"BALLADS OF THE GREEN BERETS": *Barry Sadler (RCA Victor LPM/LSP 3547).** On the Saturday before Christmas, 1965, a young soldier, the green beret of the U.S. Army Special Forces cocked jauntily on his head, entered an RCA Victor studio in New York City and faced a recording microphone for the first time in his life. He recorded 12 of his own songs of a soldier's life in Vietnam. The "Green Beret" soldier was Barry Sadler; "The Ballad of the Green Berets" coupled with "Letter from Vietnam" was the single. Shortly after the single was issued, an album of all 12 songs followed. To date, it has sold a million copies, and the single, more than 2 million.

*Also available in 8-track stereo tape.



OTHER CURRENT RELEASES

Electronically



Speaking...

DO-IT-YOURSELF GROUND STATION

An unusual addition to space-age history was recorded recently in Moorestown, N.J., when a "ham" radio operator captured on film the first usable photos ever received from an orbiting satellite by a person using do-it-yourself equipment.

Wendell Anderson, an RCA engineer, built his own ground station for the reception of TV pictures from space, and on March 2 he began receiving weather photos from the U.S. Environmental Science Services Administration's ESSA 2 — the twelfth in the famed TIROS weather satellite series. Anderson's feat demonstrated that "ham" operators anywhere in the world can obtain good weather pictures from space by adding a few relatively inexpensive items to their existing receivers. Since the Weather Bureau has encouraged other countries and private citizens to use information transmitted by the satellite, this augurs well for the success of the project.

The homemade receiving station was built at a total cost of less than $600. Of this amount, some $250 was required for the picture-receiving equipment Anderson added to his "ham" radio receiving equipment.

For an antenna, Anderson used an ordinary cable of the type used for TV antennas. To record signals from the satellite, he bought his most expensive item, a magnetic tape recorder that cost $199. To transfer the signals to film, he bought a $15 microscope and hitched it to an argon electric light bulb. The bulb microscope apparatus operating in the dark scans an 8-by-10-inch sheet of film, which is wrapped around a rotating cylinder. The cylinder is an ordinary rolling pin with the handles removed; for smooth rotation it is cushioned by a rubber band.

The rolling pin is operated by two toy-sized electric motors ($10 each), one of which rotates the pin while the other drives the microscope horizontally very slowly so that it can register on the film the numerous lines that make up the weather picture. He then develops and prints the film in his darkroom.

ELECTRONIC HOUSEHOLD GENIE

A tiny new electronic device will substantially improve the performance and usefulness of more than 75 per cent of the electric appliances now found in the home.

Developed by the RCA Industrial Tube and Semiconductor Division, the device is called the "sensitive-gate Triac." It combines the equivalent of five transistor functions on a single silicon chip, does the work of two silicon-controlled rectifiers (SCRs), and eliminates other components in a typical electronic control circuit. The result: appliance control devices that are more compact, reliable, and economical.

One major application of the new device will be in lamp-socket light-dimmer controls. Three-way table and floor lamps are expected to be obsolete in five years, and the consumer will demand complete stepless control of the light level from full-bright to dim. The new RCA Triac makes possible for the first time miniaturized electronic control circuits that will fit into a standard lamp socket, an achievement heretofore impossible because of the space requirements of SCR circuits. The development of this device means that cost is no longer a prohibitive factor in bringing electronics into the kitchen, laundry, or workshop.

"HEAT PIPE"

The development of a "heat pipe" brings closer to reality the effective use of nuclear reactors as a direct source of high-power energy on board spacecraft. It permits the highly efficient transfer of thermal energy from a heat source to a thermionic device for direct conversion into electricity. The efficiency and reliability of the device were demonstrated in a recent 500-hour test in which the heat pipe delivered approximately 1,000 thermal watts to the input of the thermionic unit.

Developed for the U.S. Air Force by the Radio Corporation of America, the device consists of a molybdenum metal tube containing molten lithium metal. The metal is vaporized at one end of the pipe, enabling it to absorb great quantities of thermal energy from the heat source — a nuclear reactor, a radioisotope source, or a fossil-fuel burner. The vapor from the metal is transferred by thermodynamic action to the opposite end of the pipe where it condenses and releases this energy with a negligible temperature drop.

A capillary structure on the inner wall of the heat pipe, similar to a wick, returns the condensate to the boiler where the continuous cycle is repeated. Since the heat pipe has no moving parts and is unaffected by gravity, the device will operate effectively in the weightless environment of outer space.

NEW MICROWAVE DEVICE

A tiny semiconductor device that generates frequencies up to 40 billion cycles per second promises to open a wide range of untapped microwave frequencies for use in high-definition "picture-taking" radar, military communications, and industrial control systems. Developed at the RCA Laboratories, Princeton, N.J., the new unit is a microscopic crystal of the compound gallium arsenide produced in pure form by a process known as epitaxial growth. It is the first solid-state device known to operate reliably above the level of 10 billion cycles per second, is simple and compact, and can be produced in quantity, employing techniques used in the manufacture of transistors and integrated circuits.

INTEGRATED CIRCUITS FOR COMMUNICATIONS

Integrated circuits — specks of crystal that carry complete arrays of electronic components and their connections — are now advancing beyond their initial foothold in computer technology to win a new place in the broader field of communications.

The first home television sets containing integrated circuits will be marketed this year by RCA. The tiny silicon chips, about the size of a matchhead, will be used in the audio stage of certain sets in the RCA Victor line, replacing conventional circuits that employ discrete components.

Announcement of this pioneering step was closely followed by word from RCA Laboratories of a new process that opens the way for the first time to a general application of integrated circuits to all principal types of electronic communications — including radio, television, radar, and microwave systems.

Present types of integrated circuits are useful only in low-voltage applications, as in computer operations and the audio portion of TV set circuitry, and they tend to break down under the high voltages encountered in most high-frequency communications equipment. The new process promises to overcome the problem by mass-producing integrated circuits complete with insulating borders that can withstand voltages 100 times greater than those that can be tolerated by present types.

The New York skyline became even brighter in March as a rejuvenation process added new color and luster to the huge "RCA" sign atop the RCA Building, 850 feet above Rockefeller Center. The 30-foot-high sign, a famous skyline landmark since 1937, has been brightened by a combination of green phosphorescent powders on glass tubing, new neon gas, and higher voltage than used heretofore. Its color has been changed from yellow to lustrous orange-red, which has greater distance visibility and more effective penetration during bad weather.

ELECTRONIC AGE

RCA

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