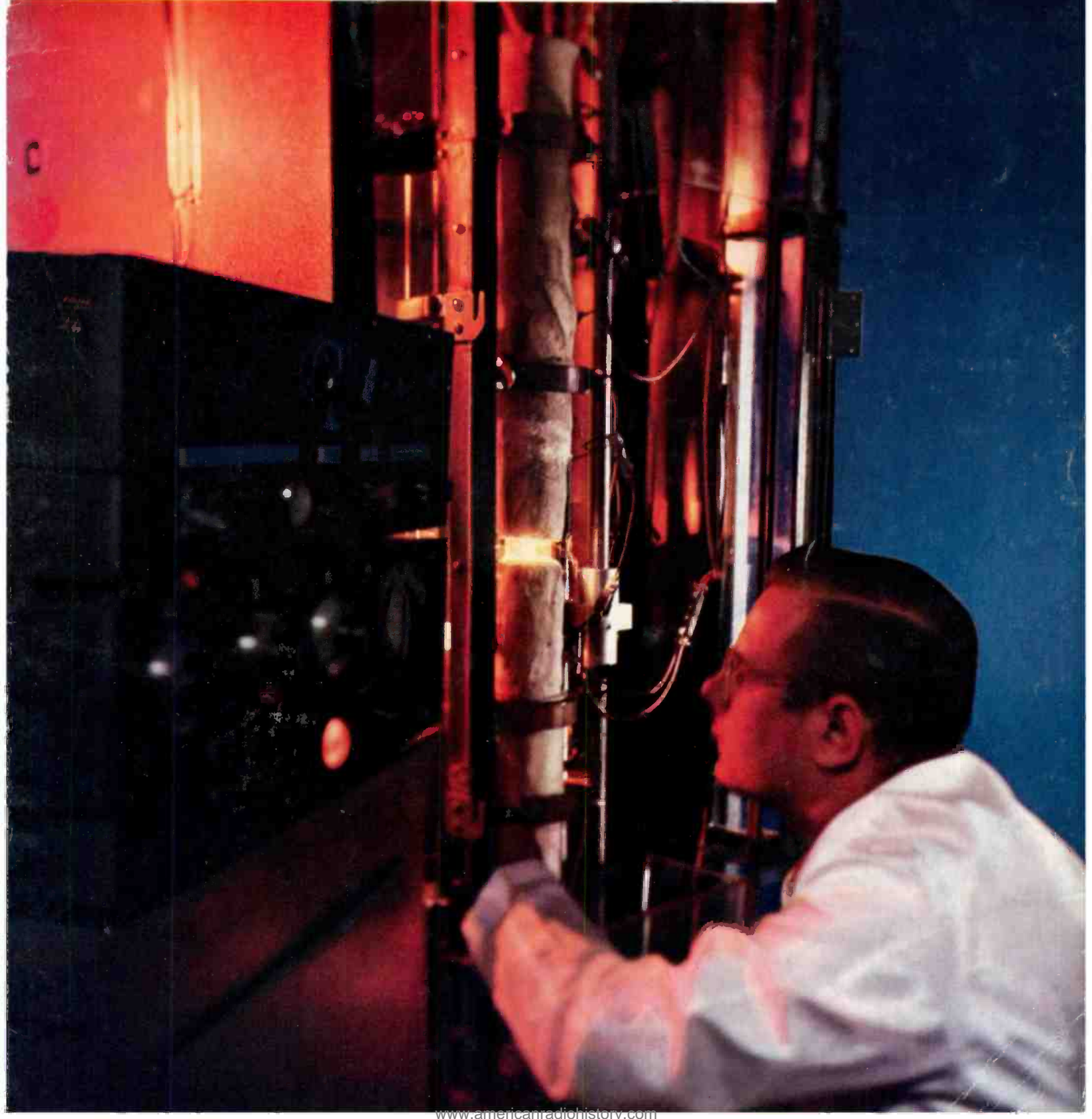




# Electronic Age

WINTER / 1959-60





RESEARCH  
 MANUFACTURING  
 COMMUNICATIONS  
 BROADCASTING  
 TELEVISION

# Electronic Age

WINTER 1959-60 / VOLUME 19 / NUMBER 1

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In this issue...

	Page
<b>ELECTRONIC PROSPECTS FOR THE 1960's</b> <i>General Sarnoff outlines the shape of things to come and reviews RCA's accomplishments in 1959</i> .....	2
<b>TV COVERS THE PRESIDENT</b> <i>American viewers see films of historic tour within hours</i> .....	8
<b>THE CHALLENGE OF QUALITY IN EDUCATION</b> <i>RCA's President Burns outlines the role television can play in upgrading America's educational processes</i> .....	10
<b>BROADWAY TRANSPLANTED</b> <i>RCA Victor records musical version of "Ah, Wilderness"</i> .....	16
<b>MARVELOUS MIDGET OF ELECTRONICS</b> <i>Tiny tunnel diode has great future in Space Age instruments</i> .....	18
<b>TELEVISION: SHADOW AND SUBSTANCE</b> <i>NBC expresses faith in public's ability to recognize the TV industry's solid accomplishments</i> .....	20
<b>BANDIT-PROOF BANK</b> <i>Electronic eyes and ears protect First National Bank of Miami</i> .....	22
<b>CINCINNATI'S FESTIVAL OF COLOR</b> <i>WLW-TV adds sports to already strong local color schedule</i> .....	25
<b>MAPPING THE ROAD TO MARS</b> <i>Ingenious devices help scientists test space equipment</i> .....	27
<b>FROM THE YUKON TO THE CONGO</b> <i>Canadian subsidiary builds microwave systems for the world</i> .....	30
<b>ELECTRONICALLY SPEAKING</b> <i>News of current developments briefly told</i> .....	32



**COVER PHOTO:** One of the most critical steps in the development of semiconductor devices such as RCA's revolutionary germanium tunnel diode is the growing of a crystal in a furnace. Here, J. W. Robinson of the RCA Laboratories staff checks the operation of a floating zone furnace used to purify semiconductor materials. See story on page 18.

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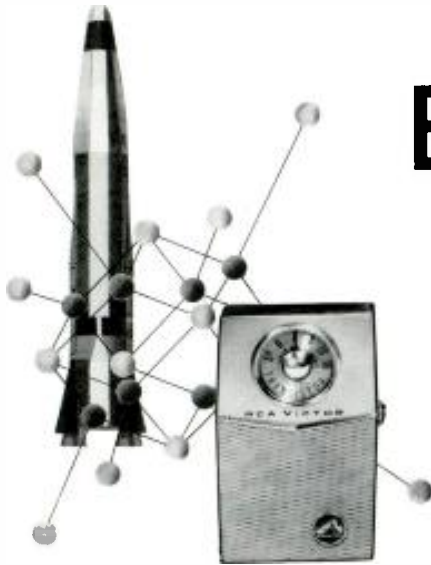
**JOHN Q. CANNON, Secretary**

**ERNEST B. GORIN, Treasurer**

Another TV "first" for RCA Victor is the Hillsborough which hides away in a table when it is not in use.



**RCA plans for the "dynamic decade" of the sixties  
in industrial automation, national defense and home entertainment.  
A year-end statement of accomplishments in 1959...  
and the shape of things to come.**



# ELECTRONIC PROSPECTS

By **DAVID SARNOFF**,  
*Chairman of the Board,*  
*Radio Corporation of America*

**T**HE PAST DECADE saw the base of the electronics industry vastly broadened by a series of spectacular breakthroughs. The tiny transistor opened up a whole world of miniaturization. Color television added an exciting new dimension to home entertainment. Electronic communications, computers and controls continued to reshape the strategy and tactics of modern defense. They helped to usher in the Jet Age of commercial aviation, and opened to exploration the infinity of outer space.

Impressive as these developments were, I am confident that even they will be eclipsed by events of the decade ahead. Projects now taking shape in laboratories suggest these ten major developments likely to affect us before the end of the next ten years:

1. Super computers — smarter, smaller and speedier (by as much as a thousand times) — will take over more and more office and factory chores.
2. Global television in full color, relayed by orbiting

satellites, will provide the home viewer with a thrilling window on the world.

3. Electronic systems without any moving parts will heat and cool the home more efficiently, and electroluminescent panels in the walls and ceilings will replace bulky electrical fixtures and cumbersome cords.
4. New homes and apartments will come fully equipped with electronic sight-and-sound systems for communications and entertainment.
5. Electronic safety devices for highways will take much of the danger out of driving.
6. Accurate long-range weather forecasts will be made possible by satellites' electronic observation of cloud formations.
7. Electronic aids to medicine will open a new front in the war on disease and bring an avalanche of improvements in preventive medicine, diagnosis and treatment of human ills.
8. Classes of 100,000 students or more under one gifted instructor will become commonplace with educational television and other electronic tools.
9. Our national security will be immeasurably enhanced by advances in electronics and atomics, including the development of an effective anti-missile missile.
10. Improved basic circuitry — the components and materials that amplify, direct and control impulses — will throw a whole new light on what is possible in the way of advanced systems for defense and space exploration as well as for the consumer and industrial markets.

RCA is equipped to contribute more importantly than ever to the pace of progress in the future. Its

*RCA Chairman David Sarnoff examines a strip of video tape, the use of which was made much simpler and more flexible during 1959.*

# FOR THE 1960's

contributions will be made not only in consumer goods but also in national defense and space exploration; in electronic computers; controls; communications; and circuitry; in television and radio broadcasting; and in the servicing of electronic equipment and facilities. In all these areas, we plan to continue and expand our program of research and development, as the foundation for progress in the forthcoming dynamic decade.

## CONSUMER GOODS

During the decade of the Sixties, Americans will have increasing leisure for home entertainment, and every type of entertainment will be readily accessible — on television and radio, on record and tape. Color television will continue to grow, and eventually most programs will be telecast in full color.

The future expansion of color TV was dramatically foreshadowed by developments of the past year. The growing public acceptance of this new medium was reflected in mounting interest on the part of advertisers, TV columnists, dealers and distributors, and the buying public.

This interest was spurred by the high quality of color receivers and the increase in color programming. NBC stepped up its color schedule 30 per cent, offering major color shows every night of the week and throughout the weekend.

Sales of color TV sets climbed steadily during the year and have been running at a rate of 30 per cent ahead of the previous year. During 1959, for the first time, RCA crossed the "break-even" line and began to earn a profit on the sale of color sets. As the sales volume continues to increase, so will the profits.

In the color broadcasting field, a large number of advertisers are already sponsoring color programs on



NBC and are presenting their commercials in color. It is expected that as sales of color sets increase, substantial advertising support will be available for additional color programs and color commercials, because of the tremendously greater impact of color over black-and-white, both in programming and commercials. This will bring about the classic upward spiral of increased advertising support leading to increased color programming and in turn to color circulation, until color television becomes established as a basic program and advertising medium.

We look for substantial progress in color television during 1960 and further progress in the years to follow.

There is nothing on the horizon as yet which promises significantly better or lower-priced color TV than is now offered to the public by RCA.

History will repeat itself in color TV as it did in black-and-white television and in radios, phonographs and other household devices. Every decade has seen one particular product lead the surge, and we are confident that color TV will fill this role in the Sixties.

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### Financial Summary

The Radio Corporation of America's sales for 1959 increased 17 per cent over 1958, and profits after taxes increased 29 per cent.

Business volume for the year reached an all-time high of approximately \$1,375,000,000, compared with \$1,176,000,000 for 1958.

Profits after taxes rose to some \$40,000,000 from \$30,900,000 in 1958. Earnings per share of common stock increased to approximately \$2.65 in 1959 from \$2.01 in the preceding year.

Cash dividends to shareholders declared for 1959 totalled \$17,044,000 (preferred \$3,153,000; common \$13,891,000). In addition, for the first time, a 2 per cent stock dividend was declared, instead of the former 50-cent cash "extra," with a view to conserving cash for the continuing growth of the company's business and broadening the base for future earnings.

The notable improvement in earnings in 1959 reflects increases in virtually all of the company's major operating units, and the cumulative effects of a corporate-wide cost-reduction program.

Sales to the Government in 1959, largely for defense programs, amounted to some \$441,700,000, an increase of 45 per cent over 1958. The backlog of firm defense orders at year-end was \$325,000,000 a rise of \$25,000,000 during the year.

At the year-end, RCA had 86,000 employees, including 6,800 in foreign subsidiaries. This represents an increase of 11 per cent over 1958. ■

We are firm in our belief that the future of television is in color and that our pioneering efforts and investments in this new field will repay our shareholders and also benefit the television industry.

During 1959, the company intensified its efforts not only in color television but also in other consumer goods to improve its present posture and enhance its future prospects.

Sales of black-and-white receivers increased over 1958, with portable models setting the pace. One of the oldest of home entertainment products — the radio — enjoyed a buoyant resurgence of popularity. RCA sold more radios in 1959 than in any other year.

By far the most significant trend in recorded music was the increasing popularity of stereophonic sound, the full-dimensional reproduction of high-fidelity music on disk and tape. One out of every three RCA Victor L.P.'s sold was in stereo; and one out of every five stereo L.P.'s bought in dealer stores was on the RCA Victor label. The magazine-loading tape cartridge, introduced by RCA, offered a new and easy-to-handle method for playing stereophonic music from tape recordings. Distribution outlets for RCA Victor records were expanded steadily, with notable progress being made in foreign markets which offer tremendous opportunities for the future.

### SPACE EXPLORATION

During the decade of the Sixties, man will embark on his most stirring adventure. He will head into the uncharted space of an unknown universe, breaking the terrestrial bonds that have contained him and his ancestors since the beginning of time. With the aid of electronics, he will learn to use outer space for communications, weather forecasting and other purposes.

When America's first human rocket passenger blasts off from Cape Canaveral, possibly some time in 1960, the RCA Service Company will play an active part in this experiment as it has in missile-tracking for the past six years. Its 3,200-man technical team at Canaveral and the down-range islands will have the exacting assignment of determining where the rocket is during flight, and collecting critical data on what is happening to the space capsule.

RCA engineers and technicians are also making preparations to assist in Project Mercury, the nation's effort to put a man in orbit around the earth, and in the highly complex "deep space" missions to the moon and beyond.

Typical of the complexity of today's space systems is a weather satellite developed at RCA's Astro-Electronic Products Division. Equipped with a pair of cloud-scanning television cameras, the satellite is designed to take pictures of cloud patterns over a large





*The RCA 501 will help increase the accuracy of delivering nine million New York telephone directories annually.*

portion of the earth. Besides the nation's first spaceborne television pickup, storage and transmission equipment, the satellite contains miniature video tape recorders, solar cell and rechargeable battery power supplies, and an imposing array of control and communications equipment. Scheduled for launching in the near future, it heralds the ultimate development of a global weather study and forecasting service based on satellite observation.

#### DEFENSE ELECTRONICS

During the decade of the Sixties, technological advances in the weapons of mass destruction will leave little doubt that the choice is between survival and annihilation. To retain the edge in major weapons, it will be necessary to retain the edge in electronics which has revolutionized our concepts of warfare in this era of missiles and H-bombs.

A decisive element in the nation's deterrent strategy in the Sixties will be the Ballistic Missile Early Warning System (BMEWS). One of the most ingenious and elaborate radar alarms ever devised, BMEWS is intended to warn against the danger of ballistic missile attack across the polar wastes.

As prime contractor to the Air Force for BMEWS, RCA has over-all responsibility for this massive project that embraces all three of the Armed Services and involves some 2,900 independent American industrial firms as subcontractors.

I am pleased to be able to report that the project

is moving ahead right on schedule. Construction at one of the three sites is about 90 per cent completed, and at another is 50 per cent finished. They are equipped with mammoth radar antennas, each half again as long as a football field and rugged enough to withstand arctic gales. The radars are designed to detect the approach of enemy missiles so that information about them can be relayed swiftly to the North American Defense Command which can order retaliatory action.

Effective retaliation requires that missile crews be able to launch a maximum number of missiles in rapid order. Up to now this has been complicated by the fact that a missile contains more than 40,000 precision components which have to be checked before flight. Under ordinary conditions, it might take a swarm of skilled technicians ten to fifteen hours to make a thorough pre-flight check.

Last September, for the first time, an electronic checkout and launch control system, developed by RCA, helped put an Atlas intercontinental ballistic missile into the skies in minutes instead of hours. The new system, installed at Vandenberg Air Force Base in California, uses computer techniques to determine whether a missile is ready to go. The entire countdown operation is controlled from a push-button console. When the checkout sequence is completed, the launch crew knows instantly which parts, if any, require attention.

As increasing dependence is placed upon missiles in our defense arsenal, the need for smaller and smaller

components becomes imperative. The critical importance of miniaturization in the Space Age is sharply underscored by the fact that it takes up to 1,000 pounds of missile to push one pound of satellite into orbit.

One of the most promising miniaturization programs for the Sixties is that undertaken by RCA and the Army Signal Corps. Its purpose is to reduce the basic circuitry of a wide variety of electronic devices to small blocks, or "micromodules," of uniform size and shape. Two micromodules – the size of a tiny pair of dice – can form a complete electronic circuit that normally would require eighty-eight components. Having thoroughly demonstrated the feasibility of the micromodule concept, RCA is now in the stage of sample production. Eventually, a tenfold reduction in size and weight of many military devices is foreseen.

While micromodules and other so-called "solid state" devices are being compressed into ever smaller packages, our engineers are also reducing the size of electron tubes. In 1959, the design of a new thimble-size tube, called the "Nuvistor," attracted widespread attention because of its improved ruggedness and efficiency. When the Nuvistor goes into commercial production in 1960, it is expected to find application not only in defense equipment, but also in the market for electronic systems for business and industry.

#### **ELECTRONIC COMPUTERS AND AUTOMATION**

During the decade of the Sixties, the era of electronic computers and automation – already well under way – will reach a new high. Increasingly, office procedures and factory operations will be handled automatically. This revolution in production methods will ultimately free millions from routine chores and hazardous toil, and give them ever broader scope for the exercise of their highest talents.

Computer service centers will be set up in cities throughout America. The small businessman of the future will have a direct line to a computer center, just as he now has a wire to the telephone office. The center will receive his accounts in coded form, keep his books on magnetic tape instead of ledgers, and print out his bills, checks and tax forms at high speed, double-checked for accuracy.

RCA pioneered in this direction in 1959. It set up an electronic system center – the first of its kind – at its Cherry Hill, New Jersey, offices. It initiated a similar center in the Wall Street financial district to handle a wide range of work for brokerage houses. Eventually, such RCA Centers are planned for Washington, D.C., and other cities across the country.

Core of the computer centers is the RCA 501, the first fully-transistorized, general-purpose data processing system on the market. More than forty RCA 501

systems have been installed or are now on order – for insurance companies, public utilities, industrial concerns, banks and branches of the Armed Forces.

Another major step in the computer field in 1959 was the introduction of the RCA 110 control computer. This flexible computing unit is designed for automation of material handling in plants and warehouses, and for control of a variety of industrial processes.

In the automated factory of the Sixties, there will be heavy reliance not only on computers but also on electronic controls. Already, RCA control systems are helping automobile makers inspect valves, feeding parts into grinder machines, speeding up newspaper production, keeping an electronic eye peeled for damaging metal particles in textile production, and doing scores of other vital jobs. In the years ahead, electronics will add new dimensions to human efficiency.

#### **COMMUNICATIONS**

During the decade of the Sixties, personal radio communications will come into its own. We will be moving in the direction of the miniature transmitter-receiver, with which people will be able to talk to friends and business associates anywhere in the world. Each receiver will have a decoding unit that will respond to only one of a million or more possible arrangements of pulses sent out from a transmitter. In this way, the individual will be assured of complete privacy in his conversation, even though he will be on the world's largest party line.

Forerunner of this dramatic era of personal communications is RCA's tiny, belt-worn Personalfone which found new uses in 1959 in traffic control, industrial plant security and other areas. The Personalfone was carried by correspondents of the Associated Press to assist in coverage of President Eisenhower's recent historic 11-nation goodwill tour. It was also selected for use at the Winter Olympic Games.

The increasing scope and complexity of manufacturing, transportation, commercial and government operations gave further impetus in 1959 to the use of all kinds of communications systems.

RCA is participating with Western Union in two multi-million-dollar communications projects for the U.S. Government.

Our Canadian subsidiary began work on a 1,200-mile microwave system for the Canadian National Railways which will open up greatly improved telephone facilities in Western Canada and Alaska. RCA microwave systems are also being installed in Colombia, Brazil, Cuba, Chile, Pakistan and other foreign countries where modern communications is viewed as an indispensable step toward higher production.

The growing importance of communications on a



world-wide scale was amply demonstrated by the activities of RCA Communications, Inc. This global radiotelegraph system carried an all-time high of nearly 9 million messages during 1959. It also expanded its world-wide network to provide the United States with the widest available range of communications services to ninety-three countries.

#### BROADCASTING

During the decade of the Sixties, international television will become a glowing reality. The home viewer will be taken to London for a message from Queen Elizabeth, to Edinburgh for the music festival, to Stockholm for the Nobel Prize award dinner, to Rome for an audience with the Pope. Educational courses will expand and multiply until eventually it will be possible for a person, who cannot get to the classroom,

to earn a college degree right in his own living room.

The great potential of educational television was dramatically underscored during 1959 by the success of NBC's Continental Classroom. The program launched a new college-level course in Modern Chemistry — in color — and reran its initial course in Atomic Age Physics. Both were offered for academic credit by more than 300 colleges and universities across the country, and almost three quarters of a million early-rising "students" followed the daily lectures on their home television screens.

In other areas, too, 1959 was a year of significant achievement for the National Broadcasting Company.

The NBC television network presented a program schedule which set the medium's standard for balance and diversity. It doubled the volume of its educational programming, gained new recognition for leadership in the coverage of news and public affairs, presented the most extensive sports calendar on TV, and led all networks in dollars gained in gross billings over 1958.

In the light of recent experience with some objectionable practices which had found their way into the young and rapidly growing TV industry, NBC has established comprehensive procedures to assure the integrity and propriety of all program and advertising material broadcast over its facilities.

#### RESEARCH

During the decade of the Sixties, progress in all areas of electronics will draw dynamic force and sustenance from the new scientific knowledge flowing from electronics research laboratories.

The electronics industry can be likened to growing trees with many branches. Their roots are firmly planted in the fertile soil of research. The possibilities for further growth are limitless for companies like RCA dedicated to continued research and development.

Whether it be communications, computers, controls, weapons, appliances or signaling in any form, electronic developments touch and revitalize almost every other business and industry. Already they have made significant contributions to communications, to navigation and transportation, to manufacturing and merchandising, to advertising and sales, to news and information, to education and entertainment, and to a number of other activities.

The products of electronic research and development have revolutionized the means of modern warfare and defense, and their potentialities for peaceful use in every walk of life are even greater. Coupled with research under way in the fields of atomic and solar energy, they promise a continued growth of the economy and a rising standard of living for all mankind. ■



*Contributing to the success of color TV during 1959 was the heavy schedule of major color programs on NBC, which featured such stars as Fred Astaire and Barrie Chase (left). RCA improved its posture in other consumer product areas as well with innovations such as the RCA Victor automatic Auto "Victrola" (below) which plays up to two hours of music through the car radio speaker.*





Films of President Eisenhower's triumphal entry into Ankara, Turkey, on December 6 were shown on NBC the following day.

## TV COVERS THE PRESIDENT

U.S. viewers see highlights of Eisenhower tour within hours of event

**A**S THE MOUNTED LANCERS escorting President Eisenhower turned into the fair grounds at New Delhi, NBC News cameraman David Weigman recorded the pomp and pageantry. He focused on the President cutting a ribbon at the American exhibit and addressing the massed crowds with an appeal for a "world-wide war against hunger." As the President finished his speech, Weigman unloaded his camera and handed the film to an Indian driver.

"Rush this to Palam Airport," he said. "There's a jet leaving at 8:30."

The film was flown from India to London and there it was put aboard a jet for New York. Six hours later, in NBC's studio 6B, producer Chet Hagan anxiously checked the control tower at Idlewild Airport:

"Anything yet on the Comet from London?"

"We've made contact with it," came the reply, "but

we don't know whether we can bring it in in this fog."

"We go on the air in fifteen minutes," Hagan said, "and we need that film."

Over the phone, Hagan could hear the pilot radioing his approach: "Wheels down . . . flaps down . . . touch down." The plane had no sooner rolled to a stop than the film was handed to a waiting messenger who rushed it by motorcycle to a special studio set up in a hangar of Trans World Airlines. There it was processed, edited and telecast directly on the NBC-TV Network's "Journey to Understanding" series, with only seconds to spare.

Thus did President Eisenhower's historic 11-nation goodwill mission mark television's swiftest and most comprehensive coverage of a foreign news event and bring the era of global TV a long step closer. Whether the President was watching a display of Pakistani



horsemanship, touring a farm village in India or meeting with Western leaders in Paris, the sights and sounds of his trip were seen and heard by home viewers in the United States within hours after they were recorded overseas.

Elaborate preparations met their first full test when President Eisenhower's plane touched down at its first stop, Ciampino Airport outside Rome shortly after noon on December 4. The welcoming ceremonies at the airport were televised live and transmitted on the Eurovision network to London. There the coverage was recorded on kinescope, edited to a one-minute segment and sent on the trans-Atlantic cable system via Montreal to New York. The NBC coverage, the first film of the trip to arrive in the U.S., was telecast at 10 a.m. New York time, less than four hours after the President had set foot on the Ciampino runway. Thanks to the speed of the coverage and the six-hour time difference between the two countries, the film was seen by American audiences at an earlier hour than it was shot in Italy.

As the Eisenhower party moved eastward — to Turkey, Afghanistan, Pakistan and India — communication lines lengthened at the rate of a thousand miles a day. NBC News kept pace by using a fast combination of charter planes, jet flights and electronics. The President's reception in Turkey, which was described as "stupendous," was recorded on film that was rushed by car through the crowded streets of Ankara to a charter plane waiting at Esenboga Airport. It was flown to Athens where it connected with a jet flight for London and from there was transmitted to the U.S. on the cable film system, used exclusively by NBC among the American networks. It was not only the first film of the event to reach the U.S., but was telecast on Eurovision as the first Ankara coverage to be seen by European audiences.

With the Presidential party, meanwhile, correspondents and cameramen were covering the story from every conceivable angle. They filmed exclusive interviews with Indian Prime Minister Nehru, Tunisian President Bourguiba and other leaders along the way. They examined the military situation in Turkey, the Communist threat in Iran, and the food problems of India. They traveled with the President by day and wrote their reports by night, often catching only an hour or two of sleep a day. The pace was so fast that they seemed to lose their sense of time. Ray Scherer of NBC told how he turned to a colleague on the press plane and asked what day it was. "It started a lively debate among the newsmen aboard," he said. "We finally settled it by asking the navigator."

The millions who crowded the route were an impressive tribute to the U.S. President, but they posed

some special problems for cameramen and correspondents. NBC's Cecil Brown approached a group in New Delhi for man-in-the-street interviews and was soon surrounded and finally engulfed completely by thousands of friendly Indians. All that could be seen of him on the film sent back to New York was a single hand waving at the camera. Another problem was the prompt dispatch of TV and radio reports without losing touch with the fast-moving tour. In Ankara, Russ Tornabene of NBC jumped from a moving press bus as it passed a radio studio, where he broadcast the first news of the trip from Turkey. In India, when officials balked at permitting Tornabene to charter a plane to fly out film, the enterprising newsman telephoned the Minister of Aviation, had him called from his bath, and won permission for the flight.

The President's arrival in Paris for the Western Summit conference signaled the start of a complex electronic operation which permitted NBC News to originate entire programs in the French capital. One of these was "Time: Present — Chet Huntley Reporting," which was telecast in a Paris studio of Radio Diffusion Francaise. The signals were transmitted over the lines of Eurovision to Great Britain and converted to American video standards at the BBC research center at Kingswood Warren. From there, the signal was sent by microwave to London Airport, where it was recorded on video tape and put aboard a jet plane for the U.S. At the Idlewild studio, the tape was telecast on the NBC-TV Network and Huntley was seen by American viewers on the same day.

In the course of the tour, American TV newsmen developed important new techniques in overseas coverage and established promising contacts with the networks of Britain, Canada, France, Italy and Spain. NBC News Vice President William R. McAndrew saw the coverage as a nearly flawless dress rehearsal for the East-West summit conference in May and as a highly successful experiment looking to the day when intercontinental TV will be a regular service. ■



*NBC Cameramen John Peters (left) and J. P. Lemoine film President Eisenhower's arrival at the Elysée Palace in Paris.*



# The Challenge of Quality

*TV promises "the greatest forward stride in education since the invention of the printing press and the textbook"*

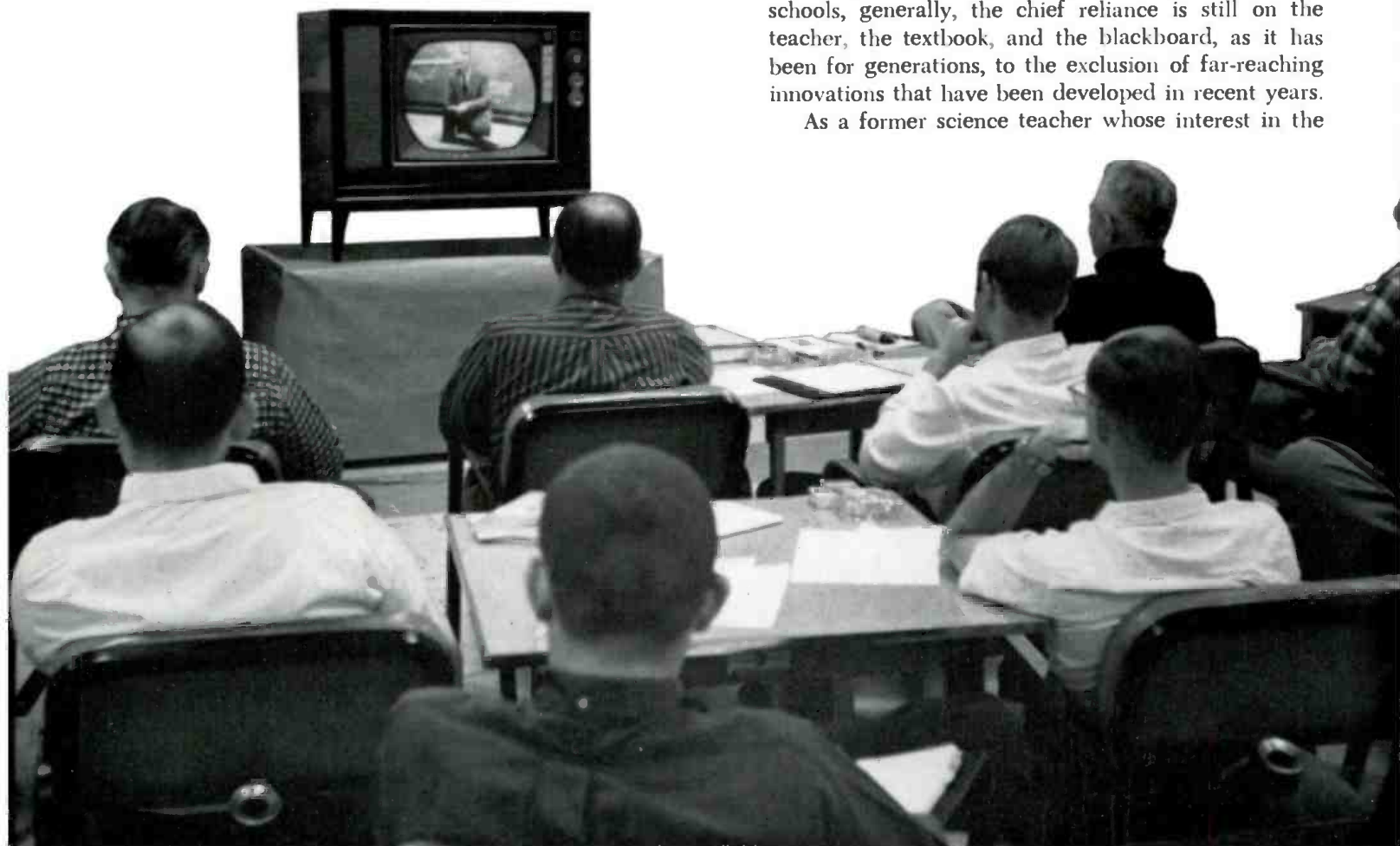
By JOHN L. BURNS,  
*President,  
Radio Corporation of America*

**T**HE DIMENSIONS of the current problem in education are clearly evident even to the layman.

They are reflected almost daily in grim headlines about the explosive increase in school population, the serious shortages of teachers and facilities, and the steady rise in the cost of education. They are revealed, too, in sobering statistics which show that one out of three high school graduates, who finishes in the top quarter of his class, does not go on to college because of a lack of funds.

Against this background, the inadequacy of our teaching methods is becoming painfully apparent. In schools, generally, the chief reliance is still on the teacher, the textbook, and the blackboard, as it has been for generations, to the exclusion of far-reaching innovations that have been developed in recent years.

As a former science teacher whose interest in the



# in Education



*This RCA electronic tape system aids in language instruction.*

educational process has deepened with the years, I believe there is still another educational problem of even greater dimensions than those so far mentioned, a problem inextricably linked with all the others.

The real challenge, I am convinced, lies in the need for a massive upgrading in the quality of education.

By this, I mean:

1. A higher level of instruction and methods.
2. A higher level of instructors.
3. A greater attention to the individual student.
4. The fullest development of the human potential.

The challenge is all the more compelling in view of the quickening tempo of technology, the growing complexity of our social organization, and the mounting menace of Communism.

To meet the challenge will require new ideas, new approaches, and a new willingness to experiment and innovate. Many of the methods and tools for bringing about an immediate upgrading of quality are at hand. But we have made only the barest start on learning how to use them. In this area, I believe that the experience of American business and industry suggests a constructive approach.

#### **IMPORTANCE OF NEW METHODS AND NEW TOOLS**

Let me say, at the outset, I am fully aware that anyone who attempts to apply to education certain concepts from business is automatically suspect.

Critics are quick to claim that the fellow who tries to translate education into dollars-and-cents terms really wants to cheapen it. They take the position that while automation in office and factory may be beneficial, automation in the classroom will not work.

They seem to forget that the biggest forward surge in the history of education was brought about by automation — in the form of the printing press. Then,

for the first time, outstandingly gifted teachers were able to set down their ideas in books that spread their wisdom and influence far beyond the narrow reach of their personal contacts. It is well to remember that the book is one of the most important products of automation in the history of man.

The fact is that education has now become our biggest business. It has an annual budget of \$20 billion, and more employees and a larger “plant” than either the steel or auto industry.

In industry, over the past half century, output per man-hour has shown a steady increase. This increase has been due basically to our skill in working out constantly better methods, and providing more and better tools to back up each worker.

Experience suggests that we can multiply the effectiveness of the good teacher with improved methods and appropriate tools, just as we have multiplied the effectiveness of the factory worker, the office worker — everybody up to and including top management. In fact, just as the printing press did.

There are now available a wide variety of new tools and techniques for improving the quality of our educational system. Foremost among them, of course, is television.

Closed-circuit installations are extending the influence of talented teachers from one to several classrooms.

The non-commercial educational stations are carrying their lessons and lectures into the home, as well as the classroom, to a potential listening audience 50 per cent larger than the nation’s total school enrollment.

The commercial stations and networks are offering an ever increasing fare of educational and cultural programs to entire regions, and, in the case of NBC’s Continental Classroom, to the whole nation. Incidentally, Continental Classroom’s course in Modern

Chemistry points up sharply the great value of color television in education. Those early risers, who have seen Dr. John Baxter's laboratory demonstrations, can appreciate color TV's amazing capacity for enlivening educational presentations.

I envisage the day when all the nation's schools will be linked in one comprehensive educational television network. Such a network, far from imposing uniformity on local curricula, could help to provide richness and variety.

Great as its potential is, however, TV is not the only new tool available to improve educational quality.

The school of tomorrow will have electronic teaching machines that will free the instructor from routine tasks and give him more time for personal counseling. The teacher's desk will be equipped with a tiny electronic scanning device linked with the library and the records office so that references can be checked quickly. A small-sized electronic computer will correct many types of examinations, process student records, survey performance and determine areas of difficulty.

Magnetic tape, which is even now finding use in the schools as well as in your own educational stations, will extend its usefulness in the years ahead. In fact, schools might well start on a program of automation today with a relatively inexpensive magnetic tape sound system, and build up from there.

Now under development at the RCA Laboratories is a magnetic tape player capable of reproducing pictures as well as sound. It works through a standard television receiver.

It also includes a recorder attachment which can pick up a program from a TV set, a closed-circuit system or a studio. A tape record made in any of these ways is ready to be played back immediately — without any processing — through a TV receiver.

#### NEW TOOLS AND HIGHER QUALITY

When these exciting new educational tools are in general use throughout our schools and colleges, their effect on quality in education can be tremendous. Just consider the advantages of closed-circuit television alone.

1. It can help bring about a higher level of instruction. It can extend the great influence of the best teachers far beyond the confines of their own classrooms, and give them a dramatic medium for projecting their ideas. As one student in Hagerstown, Maryland, put it: "In class, the teacher talks to us. On television, she talks to me."

Closed-circuit television enables schools to call upon men of specialized talents for occasional lectures. By drawing on a central video tape library, the closed-



circuit system could present lectures by the greatest minds of our times. By linking up with commercial and educational stations, it could take students to the missile range at Cape Canaveral or inside the nuclear submarine Nautilus, to the halls of Congress or the Chamber of the Supreme Court.

2. Closed-circuit television can help raise the level of instructors. The big need is to relieve the teacher of all repetitive tasks through automation and give him more time for working with individual students.

Closed-circuit TV can greatly ease the burden on teachers by giving each one a chance to do the thing he is best suited for. One teacher may be best suited for lecturing to a group of several thousand students simultaneously. Another may be able to do an outstanding job of conducting a follow-up classroom session with a handful of students. Through the more effective use of teaching talent, television can make higher salaries a reality throughout the teaching profession.

With many schools and colleges participating in a program and sharing the cost, the salary of a particularly gifted television teacher might well be in



*An RCA closed-circuit TV system is in use at Lowry Air Force Base, Colo., to train technicians as maintenance specialists for jets.*

the six-figure realm of the highest paid businessmen or other professionals. With higher salaries would come increased stature for the teacher in his own community. These factors would, in turn, keep able men and women in the teaching ranks, and attract new teachers of the highest caliber.

Since our nationwide requirements for teachers can never be met by present methods, television certainly poses no problem of unemployment for teachers.

3. Closed-circuit TV can make it possible for the teacher to give greater attention to the individual student. Once the classroom instructor has been freed from many of the chores he now performs, he will be able to devote far more time to personal counseling. Indeed, this opportunity for individualized instruction is one of the great advantages of television, magnetic tape and other electronic aids to education.

They permit the teacher to reach the student on a highly personal basis. They enable each student, in effect, to set his own pace. The fast-learner in a particular subject is challenged to work up to his full capacity. The average-learner is encouraged to develop what gifts he possesses. The slow-learner is assured of the kind of attention that will prevent his falling hopelessly behind.

A student might be in the third grade in spelling,

the second grade in arithmetic, and the fourth grade in history. We do not have equal abilities. Every pupil has potential talent of some kind, and his value in our society lies in the extent to which he is helped to use his special talent for the common good.

Former President James A. Garfield once said: "A pine bench, with Mark Hopkins at one end of it and me at the other, is a good enough college for me!"

This one-to-one teacher-student ratio has become impossible under modern classroom conditions. But with television and other electronic devices, teachers can have both the time and the means to reach the pupil once more on a person-to-person basis.

#### RESEARCH AND DEVELOPMENT

There is no doubt whatever about the capacity of educational television and other electronic devices to help us realize our democratic ideal of the fullest development of the human potential.

However, despite the fact that there are some 300 experiments going on in closed-circuit TV, few minds have begun to apply themselves as yet to the all-important questions of the best uses of these new tools and the implications they will have for teaching methods, facilities and curricula. Few have weighed the question of how to bring about a satisfactory combining of the teaching, broadcasting and graphic arts.

To answer these questions, there is urgent need for a full-scale program of Research and Development in education, comparable to the R & D programs now under way in defense and industry.

Today, industrial research is a \$12 billion operation — the "industry of discovery," as one economist calls it. In my own field of electronics, there is an axiom to the effect that "either you get into research, or you get out of business." Many industrial corporations set aside 5 to 10 per cent of their annual budget for research.

By contrast, the total amount spent annually on educational research and development comes to about one-tenth of one per cent of the overall education budget. Some of our industrial corporations are spending more money on R & D by themselves than is being spent in all branches of education combined.

It is true, of course, that a few organizations are carrying on notable experimental work in the educational field.

The Ford Foundation and its allied groups are doing a remarkable job in exploring the frontiers of teaching. Typical of their imaginative approach is the recently announced airborne educational television project in which programs will be relayed by plane to a six-state area of the Midwest.



*Closed-circuit TV at work at Fort Monmouth, N. J. (top), and at Hagerstown, Md. (bottom).*

Another example of worthwhile educational experimentation is to be found in my own home community of Greenwich, Connecticut. Recently, Greenwich joined forces with the neighboring areas of Westport, New Canaan and Darien to initiate a joint Research and Development project. The four participants are seeking a grant from one of the foundations to get the program off the ground. Once it is under way they plan to allot a certain percentage of their annual budgets to finance it.

Still another example of experimentation is the Center for Instructional Television which, I am happy to report, RCA helped to establish at New York University this fall. The main purpose of this Center is to conduct research on the most effective ways of using TV as a teaching tool, especially in uniting the teaching, broadcasting and graphic arts.

All of these projects are serving a useful function. But they are "islands of experimentation" at a time when we need not islands but entire continents. We need above all a broad blueprint.

We need scientific answers to questions which are fundamental to the whole purpose and process of learning—questions relating to the best use of teachers, the best use of facilities, and the most satisfactory curricula.

We need a broad plan of approach to bring into being all the good things made possible by modern technology—especially closed-circuit TV. The present experiments, I think, are lacking in two things.

One is scope. We must learn to think in terms of state-wide and region-wide programming instead of strictly local operations.

Another lack is a real union of the teaching, broadcasting and graphic arts. We must provide means whereby students may move through the educational process in accordance with their ability, and we must provide the greater individual counseling so sorely needed in this technological age.

#### FULL-SCALE PROGRAM

To achieve these aims, it is my proposal that we undertake a full-scale Research and Development effort in education, on local and national levels.

The program would concern itself with both short-range and long-range problems and objectives.

The short-range aspect would deal with immediate steps that could be taken to broaden our educational advance.

The long-range aspect would deal with our educational needs a decade or two hence, when the children born in the "baby boom" of the 1940's will begin to have children of their own and school enrollments will soar still higher.

To finance such a program of Research and Development, I propose that each state and locality set aside no less than 2 per cent of its education budget each year.

On the basis of an aggregate education budget of \$20 billion, this would amount to some \$400 million. This may seem tiny in comparison with the sums spent by industry and defense. But it is enormous in contrast to the \$20 million—about one-tenth of one per cent of our overall school budget—now being spent on educational research.

Can we afford such a Research and Development program in education?

I would suggest that a far more reasonable question would be: Can we afford to go on any longer without it?

Walter Lippmann put the matter clearly and concisely when he said:

"We must measure our educational efforts as we do our military efforts. That is to say, we must not measure by what would be easy and convenient to do, but by what it is necessary to do in order that the nation may survive and flourish. We have learned that we are 'rich enough to defend ourselves whatever the cost.' We must now learn that we are quite rich enough to educate ourselves as we need to be educated."

Over the long run, I am confident that research in education would pay for itself many times over—just as research in industry has done.



*The renowned Dr. Joel Hildebrand taught "Solubility" on NBC's Modern Chemistry.*



Let me give you an example of how this might work out in practice. Over the past decade, the annual per-pupil cost of running our public schools has increased by more than 70 per cent. Under conventional methods of instruction, the prospects are that this rise will continue because the cost of instruction goes up almost in direct proportion to the number of students.

However, even the preliminary research that has been done on the economics of classroom television suggests strongly that once a break-even point is reached – at about 200 to 250 students – the per pupil costs decline sharply. A study conducted by the Southern Regional Education Board showed that the cost of televised instruction would run about \$2.80 per student semester hour, compared with the present cost of \$12 to \$18 for conventional instruction.

It is my feeling that additional research could lead to even greater economies in this area. But above all the *quality* of education could be enhanced.

In a Research and Development program such as I have proposed, you members of the educational broadcasting fraternity could play a vital role. For you have in your hands the most potent means of communication between educators and the public. You can bring to your own communities a vivid awareness of the problem of quality.

#### SUMMARY AND CONCLUSION

The quality of education can be greatly upgraded by modern technology, while costs can be lowered and the increase in students can be taken care of at the same time.

The advent of new electronic tools, especially closed-circuit TV and its future derivatives, makes possible an advance in methods of education comparable to that made possible by the invention of the printing press in the Fifteenth Century.

Indeed, it is an advance which can be even greater than the development of the atomic reactor. The atomic reaction is an explosion of a material kind. The education explosion, made possible by our new electronic tools, is an explosion in thinking – affecting men's minds.

The prime needs to accomplish this advance are: (1) broader scope in the concept and the application of educational electronics; and (2) a combining of the three arts – teaching, broadcasting and graphics.

Present experiments must be drawn upon to lay out a broad business and research program to get adoption of plans for areas large enough to permit fundamental advances.

The need for greatly enlarged expenditures for research in education itself is stressed by the increas-

ingly large number of basic questions that are urgently demanding answers.

In view of all these factors and the present critical situation in education I therefore propose:

1. That plans for much broader use of educational TV be drawn up for, say, a state or group of states.
2. That a tape library of lectures by distinguished teachers be created to support such systems. This scope is needed in order to demonstrate the great benefits of educational TV.
3. That the three arts – teaching, broadcasting and graphics – be united in the creation of the tapes.
4. That a library of follow-up books to supplement the tapes be developed.
5. That an R & D fund be set up by all educational units so that advances may go on apace.
6. That other tools of educational automation be brought into existence as quickly as possible.

The task calls for bold experimentation and imaginative new approaches across the whole broad range of education, supported by a very considerable original outlay of money. The funding and implementation of these programs must come from a close collaboration between the localities and the states.

As the authoritative Rockefeller Report on Education pointed out recently: "Such innovations as the teacher aide and television should not be thought of as stopgap measures to surmount the immediate teacher shortage, but as the beginnings of a long overdue revolution in teaching techniques."

Revolutions in education have a way of occurring in cycles of thirty years or so. For example, the 1830's saw the acceptance of community responsibility for public education and the beginning of systematic teacher training programs.

The 1860's witnessed the extension of public responsibility to the high schools and the development of land-grant colleges.

In the 1890's came the great widening of college curricula and establishment of the kindergarten.

The 1920's and 1930's saw broad acceptance of John Dewey's philosophy of learning through experimentation and practice.

Today, the astonishing advances of technology give promise of effecting reforms fully as significant and far-reaching as any of these, and of raising the quality of education to new heights.

"There is a tide in the affairs of men," wrote Shakespeare, "which, taken at the flood, leads on to fortune."

Such a tide is running now in education. It is up to us to take advantage of it – for the welfare of our children and for the future of our country. ■

*(This article is a condensation of the keynote address delivered by Mr. Burns before the National Association of Educational Broadcasters in Detroit on October 28th, 1959)*





*Jackie Gleason gets into the swing of things at the recording session of "Take Me Along" four days before the show's premier.*

# BROADWAY TRANSPLANTED

Jackie Gleason  
romps through musical  
version of O'Neill's  
"Ah, Wilderness"  
on RCA Victor Records



*Uncle Sid comes back home and is startled at his nephew's growth.*



SINCE THE NIGHT of October 22, 1959, Broadway audiences have thrilled to the antics of Jackie Gleason as the celebrated television comic cavorts and generally has a good time for himself as "Uncle Sid" in the musical "Take Me Along," — an adaptation of Eugene O'Neill's comedy "Ah, Wilderness." The show — which marks Gleason's return to Broadway after an absence of 12 years — also features Walter Pidgeon and Eileen Herlie in starring roles, and was hailed by critics as one of the season's best offerings. RCA Victor Records was so confident the show would be a success that it had the entire cast assemble at its New York recording studios four days before the Broadway premier to make the tape from which both RCA Victor's regular L.P. and Living Stereo albums were made. Captured in the recordings are all the warmth and humor of Gleason's portrayal, along with the nostalgia of small-town America of 1910—truly Broadway transplanted. ■



*Sid admits the error of his ways to Miss Herlie.*



*Sid sings "For Sweet Charity" at the picnic. The new fire engine gets a rousing dedication. The finale is a happy one for Uncle Sid.*

During a lull in the recording session (right), Fred Reynolds, RCA Victor Artists and Repertoire Director (left, standing) has a word with Robert Merrill, the show's composer, while Lehman Engel (left, seated), the show's musical director, and RCA Victor engineer Ernie Oelrich take it easy. Album jacket is shown at the left.





## THE REVOLUTIONARY TUNNEL DIODE

MAY SOON BE AS USEFUL AS THE TUBE AND TRANSISTOR

# Marvelous Midget of Electronics

**A** NEW DEVICE about the size of the letter "o" in this line of type carries within its tiny bulk some of the brightest expectations to have stirred the electronics industry since the debut of the transistor.

Its name is the tunnel diode: a diode, because it has only two electrodes, or conducting elements; a "tunnel" diode because of the remarkable manner in which electrons seem to "tunnel" through a barrier formed by the junction of materials used in its construction. The tunneling effect and the simplicity inherent in all diodes have resulted in a rugged, small, and potentially cheap basic circuit component of astonishing versatility, applicable in equipment ranging from radio and television receivers to electronic data processing systems.

The tunnel diode promises to have a profound impact upon electronic computer technology and electronics in space. It functions at far higher frequencies than does any previous solid device, meaning far greater speed of operation in electronic circuits. It demands extremely little power — so little that hundreds might be operated from a single 1½-volt flashlight cell. It is considerably less sensitive than are transistors and other semiconductor devices to radiation effects and extreme changes in temperature. Its minuscule dimensions mean more circuit functions packed within a small space — a matter of critical importance particularly in satellites and space vehicles.

Not the least remarkable aspect of the tunnel diode is the speed with which it has appeared on the electronics scene. The tunneling effect which is the key to the device has been familiar to scientists for some years. However, it was not realized until recently that while the tunneling current at first increases as more voltage is applied, there is a critical point beyond which the current drops with increasing voltage. This characteristic, known as negative resistance, was observed by Dr. Leo Esaki, a Japanese scientist, who reported it in a letter to *The Physical Review* on January 15, 1958.

The report stirred the interest of scientists in Amer-

ican laboratories. Among them were Dr. D. O. North and Dr. Henry S. Sommers, Jr., of the technical staff at RCA's David Sarnoff Research Center in Princeton, N.J. To the two RCA scientists, the new data pointed to the possibility of a simple, low-power, high-speed device admirably suited to the requirements of an ultra-high-speed computer study and development program under way elsewhere in RCA Laboratories and at RCA's Electronic Data Processing Division, under U.S. Navy sponsorship.

With this objective primarily in mind, Dr. Sommers and his associates set to work with such energy that the principle was translated within six weeks into RCA's first experimental tunnel diode — the forerunner of a rapid sequence of laboratory types. Within a short time, ingenious fabrication methods were worked out by Herbert Nelson, of RCA Laboratories, making numbers of the diodes available for experiment.

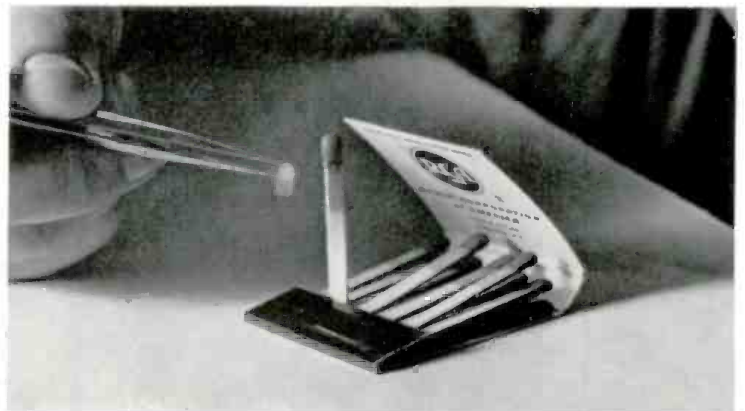
In slightly more than twelve months after the start of the research effort at Princeton, RCA scientists published the first detailed reports of tunnel diode performance in the basic circuit functions of oscillation and amplification. Their disclosures were followed closely by reports of tunnel diode research in other leading laboratories.

By this time, the RCA effort had been broadened to include advanced development work under Dr. E. L. Johnson and Dr. D. J. Donahue at the RCA Semiconductor and Materials Division at Somerville, N.J., with the aim of translating the laboratory device into a production item. The goal was achieved in mid-November, 1959, when RCA announced the availability of tunnel diodes to industry for experimental purposes — slightly over a year and a half after the start of work in the laboratory. Several other leading companies also entered the market with sample production models of the tunnel diode. Thus, by the year's end, the new device was on its way to general application following an intensive research and development program whose brevity had set something of a record in the history of electronics. ■





*With the precision of a skilled watchmaker, Edna Casamassa (above) of the RCA Semiconductor and Materials Division plant at Somerville, N. J., inserts a tunnel diode into its low-inductance case. No larger than the head of a match (right), and 100 times faster than a transistor, tunnel diodes make possible up to one billion decisions a second in an ultra-high-speed computer. Its tiny size and low power requirements also give it a promising future in Space Age instruments.*



# TELEVISION:

## *Shadow and Substance*

**NBC EXPRESSES CONFIDENCE THAT "THE AMERICAN PEOPLE CAN DISTINGUISH BETWEEN THE SINS OF A HANDFUL OF MEN AND THE SOLID ACCOMPLISHMENTS OF AN INDUSTRY."**

By **ROBERT W. SARNOFF**,

*Chairman of the Board*

and **ROBERT E. KINTNER**, *President*

*National Broadcasting Company*

**T**ELEVISION WINS a daily vote of confidence in 45,000,000 American homes. More people choose to spend more time watching it than ever before. Yet today it also falls under the shadow of some ugly words — deceit, fraud, mediocrity, irresponsibility. We believe the shadow is blinding many observers to the substance. It is time to let some light in, to take an undistorted view of the facts.

Where does the shadow come from? It is cast, over many months past, by a few men who poisoned a few defunct programs in a single narrow segment of programming.

But it is a long shadow, so long and deep that it has blacked out some remarkable achievements — such as the television debuts of Laurence Olivier, Ingrid Bergman, Alec Guinness; the massive array of special programs from Astaire and Hope, to Shaw and Ibsen, to "Life in the Thirties" and Beethoven's "Fidelio"; the alert, thorough coverage of Nikita Khrushchev's U.S. visit that brought living history into the home. Apart from these peaks, the shadow has also blacked out television's genuine progress in balanced programming that meets the full diversity of the nation's viewing desires.

We at NBC do not make light of quiz-show skull-duggeries. We have never condoned them nor taken part in them. We do not deny we erred in trusting those who deceived us. Against this corruption, we

have acted vigorously on our own and in unstinted cooperation with all official agencies.

NBC is the first network to have set up a permanent organization within its ranks devoted to the planning and execution of whatever new measures are needed to assure the highest ethical standards throughout our operations. We will crack down on improper practices wherever they may appear, in programming or advertising.

But NBC vigorously rejects the suggestion that the reprehensible conduct of a few individuals is in any sense representative of the character of the whole television industry. We reject the loose-minded notion that it reflects on the quality of our whole program service. We reject the theory that it is cause for such drastic measures as government control, creation of a "czar" or revamping our American system of broadcasting. Though we are dedicated to improving a schedule that already sets the medium's standard for program balance, we also reject the easy course of hinting about grandiose schemes for television's Utopia. We affirm these principles:

1. NBC assumes complete responsibility to the public for what appears on the NBC Television Network.
2. NBC will present quiz and other audience participation shows for the millions of viewers who enjoy them — and who have a right to expect that we can and will safeguard the integrity of *all* our programs.
3. From all possible creative sources, within our own ranks and outside, NBC seeks constantly to satisfy the widest possible range of program tastes and interests — be it by Western or ballet, panel show or opera, original drama or news special, football or physics, religion or comedy. We present adventure shows — and shows that are adventures in concept, substance and form.
4. As the broadest of mass media, and one committed by law and its own well-being to serve the public interest, we have an obligation to provide the entertainment and relaxation for which millions of Americans bought their TV sets. We also have an obligation to inform, enlighten and inspire.
5. Just as NBC pioneered radio networking and black-and-white television, we propose to keep blazing the trail for color television, which adds new dimensions of beauty, meaning and impact to our medium.

We have confidence that the American people can distinguish between the sins of a handful of men and the solid accomplishments of an industry that does its daily job under the closest public scrutiny in history. ■





TV devoted hours of prime time to Premier Khrushchev's U.S. visit



Ingrid Bergman made her TV debut in 1959



Outstanding teachers appear on Continental Classroom

TV brings top stars such as Gene Kelly regularly into American homes

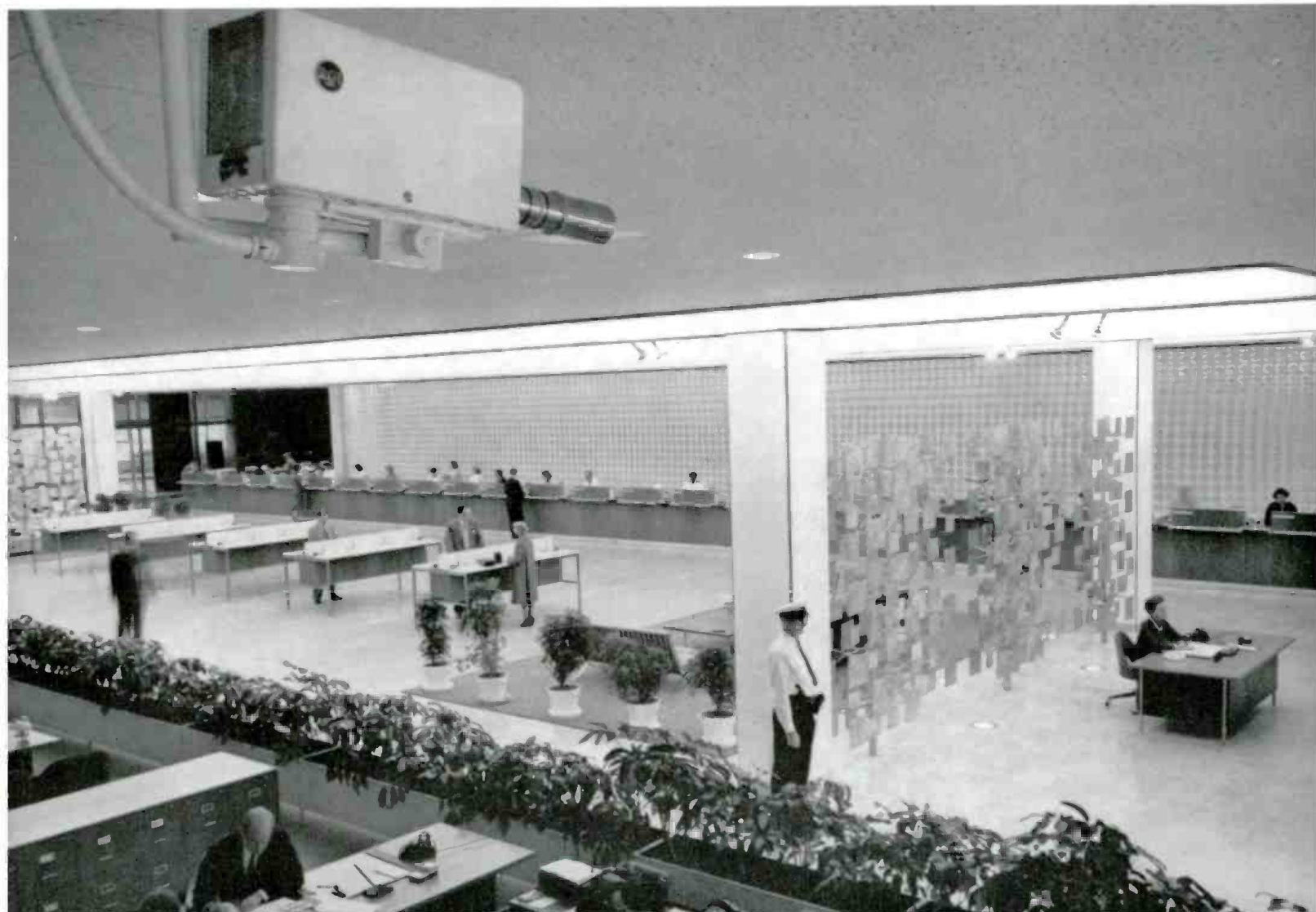






# BANDIT-PROOF BANK

*Five RCA TV cameras attached to the ceiling give guards a clear view of all teller cages at Miami's First National Bank.*





*Guard (far left) watches activity on main banking floor by monitors. Special camera (left) is used to snap picture from monitor for further study and permanent record. Guards on banking floor (below) are equipped with RCA's two-way "Personalfone" and can send or receive messages from guard headquarters as necessary.*

## Electronic eyes and ears protect the First National Bank of Miami

**A**T THE FIRST NATIONAL BANK OF MIAMI, a hold-up man would have about as much chance as a snowball in the Florida sunshine.

Bank officials planned it that way with electronics.

The main banking area on the ground floor of the bank's new 18-story building is ultra modern in design and layout, and not too far removed from the setting in similar financial institutions elsewhere. But that's where the similarity ends.

Unnoticed by the average bank patron is the fact that he is on television almost from the instant he enters the bank — and as an added security and customer service measure, he is never more than a few paces from bank employees equipped with tiny, two-way radio sets.

"The First National Bank makes full use of electronics to provide improved customer service, protective security and employee assistance," says Senior Vice President Ray F. Basten.

To handle the job, the bank has installed one of the largest closed-circuit television systems ever used for such purposes.

Attached to the ceiling are five Radio Corporation of America television cameras. These are spotted to provide complete surveillance of all 48 teller windows and the adjacent areas.

Two additional RCA television cameras are trained on the 12 teller cages at the bank's drive-in facility. Each of the seven cameras feeds its picture to a monitor in the bank guards' headquarters room. The camera and accompanying receiver have their own control unit, functioning in effect as a separate TV station in miniature.





The two cameras in the drive-in area are equipped with wide angle lenses and a special iris control which automatically adjusts for changing light conditions. The cameras also are mounted in special cases, with the glass-enclosed "business end" complete with windshield wiper to remove raindrops or condensation.

The bank's security force office resembles a television station control room more than a guard headquarters. Ranged against one wall is the bank of television monitors, giving a hawk's-eye view of activity at all teller locations. The five TV cameras in the main banking area are aligned at such an angle that the guard on monitoring watch literally can look over the bank customer's shoulder rather than directly at his back. This arrangement is not one born of idle curiosity, but rather is designed to prevent a gun-wielding criminal from keeping his weapon hidden from the TV eye during an attempted holdup.

There is a special camera in guard headquarters which can be focussed on any of the seven TV monitors to snap a picture of a suspicious character for further study and permanent record.

Aside from its anti-crime function, the TV system also enables guard headquarters to spot quickly any out-of-the-ordinary activity, such as a depositor in need of assistance or a frightened youngster temporarily separated from his parent.

This versatile little unit, known as the RCA "Personalfone," in effect turns the wearer into a walking radio station, permitting him to receive messages from guard headquarters and to reply as necessary. A self-contained two-way radio operating in the 50 and 150 megacycle bands, the receiver is fully transistorized, measures only 6½ inches in its largest dimension, and is powered by a single battery with a life span of 150 hours. The transmitter is scarcely larger. Designed for a variety of applications, the "Personalfone" also is helping New York Port Authority policemen direct traffic, and is in use by plant guards, telephone lineman and others. A special version of the "Personalfone" was used in December, 1958, to relay President Eisenhower's voice to earth from the Atlas "talking satellite."

The radio-TV hookup is complementary. A guard stationed near the bank's main entrance, for example, can radio his headquarters that his suspicions have been aroused by a new arrival on the scene. The guard may remain at his post while the closed-circuit television system goes into action, keeping a watchful eye on the subject in question. If further cause for alarm is revealed on the TV screen, the duty officer would instruct the floor guard to move in.

In each teller's cage, there is a concealed button which permits him to put his conversation with anyone at his window "on the air" via a circuit to guard headquarters. Details of such a monitored discussion may warrant telling a floor guard via belt radio to step into the picture.

The special circuit linking teller cages with the security force officer is a one-way hookup — a feature designed to prevent a guard from inadvertently talking back to the teller and thus alerting a would-be robber.

As an added service for its depositors, the Miami bank has equipped its "floormen" with RCA pocket-size radio receivers, linked to the overall radio system.

The floormen are specially trained to assist anyone with a banking problem. The receivers they carry are the same unit which forms part of the two-way "Personalfone" worn by the uniformed guards.

Each of the teller locations has a microphone which can be used to notify security force headquarters that the services of a floorman are required by a depositor. The duty officer relays the request over the radio system and the customer is being helped in a matter of seconds.

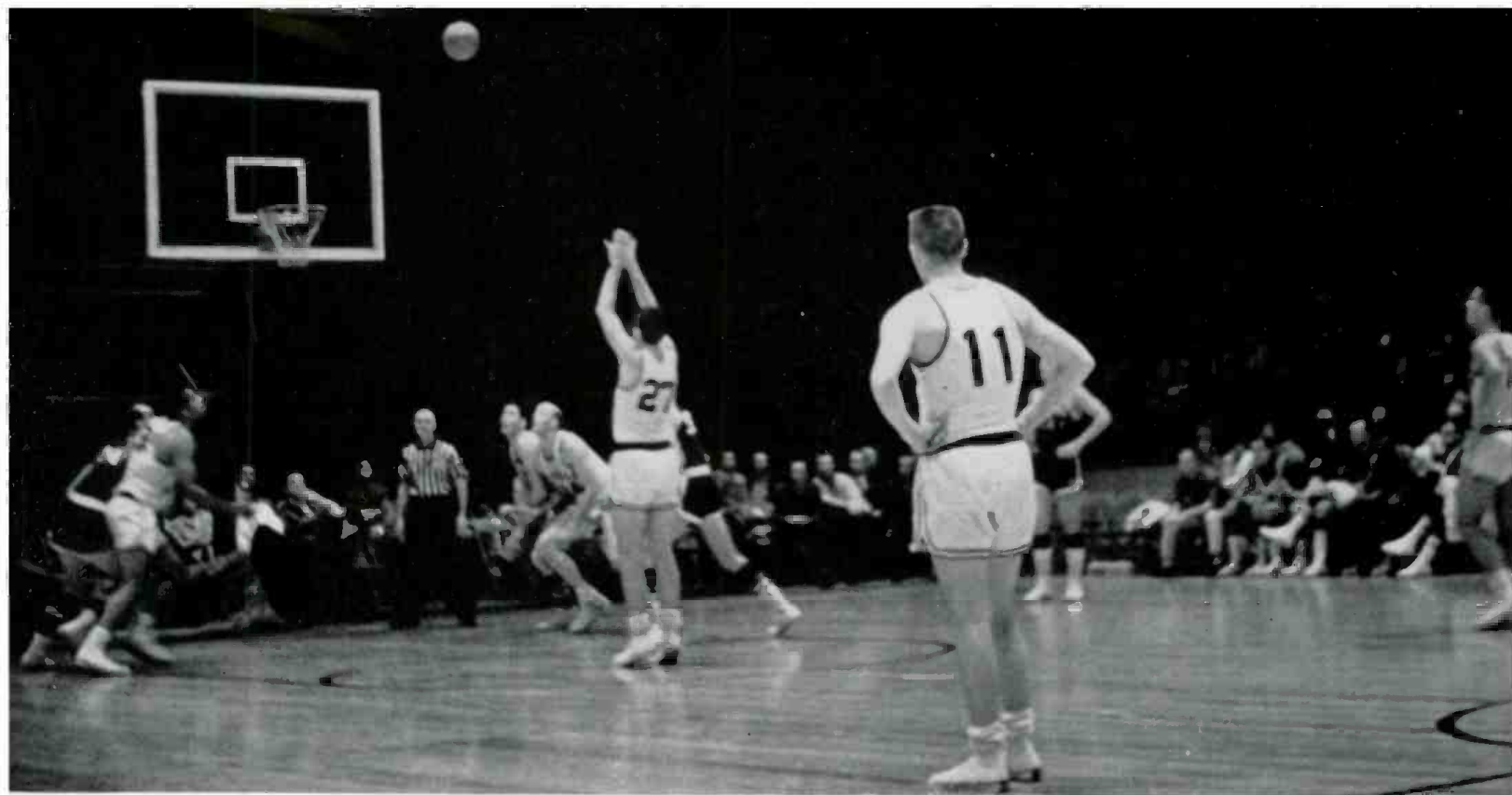
"Closed-circuit television and two-way personal communications are proving valuable banking aids," Mr. Basten says. "Not only are our depositors benefiting directly, but it would take a foolhardy bandit to attempt a holdup with a television camera trained on his every move." ■



*Tellers use one-way microphones to call floormen for aid.*

The security office duty officer not only can see what is taking place on the banking floor and in the drive-in area through the medium of television, but he also is in direct contact with various members of the guard force by way of the tiny two-way radios which each guard wears attached to his belt.





*Cincinnati viewers are treated to colorcasts of both professional and college basketball games this season on WLW-T.*

# CINCINNATI'S FESTIVAL OF COLOR

**Local color program  
push in Ohio  
has boosted color set sales  
and audience ratings**

**A** QUICK 6-foot 5-inch forward takes a long pass down-court, turns, and hooks it through the basket. A deafening roar goes up from the crowd jammed into the spacious Cincinnati Gardens.

In a tavern in suburban Cincinnati, all eyes are turned toward the color television set at one end of the bar.

"Atta boy, Oscar," yells one delighted patron, "pour it on!"

It's no ordinary basketball team the patrons are watching, but the University of Cincinnati's top-ranked Bearcats, led by All-American Oscar Robertson.

It's no ordinary telecast, either, for it's being broadcast in "LIVING COLOR" over Crosley Broadcasting Corporation's Station WLW-T — currently the only TV station in the nation able to colorcast night sporting events from locations away from the studio.

By adding sports to an already heavy color schedule which averages 19 hours per week of local programs plus an average of 20 hours weekly of NBC network programs, and by supporting this with extensive promotional efforts, WLW-T has turned the Cincinnati area into a festival of color. In doing so, WLW-T has earned for itself the praise of the RCA Victor distributor, Ohio Appliances, Inc., as being "the chief reason for the outstanding success of color TV in the Cincinnati area."

WLW-T became the first station in the country to telecast major league baseball in color last summer

on a local and regional basis when it colorcast 12 weekend day games of the Cincinnati Redlegs. The World Series games on NBC were the only other major league contests carried in color in 1959.

During the current basketball season, WLW-T racked up another first when it fed a colorcast of a Cincinnati Royals professional game to the NBC network on November 21, 1959, and again on November 22. In addition to the five professional basketball games scheduled for the current season, WLW-T already has colorcast two home games of the University of Cincinnati, and will carry two more this season.

Looking to the coming baseball season, Crosley's President R. E. Dunville already has assured the hometown viewers of another colorful year by announcing that WLW-T will carry a total of 23 weekend home games of the Reds in color—approximately ten of which will be night games.



*WLW-T's popular Ruth Lyons (left) receives a gold plaque from RCA Vice President James M. Toney for her "outstanding record" of more than 870 hours before color TV cameras since 1957. The 90-minute show each weekday is a highlight of WLW-T's local color schedule which averages 19 hours each week. In addition, the station broadcasts an average of 20 hours of NBC color programs each week, which include such specials as "The Moon and Sixpence" (below).*



"It has been the belief of Crosley Broadcasting Corporation," Mr. Dunville says, "that the inauguration of color television must closely parallel the development of black-and-white television. That is to say that the same techniques that built monochrome television to its present stage must be employed in color. We believe sincerely that color television cannot be an 'exclusive affair' with a few scattered spectaculars and specials, but rather a regular program fare. The most important factor in the development of monochrome was to make television available in places where it could be sampled by many. This is a truism and so it must be with Color Television. It is for this reason that we felt that telecasting of the Cincinnati Redleg games would lend itself to this concept."

Live colorcasts of ball games and other local events are made possible by WLW-T's RCA-equipped color TV mobile unit—the only one owned by an independent broadcasting station. Altogether, Crosley's investment in color is in the neighborhood of one million dollars.

The heavy sports schedule in color has made it easy to sell tavern owners in the area on the idea of installing color sets for the enjoyment of their patrons. Some 300 already have done so, and one tavern owner reports he usually can count on an additional \$100 in business every time WLW-T colorcasts sports.

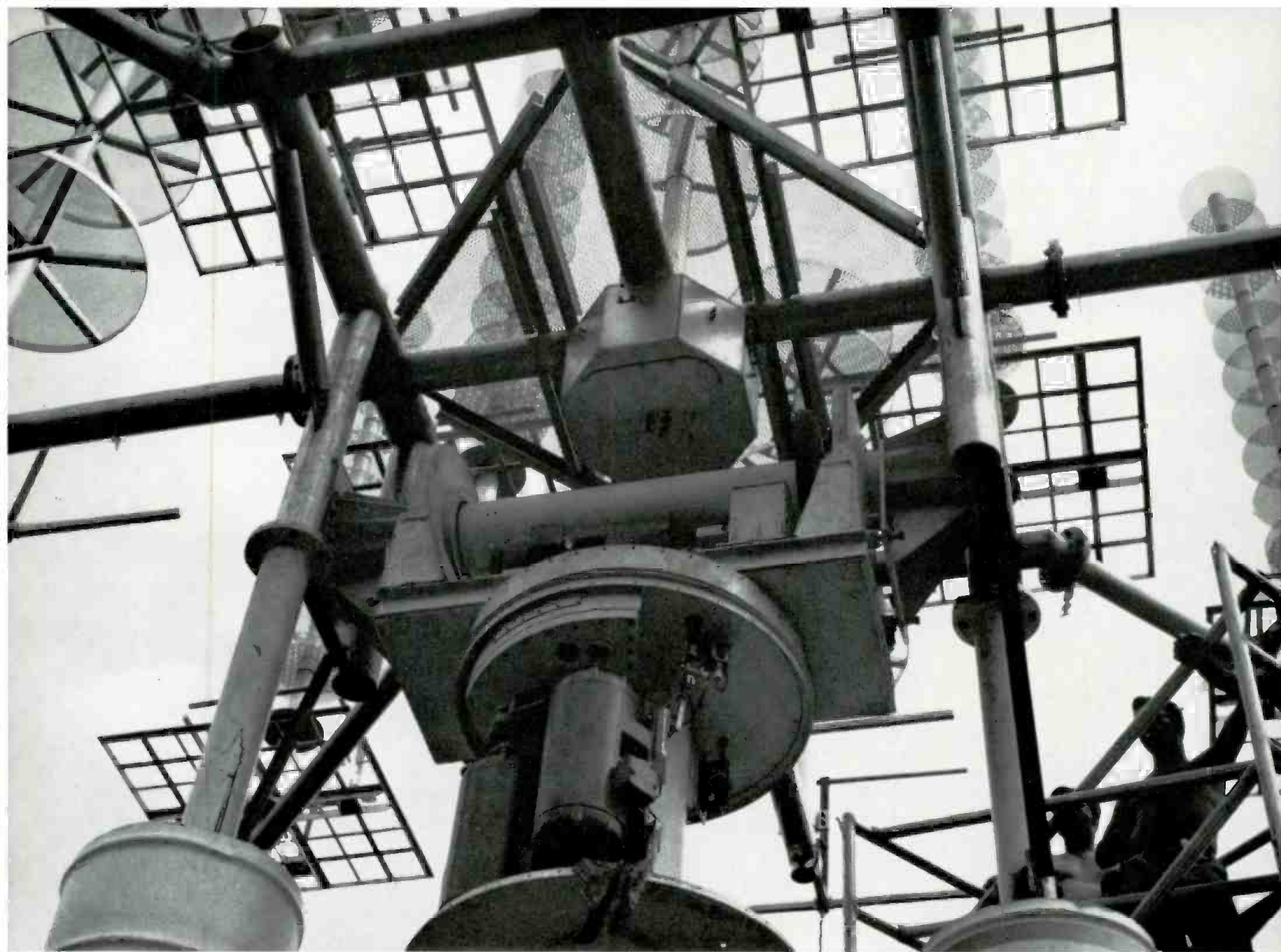
WLW-T presented its first local color show on August 9, 1957, when the popular 90-minute Ruth Lyons "50-50 Club" made its debut. Since then WLW-T has steadily increased the number of local color programs until it currently colorcasts most of its local live shows. The total is substantially increased with specials, such as local baseball, football and basketball, plus annual fashion shows from leading department stores. For the month of January alone, WLW-T will broadcast a total of 157½ hours of color programs, including NBC shows.

The heavy emphasis on color programming and intense promotional activity have paid off in steadily mounting sales, and currently two of every five RCA sets sold in the Cincinnati area are color sets.

The demand for color sets was so great during the recent Christmas buying season that Ohio Appliances, Inc., completely sold out of all color models except one, and at last report had a steadily increasing file of back orders.

The classic upward spiral — whereby increased programming leads to increased color sales and advertising support — thus seems to have become reality for Cincinnati, transforming color TV from an agreeable novelty into a durable force in the entertainment field. ■





*Specially-built tools, such as this antenna, are a necessary part of the program of scientists to map man's flight into Space.*

# MAPPING THE ROAD TO MARS

*Astro-Electronic engineers design ingenious devices*

*to simulate missile and satellite flight*

**O**UTER SPACE is being brought down to earth today in laboratories across the nation. Behind each successful launching of a satellite or space vehicle stands an array of earth-bound machines in which every component, circuit, and assembly of the space-borne system has been subjected to the harsh conditions known or believed to exist outside the protective blanket of atmosphere surrounding the earth.

The machines have been designed by space scientists as the most economical — if not the only — means of determining how electronic, electrical, and mechan-

ical systems will function in space. In great vacuum chambers, entire satellite systems are operated on the ground in surroundings similar to those 200 or more miles up. Shock and vibration machines punish space components and sub-assemblies to determine how they will weather the extreme stress of launching and upward flight. Placed between large magnetic coils, the space systems are “flown” in magnetic fields simulating those that surround the earth, to determine the effect upon their operation and motion in space.

With these and other test devices, improvised in





many cases to meet the needs of a particular project, scientists and engineers of the Radio Corporation of America and other major companies are solving one of their greatest problems – the inability to conduct actual test flights in outer space itself.

From the start, the great leap into space has raised technical problems unprecedented in human history. For the first time, a concerted effort is being made to penetrate an environment completely alien to any human experience. Aside from telescopic observation plus a scattering of data conveyed back from the handful of satellites and lunar probes, the physical environment of space is today more a matter of deduction and conjecture than of genuine knowledge.

The only path to more detailed knowledge of the space environment is more intensive exploration. Since man cannot yet proceed safely into space, the job must be done – as we have started to do it – by extending human perception through space electronic systems that can detect, measure, and observe, and communicate the data back to earth by radio or television. These would seem at first to be routine functions for electronics – but there is one consideration that turns the routine into a technical challenge of staggering complexity: the conditions under which the functions must be performed have practically no precedent.

Space technology must cope with extremes. All types of equipment, from the smallest component to a complete satellite or space vehicle, must be designed within the narrowest limits of weight and volume in order to fit the small load capacity of today's launching rockets. Each component and assembly must be able to withstand the tremendous shock and stress of launching and upward flight. Finally, the equipment must function reliably for weeks or months in space without human attention, subjected to extremes of heat and cold, bombarded by cosmic and other radiation, surrounded by virtual vacuum, and free of the strong gravitational field in which conventional electronic and mechanical systems are designed to operate.

Added to these stringent conditions is a further complication. Satellites and space probes cannot be flight tested economically to determine how well they will operate in space. Until it becomes feasible to return them intact to earth, their first flight into space will also be their last. At the present early stage of space exploration, each satellite or space probe is likely to include new devices or techniques. The lack of an opportunity to test these innovations under actual operating conditions places the scientist or engineer in a position analogous to that of a composer who is expected to write and score a new symphony, and to lead a strange orchestra in the first public performance of the work without any rehearsal.

*I. G. Harrett of the RCA Astro-Electronic Products Division places a TV tape recorder for a satellite on a special shock tester.*

Faced with this dilemma, the space scientists are doing their best to create on the ground a rough approximation of the environment in which their equipment must function. As a result, space laboratories across the country are being equipped with ingenious devices for torturing components, devices, circuits, and apparatus, and for simulating on a small scale the magnetic, thermal and other conditions that are known or believed to exist at varying distances beyond the upper limit of direct human observation.

An array of such environmental test facilities has been developed recently to rehearse the probable career of a large weather satellite system under development at the Space Center of RCA's Astro-Electronic Products Division at Princeton, N. J. Because of the large size of the satellite itself, and because of the large number of unsolved problems in satellite flight, an unusually complex program of testing has been undertaken with specialized equipment to ensure as far as possible that the project will fulfill all of the operational requirements. These include not only the functioning of television, electronic control, and communications systems in the satellite, but also the proper motion and attitude of the satellite in space, and the reliability of communication and control systems linking the satellite and the ground station complex.

Some of the problems raised by these requirements called for the adaptation or design by RCA engineers of special test facilities large enough to accommodate the entire satellite with its electronic contents. Thus the AEP Space Center was equipped with a vacuum chamber capable of holding the completed satellite and reducing the atmosphere around it to a vacuum comparable to that encountered some 400,000 feet above the earth. Cooling coils and heating strips built into the chamber produced variations in temperature ranging from  $-30$  to  $150$  degrees centigrade. These conditions are roughly comparable to the expected vacuum and temperature characteristics of the region in which the satellite is expected to operate. Their simulation has provided the RCA specialists with essential information about the distribution of heat and methods of thermal control within the satellite, and about the behavior of materials on the satellite under the extremes of heat and cold that are likely to be encountered.

Anticipating a large amount of vibration and stress during and just after the launching of the satellite, the RCA engineers have used two types of installation to simulate the effects of this ordeal on the assembled payload. One of the test devices is a standard item capable of shaking the entire satellite at a vibration rate of up to 2500 cycles per second and subjecting it to forces of 20G — twenty times the force of normal

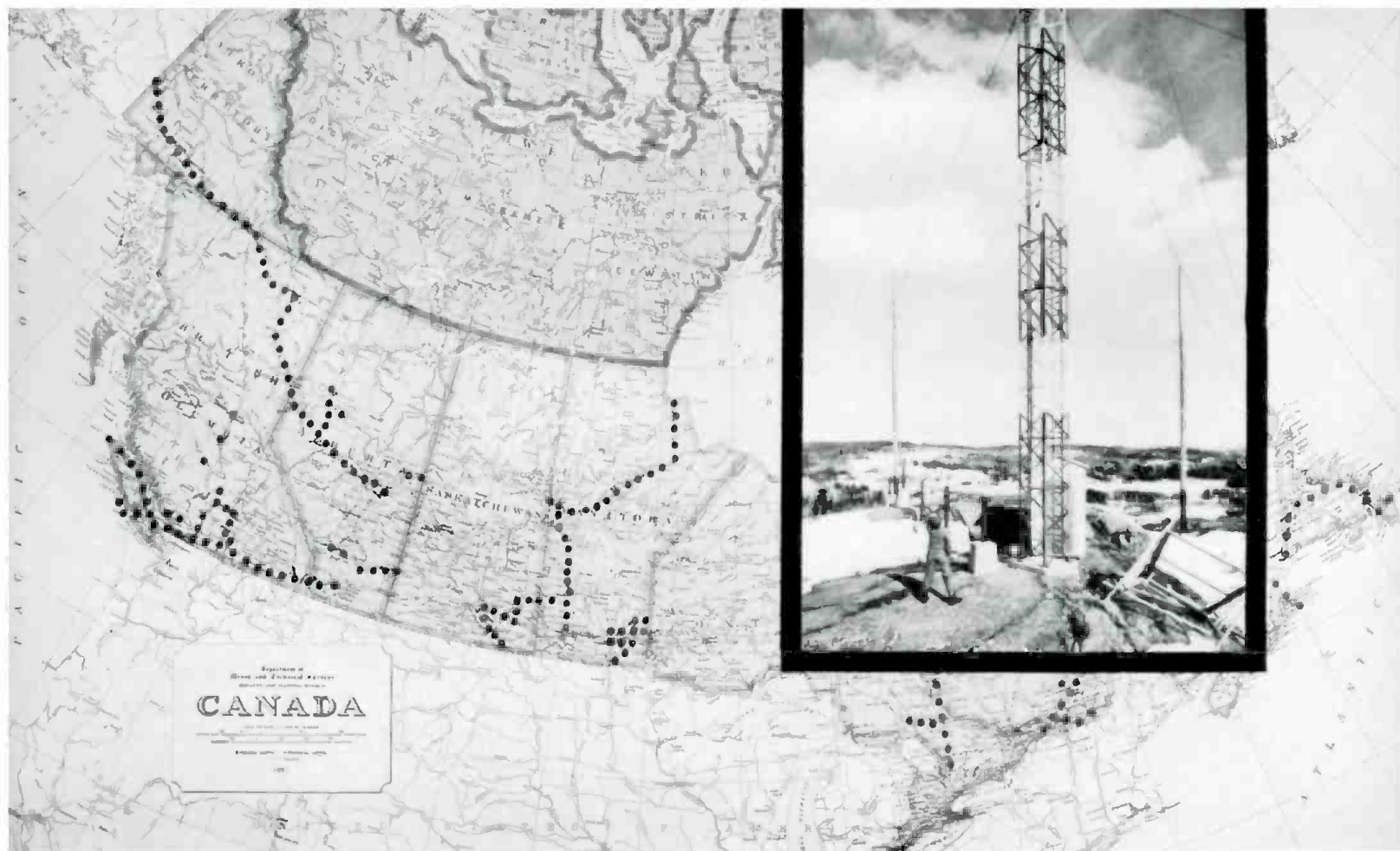
gravity. The other, specially designed at the AEP Space Center, simulates the acceleration load distribution throughout the satellite structure under the forces that may be encountered during launching and upward flight. With this special machine, the satellite has been tested up to forces of 40G.

To function properly in space, the satellite will have to rotate on its spin axis at a certain rate. One of the problems facing the RCA team has been to determine how much the spin rate may be slowed by the effect of the earth's magnetic field upon magnetic materials in the satellite. To evaluate the effect, they devised a large magnetic drag test system in which the entire satellite could be supported on a specially designed bearing within a variable magnetic field generated by two extremely large coils. With the system, the RCA engineers have been able to determine the extent to which the satellite's spin will be slowed by magnetic drag during a given time. On the basis of the tests, it has been possible to calculate the amount and frequency of push needed to restore the desired spin, and to install small "spin-up" rockets that can be fired by remote control from the ground.

Besides these and other large installations to test the complete satellite in various environmental conditions, several advanced test facilities also have been designed and used to simulate special circumstances that may be met by important components and subsystems. For example, the satellite will carry perhaps the largest array of solar cells yet used in space to convert sunlight to electric power. To test large quantities of solar cells under probable operating conditions, the Space Center engineers designed and built specialized equipment including an indoor lighting array whose output can be varied to simulate the illumination received from the sun at various altitudes from sea level up to the height of the orbit in which the satellite is expected to circle the earth.

With such facilities as these, designed in each case for tests of specific satellites and space vehicles, scientists and engineers across the country are simulating conditions in space to ensure the successful operation of increasingly complex systems before they are committed to launching. The degree of their success can be measured by the effectiveness and reliability of satellites that have achieved orbit and sent new data to earth, and by pioneering vehicles that have passed beyond the moon into paths around the sun, communicating by radio from hundreds of thousands of miles away. In the final analysis, the importance of environmental simulation lies in the extent to which it is hastening the day when man will be able to perform his experiments not in simulated surroundings on the ground, but in the harsh environment of space. ■





*Dots along Alaska Highway (upper left) trace route of new microwave system; other dots show existing systems like the one in inset.*

# FROM THE YUKON TO THE CONGO

Equipment made by RCA Victor in Canada  
provides communications in far-flung lands

**A**LONG THE ALASKA HIGHWAY, stretching northwest through rugged territory from southwestern Alberta to the Yukon-Alaska border, teams of men are braving bitter weather through the winter months to pave the way for one of the most important communications links in Canada. It is the 1,200-mile microwave radio-relay system now being constructed for Canadian National Railways and Canadian National Telegraphs.

When completed, some two years hence, this system will provide greatly improved telephone and telegraph facilities for Western Canada and for Alaska, now a full-fledged U. S. State. It also will furnish a communications system of immense value to the joint U. S.-Canada defense programs.

The teams are composed of men from RCA Victor Company, Ltd., the Canadian subsidiary of the Radio

Corporation of America. And, working as they are in sub-zero temperatures and howling winds, they are dramatically symbolic of the pioneering role RCA Victor, Ltd., is playing in the communications field, not only in Canada but abroad.

All over the free world—from the rivers of the Belgian Congo to the villages of Nepal, from the oil fields of Venezuela to cities and villages in Egypt and Syria—communications equipment designed or produced by RCA Victor, Ltd., will be found in use—microwave, single-sideband radio, television and radio transmitters, TV “satellite” relay antennas. Indeed, the Canadian company is now regarded by RCA as its principal engineering and production source of microwave equipment for projects anywhere in the world.

In Canada itself, in the last ten years, RCA Victor, Ltd., has equipped 240 microwave stations for 32 communications systems spanning nearly 7,000 miles of territory. Among the larger ones is a 14-station 440-mile network serving Canada's largest electric utility, the Quebec Hydro Electric Commission. It not only provides telephone and teletype connections along the line — including phone contact with mobile units — but also provides automatic readings of power output at the hydro station and enables supervisors at Montreal to increase or decrease that output as the demand for power rises and falls.

The 1,200-mile Alaska Highway system will be the largest single microwave project in Canada, capable of carrying 600 telephone or telegraph transmissions at once. It will link with the Alaska communications network to the west and with the rest of Canada to the east. To carry these voice and dot-dash conversations over the mountains and through the thickly timbered wilderness of this part of Canada, fifty radio relay stations will be built between Grande Prairie, Alberta, and a point near Snag, on the Yukon-Alaska border. By the addition of further equipment, at relatively low cost, the system could at some future time carry television as well.

Weather and terrain provide hardships in the Northwest — as any character from Robert W. Service's ballads of the Yukon could attest. At some wilderness sites, surveyors had to be brought in by helicopter. In the Snag area a surveying team spent three weeks last October doing a job that elsewhere, in normal circumstances, might have taken three days. The reason: temperatures that plunged to 30 below and froze equipment, fogged lenses and sharply limited mobility. In mid-winter, Snag temperatures drop to 85 below — coldest in North America.

But weather and terrain have seldom been allies in regions far north of Canada's big cities. In constructing a network of stations for the Royal Canadian Air Force, men worked in temperatures as low as 40 below zero. Radio equipment had to be hauled from the road by toboggan up snow-covered, forested hills.

Perhaps the roughest job was a 21-station network for Canadian National Railways in Newfoundland, where the only access to many sites was by foot from the railway — and pity the construction worker who headed back from the project to the railroad not knowing which day the next train was due, with the temperature 40 below.

Canada, with its rugged country and its fast growing need for communications, has been an excellent laboratory for development of microwave and other communications systems. The results are felt globally.

Early this year the people of Brazil dedicate a

new capital city, Brasilia. To connect it by telephone with the rest of the nation, a microwave system is being installed. The contract to build it was awarded to RCA International over bids from competing companies in the United States, England, France and Germany — because of the engineering know-how, the experience and the production facilities of RCA Victor in Canada. It is the most recent of numerous systems installed by RCA with the help of its Canadian subsidiary in foreign countries — Arabia, Australia, Colombia, Pakistan and Venezuela.

Similarly, single-sideband radio systems developed in the Montreal laboratories of RCA Victor, Ltd., are in use in many countries.

The application of the single-sideband principle for ordinary radio, permitting long-distance communication with high fidelity, was first achieved a few years ago by RCA Radiomarine engineers in New York. RCA Victor, Ltd., undertook to develop it for production in its Montreal laboratories. Supplementing the production program of the Camden, N. J., plant, the Montreal plant is in the midst of a program calling for the building of 1,500 transmitter-receivers that will be delivered to all corners of the world.

In the Belgian Congo today, RCA single-sideband radios are providing communications for river boats. In Thailand they are serving the civil aviation authorities for point-to-point contact on the ground. In Venezuela they have been linked in a national radiophone network for a bank. In Nepal they have been installed to provide a national communications network, releasing local telephone facilities for village use. In Burma they are performing still other valuable service.

Another RCA Victor, Ltd., contribution has been in TV relay transmitters, known as "satellites," which pick up signals from the master station and pass them on to still further areas. This equipment was developed in 1955-56 in an effort to solve Canada's problem of extending television into its more remote territories. Today, of Canada's 15 million TV viewers, 2.5 million are seeing programs through the eyes of the "satellite" transmitters. And so are still other audiences in Egypt, Syria, Mexico, Venezuela and the Dominican Republic.

Thus goes the global pattern of the Canadian arm of Radio Corporation of America. Into this pattern are falling still other lines of communications equipment — transmitters ranging the spectrum from LF to UHF, receivers, antennas of many types, radars, detection equipment, navigational aids, etc. Their widespread use constitutes a glowing tribute to the initiative, ingenuity and technical capabilities of the Canadian engineers, scientists and marketing experts who are making great progress in the electronics field, not only in their own country but on an international basis. ■



# ELECTRONICALLY SPEAKING

## BUILDING BOOM

Four major real estate developments involving RCA, including naming a new 13-story building in Washington, D.C., the "RCA Building," were announced during the last quarter of 1959.

The new glass and aluminum office building in Washington was named the RCA Building on Dec. 28 after RCA signed a lease aggregating \$2,500,000 to become a major tenant.

RCA Communications, Inc., has disposed of its properties on Broad and Beaver Streets in Lower Manhattan in New York and has contracted to become the prime tenant in a new 38-story building to be erected on the same site, it was announced Dec. 10 by Thompson H. Mitchell, President.

Construction of a new plant to manufacture industrial electronic products in the Washington-Canonsburg, Pa., area was announced by T. A. Smith, Executive Vice President, RCA Industrial Electronic Products, on Nov. 17. And ground breaking ceremonies for the new RCA Semiconductor and Materials Division plant at Mountain-top, Pa., were held on Oct. 2.

## MONROE SIGNED AGAIN

Vaughn Monroe, the "voice of RCA" in radio-TV advertising and sales promotions for the past six years, has had his contract renewed for another three years. In addition to handling TV and radio commercials, Mr. Monroe travels more than 100,000 miles annually — visiting RCA manufacturing

plants, attending RCA distributor and dealer meetings, introducing the new consumer product line every June and speaking to advertising and service clubs.

## MISSILE MAID

Among the more photogenic features of the Missile Test Project at Cape Canaveral, Fla., is one five-foot, five-inch, blue-eyed lass who not only has stumped the experts on a TV panel show, but who also has made a believer in women scientists out of United Feature Syndicate columnist Ed Koterba.

The woman scientist is Mrs. Helen Mann, a programmer for the RCA Service Company's data processing group at Cape Canaveral.

"She looks more like a model who just stepped out of a Hollywood hat box rather than a lady just off a launching pad," Koterba wrote in his nationally-syndicated column, "Assignment: Washington."

"Helen Mann is a Cape Canaveral missile maid with a master's degree," Koterba wrote. "And she says she has a good reason to expect lady space scientists to sweep the industry. 'Women,' she says, 'have more patience — they're built that way — and a person needs a lot of patience in space science research.'"

Koterba wrote that there was some talk at the American Rocket Society annual meeting — where he interviewed Mrs. Mann — about women possibly being called up soon for space flight training.

"If there are a few feminine space volunteers like Helen Mann," he wrote, "I can predict one thing:

the waiting line of male recruits would reach to the moon."

## RADIATION PROTECTION

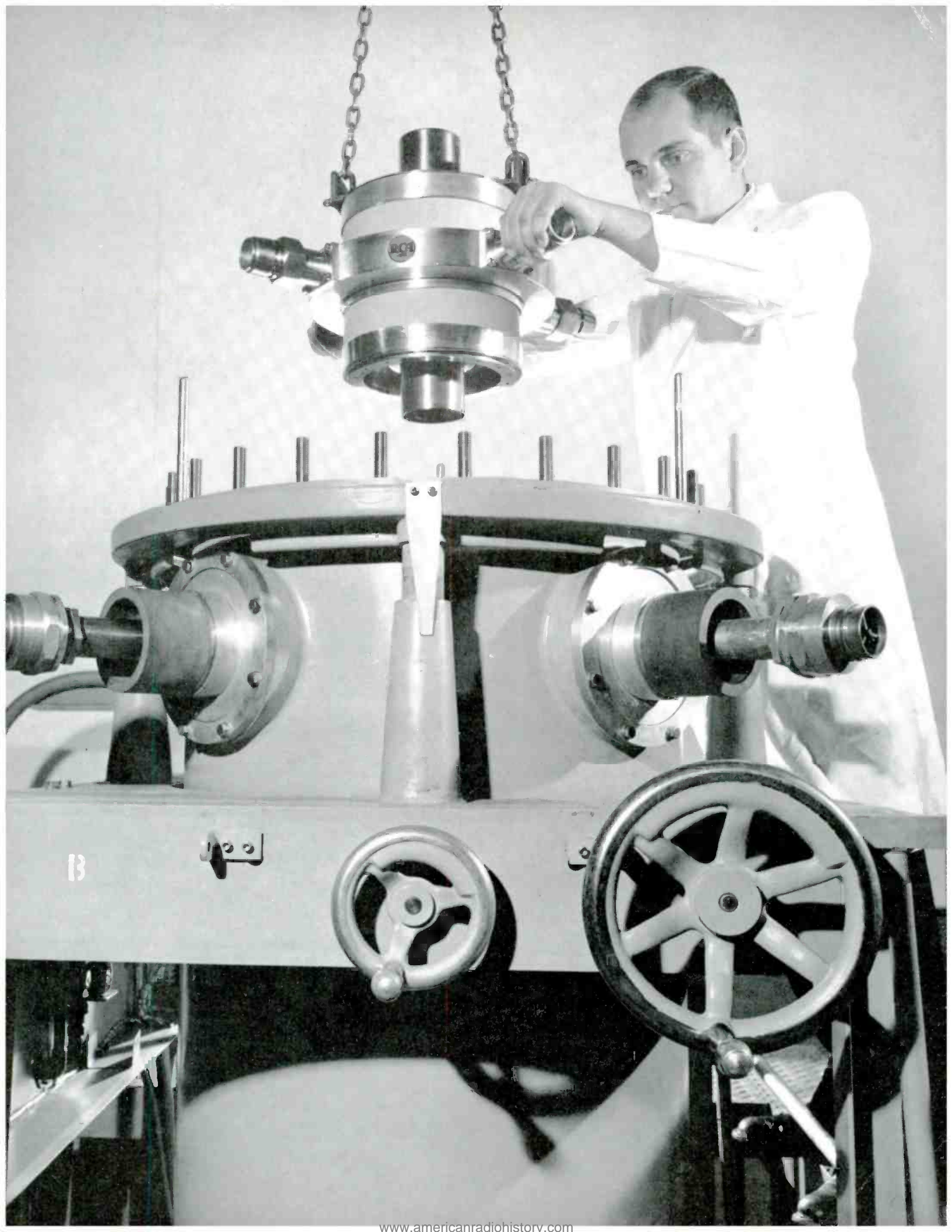
Publication of "Atomic Radiation (Part II)," a 110-page companion volume to the widely-used text "Atomic Radiation," has been announced by the RCA Service Company.

Intended primarily as a practical guide for industrial, military, and research installations engaged in nuclear energy activities, the new book is equally useful as a text for scientific schools and colleges and for civil defense training. It is available from RCA Service Company, Government Services (210-1), Camden 8, N. J., at \$2.65 per copy, postpaid.

## WORLD'S MOST POWERFUL TUBE

Gerald Grill (right), engineering technician, guides world's most powerful electron tube into a test chamber at the RCA Electron Tube Division Plant at Lancaster, Pa. In this operation, the tube is subjected to rigorous electrical tests, which simulate the actual operating conditions of an ultra-powerful transmitter.

The tube, which weighs approximately 150 pounds, can produce 5 million peak watts of long-pulse power at 450 megacycles. It has potential ability to deliver power enough to explore the possibilities of outer-space communication, inter-continental television, missile guidance, super-power radar, and scatter transmission on a global scale.





ANOTHER WAY  
RCA SERVES YOU  
THROUGH  
ELECTRONICS



## The second most prized possession of Rodgers and Hammerstein

You probably know all about them. You certainly don't need a long introduction to Rodgers and Hammerstein, the men who created a whole new musical theater.

A simple flower drum, symbolic of "Flower Drum Song," is their most prized possession. R&H's second most prized possession is today's RCA Victor Color TV.

For they have worked in color television. They believe in it, and know how exciting it is. The Rodgers and Hammerstein television production of "Cinderella" received rave reviews. Critic after critic singled out the colors of sets and costumes for special praise. R&H know that on television or on the stage,

color is a vital force in setting a mood—heightening the action—actually giving the audience more enjoyment.

Whether your taste runs to musicals or westerns, sports or comedy, RCA Victor "Living Color" TV is the way to watch any show. The color picture is brilliant, the black-and-white picture of finest quality, too. And the sound system is so advanced, it can serve as the second speaker unit for your Stereo High Fidelity setup. See RCA Victor Color TV at your dealer's. Prices as low as \$495.

ON THE 5TH ANNIVERSARY OF COLOR TV, SEE THE DIFFERENCE COLOR TV MAKES



Service is no problem. See your local dealer, serviceman, or RCA Service Co. Nat'l. adv. list price shown, opt. with dealer. UHF opt., extra. Price, specifications subject to change without notice.