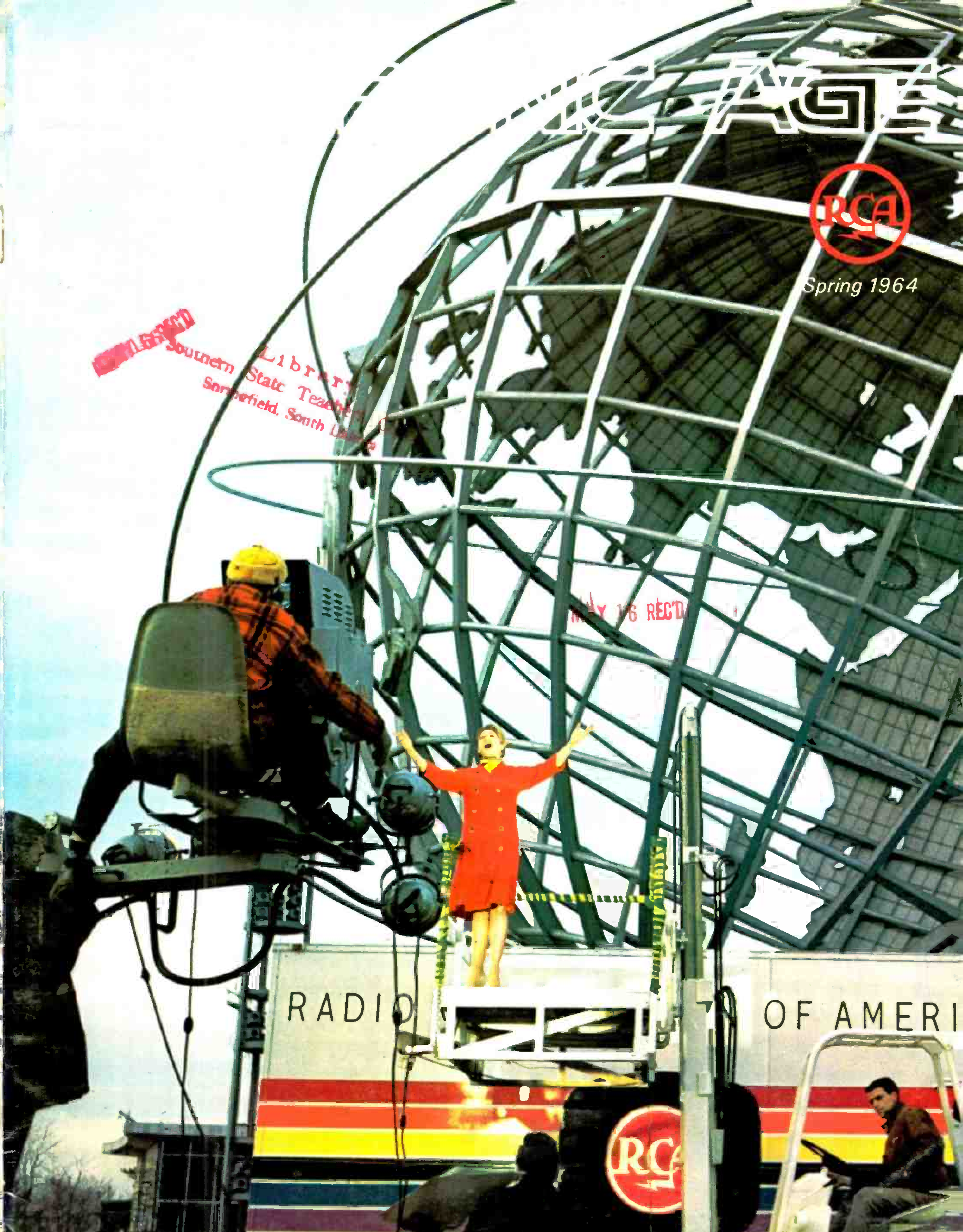
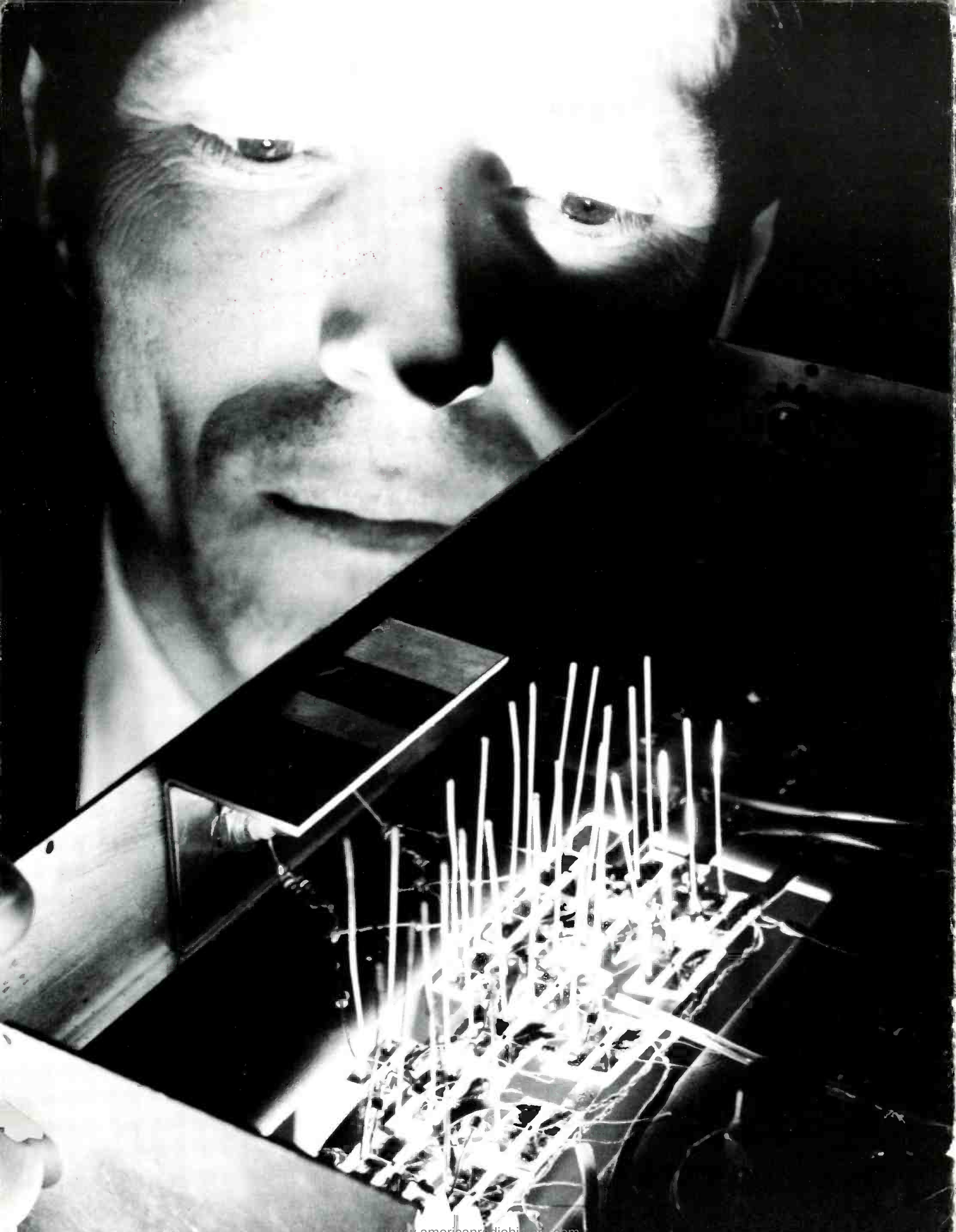

RCA
Spring 1964
RADIO
OF AMERI
RCA



Spring 1964
Vol. 23/No. 2

ELECTRONIC AGE

IN THIS ISSUE...

Published quarterly by
RADIO CORPORATION OF AMERICA
30 Rockefeller Plaza, New York, N.Y. 10020

DAVID SARNOFF, Chairman of the Board
ELMER W. ENGSTROM, President
FRANK M. FOLSOM, Chairman, Executive Committee
JOHN Q. CANNON, Secretary
ERNEST B. GORIN, Treasurer

Editor
JULES KOSLOW
Associate Editor
FREDERICK W. ROLOFF

When requesting a change of address, please include the code letters and numbers appearing with stenciled address.

◀ Dr. George R. Briggs, a member of the RCA Laboratories technical staff, holds a new type of arithmetic computer circuit 10,000 times more resistant to nuclear radiation than standard transistor circuits. These new circuits have been developed by scientists of RCA for potential use in electronic control systems for nuclear reactors and missiles.

COVER: An RCA color television camera and mobile unit in front of the Unisphere epitomize RCA's color television coverage at the New York World's Fair. A report on RCA's participation and services at the Fair starts on page 2.

RCA at the Fair

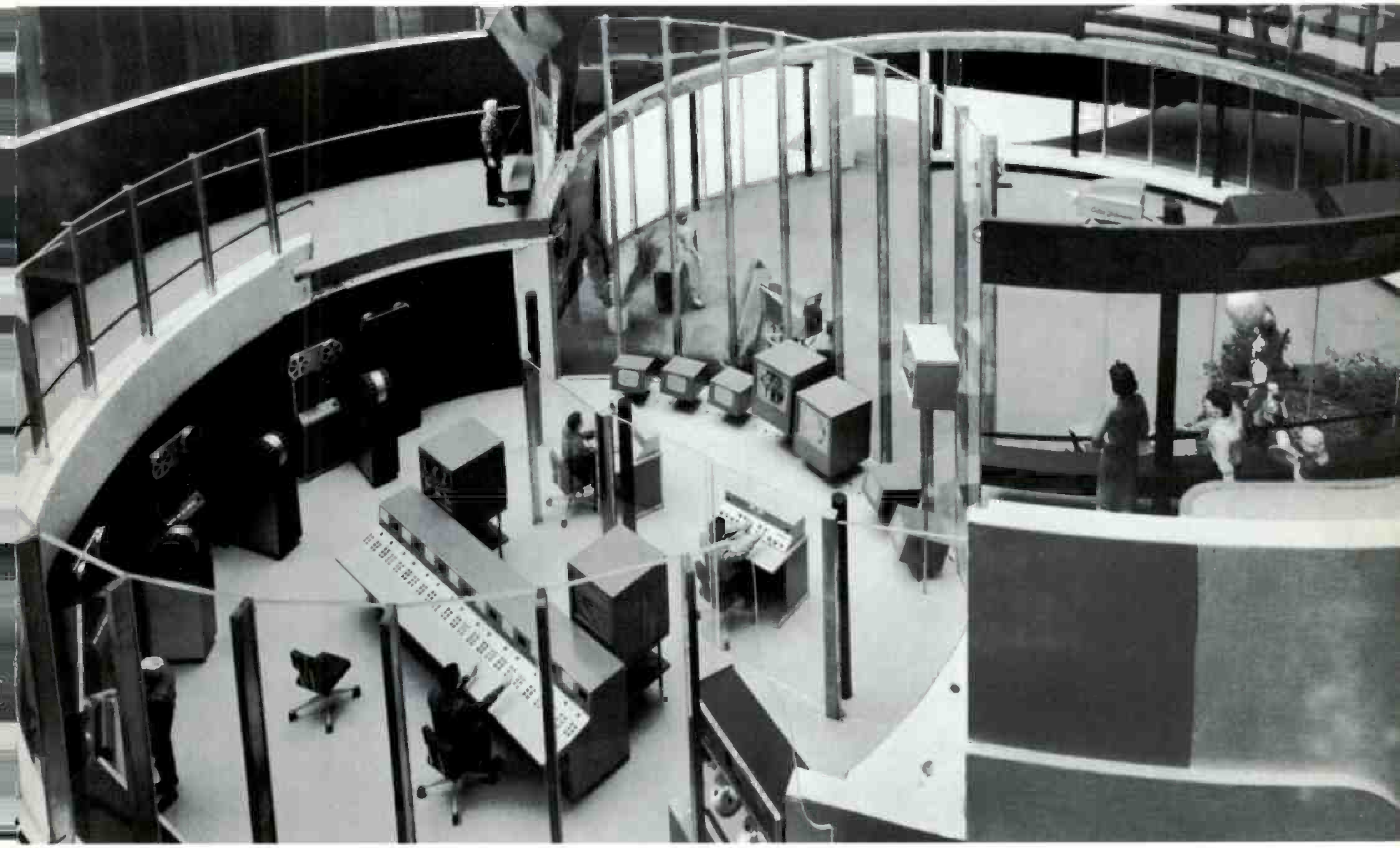
The RCA Exhibit at the main entrance to the Fair . . .

When you come to the 1964-65 New York World's Fair, RCA will be just inside the front door with an exciting and colorful welcome.

Facing the millions of Fair visitors as they enter the Main Gate is the RCA Exhibit, an arrangement of large overlapping "hatbox" cylinders, designed to be the center of two unique activities in one. Inside the Exhibit is an ultramodern color television facility – a "fishbowl" color TV studio in which visitors can see all the activities involved in staging and transmitting color programs. The RCA Exhibit also serves the Fair as the official Color TV Communications Center, sending a continuous flow of entertainment, news, feature, and general information color programs over a closed-circuit network to more than 300 color TV receivers located at exhibits, restaurants, lounges, and waiting rooms throughout the Fair grounds.

As visitors enter the foyer of the RCA Exhibit, they can see themselves twice on color TV – once

Visitors to the New York World's Fair can watch the production of TV programs in a complete color broadcasting facility; listen to stereo recordings in special lounges; watch closed-circuit color TV on sets located throughout the Fair; and keep informed of Fair doings via RCA loudspeakers.



. . . has a color TV studio and control room, shown in model above.

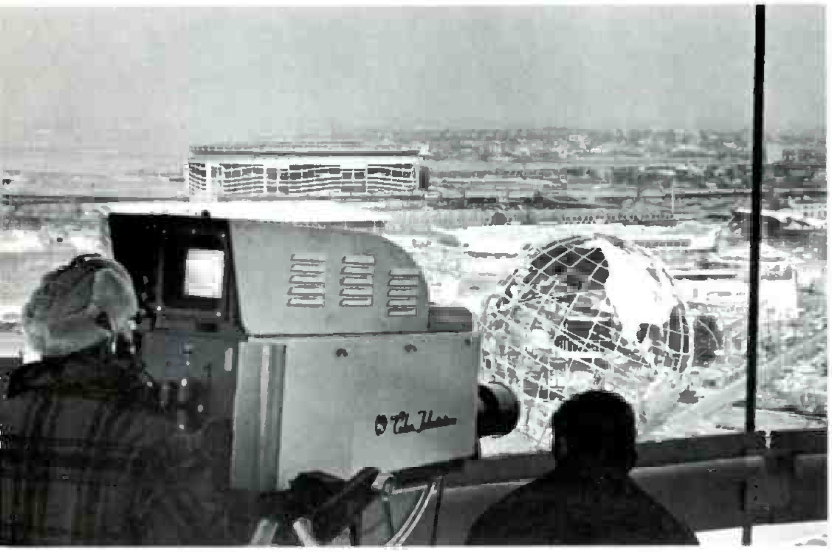
"live" as they stand before the camera, and again in a "delayed" playback from a television tape recorder.

Directly to one side is a gently curving circular ramp up which the visitors then move to a circular viewing gallery with picture windows overlooking the TV studio area.

From the gallery, the visitors look directly into an elaborate color TV programming facility, with a full view of the cameramen and performers, and the activities in the adjoining control room. As they walk along the gallery, visitors see the program on color TV monitors located above the viewing windows, just as they would see it on the color TV screen in their living room. Throughout the tour, tape recordings and guides will provide the visitors with an explanation of what they are seeing. Multilingual guides, incidentally, will be available to serve the foreign guests.

The visitors next cross the bridge above the

Programming at the RCA Exhibit includes pretty zoologists and animal friends.



RCA color television cameras can cover the World's Fair from various angles and altitudes.

At the RCA Exhibit, a number of prominent cartoonists draw caricatures of visitors.

studio and control room to follow a reverse course around the edge of the control room where the director, recording engineers, and other specialists are at work. A ramp leads them down to the ground floor where, in special rooms, they may hear the finest in stereophonic recorded music.

The Color TV Communications Center is in operation twelve hours a day, seven days a week. The program fare ranges from children's participation shows and fashion displays to live pickup of special events elsewhere at the Fair by means of an RCA color TV mobile unit. The World's Fair Corporation is utilizing the system for a five-minute newscast every hour about Fair activities, and for public service announcements.

All of the programming is designed with two objectives — to inform and entertain visitors and to provide an unprecedented behind-the-scenes view of color TV programming and production.

These are some of the program highlights that will continue through the Fair season:

A children's participation show, featuring such noted television personalities as Paul Tripp and Sonny Fox, famous newspaper cartoonists, and representatives of the Bronx Zoo and the New York Aquarium, with live exhibits.

A wide range of fashion shows, featuring styles for both men and women, and involving personal appearances of television stars.

Sports programs, including interviews with outstanding athletes and demonstrations by them, and live pickups of the Olympics and AAU trials.

Weekly color programs featuring more than 60 of the nation's leading newspaper comics artists. Their demonstrations will include on-the-spot cartoon drawings of visiting dignitaries, and also children and adults in the studio audience.

Outstanding concert artists in live performances will be a regular feature.

Live vignettes from some of the Fair's spectacular shows, featuring dancers, singers, comedians, and circus clowns.

In addition to these entertainment features, the system will provide a continuing flow of instructive and useful programs. One of the most unusual is a "candid camera" demonstration by an expert pickpocket, providing helpful tips on ways to avoid losing wallets and handbags in a crowd.

Another unusual service is the employment of the color TV system to reunite lost children with their parents. The children are brought to the

continued on page 6

Fair-goers can view this color television control operation from an ascending ramp at the RCA Exhibit.

Pianist Peter Nero is one of the outstanding performers who will appear on color television at the RCA Exhibit.

1939 — David Sarnoff introduces commercial television at the New York World's Fair: "Now we add sight to sound."

FROM THE HISTORY BOOK

The RCA Color TV Center at the 1964-65 Fair recalls the historic RCA Exhibit which opened 25 years ago on the same site at the New York World's Fair of 1939.

Then, as now, the emphasis was on television — but in 1939 it was the inauguration of the first regular commercial service for black-and-white TV, pioneered by RCA. President Franklin D. Roosevelt was televised "live" as he officially opened the Fair on April 30. The ceremony was picked up by an RCA/NBC "telemobile" and flashed to a transmitter atop the Empire State Building. Ten days earlier, David Sarnoff, then President of RCA, had inaugurated the NBC television service with the dramatic words: "Now we add sight to sound."

The deluxe RCA Victor television set shown at the 1939 Fair retailed at about $600 and provided an image which measured $7\frac{3}{8}$ by $9\frac{3}{4}$ inches and was reflected in a mirror on the underside of the raised lid.

NBC's regular service consisted of two evening programs per week, each an hour long. There was no evident public pressure for much more, since the total number of TV sets within range of the telecasts at the time was only about 150 — barely half the number of color sets linked today in the closed-circuit system at the 1964-65 Fair.

1964 — Twenty-five years later, and at the same site, David Sarnoff dedicates RCA color television exhibit and service.

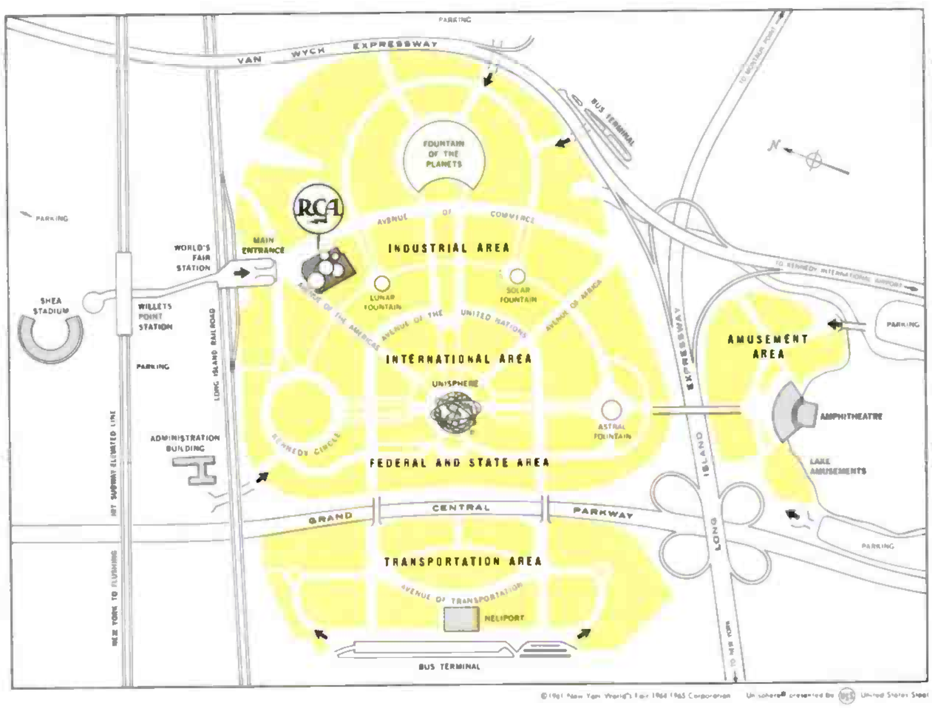
NBC's Hugh Downs views interior of RCA color facility. Wall-set TV monitors reflect operations in the studio.

RCA Center and shown over the closed-circuit color system, hopefully to be seen and reclaimed by worried parents.

The "see yourself" feature at the entrance to the RCA Exhibit may well become one of the major hits of the Fair, judging by the popularity of a similar feature that has been operating in black-and-white at the RCA Exhibition Hall in New York and at previous RCA exhibits in many parts of the world. The system at the New York World's Fair, however, is considerably more elaborate than are these prior examples.

Although color television is the star of RCA's appearance at the Fair, RCA sound is also present to an impressive degree. In addition to the stereophonic music rooms in the Exhibit, the company has provided the sound distribution system for public address purposes and to furnish background music. In all, 550 speakers are used.

RCA also has built the world's most powerful speaker and installed it in the "Fountain of the Planets" at the Fair. The 7,000-pound unit has an output equivalent to that of 1,000 console phonographs operating at full power. The same audio tape that provides sound for the fountain through the great speaker also controls a spectacular display of lights, water, and fireworks. ■



Superconductivity

by Bruce Shore

A strange phenomenon allows electrical currents to be carried without the slightest resistance—opening the way for an exotic generation of high-performance computers, microwave radar and communications equipment, and propulsion systems for outer space.

Dense electric currents 2,500 times thicker than the currents that can be squeezed through a normal copper wire . . . persistent currents carried without the slightest resistance in supercooled metal films thinner than steam on a windowpane . . . structured currents whose orderly flow generates magnetic fields so fierce they can exert 12 tons of pressure per square inch, or so facile they can open and close an electric switch 100 million times a second — such are the manifestations of superconductivity.

First observed in 1911 by the Dutch physicist, Heike Kamerlingh Onnes, superconductivity is presently central to a number of scientific investigations aimed at achieving an exotic generation of high-performance computers, microwave radar and communications equipment, magnets, scientific instruments, high-current storage batteries, magnetohydrodynamic (MHD) power supplies, and propulsion systems for outer space.

Though there is reason to hope that superconductivity may one day be found to exist in some materials at room temperature, for the moment it is a phenomenon of the extreme cold. In most of the 900 metals and metal alloys in which superconductivity has been produced, its onset is triggered by cooling to the atom-numbing temperatures of liquid helium — 480°F below the freezing point of water and only 7°F above absolute zero.

Precisely what happens to the atomic and elec-

Operating in liquid helium at a temperature close to absolute zero, this revolutionary computer memory takes advantage of the phenomenon of superconductivity to store 16,384 bits of information.

...superconductivity is presently central to a number of scientific investigations...

tronic organization of metals at such chilling levels is still not entirely understood. Nevertheless, much light was shed on the subject in 1957 when University of Illinois scientists John Bardeen, Leon N. Cooper, and J. R. Schrieffer succeeded in extracting from the rich lode of quantum mechanics a theory that explains most of what is observed. Based on this theory (now called the BCS theory) and the sharp, if less comprehensive, insights of several other investigators, the following picture of superconductivity can be drawn.

Though ostensibly hard and unyielding, metals are really "underwater jungle-gyms" at the submicroscopic level – rigid networks of atoms submerged in a rich "electron soup." Though their electrons do not really lose individuality, they are so numerous and so intermingled that they take on the appearance of a continuous fluid. Thus, the slightest heat disturbs them, as it does water molecules, not only individually but collectively. Eddies, waves, and other perturbations appear as bulk phenomena.

These can be completely overridden and a current made to flow, however, if an electric field stronger than the heat energy present is applied. The heat does not disappear, of course. It remains as a source of turbulence in the current.

To overcome this turbulence and, therefore, to increase the amount of current metals will carry, scientists usually resort to cooling. This helps greatly but, for most metals, does not eliminate the problem.

There are a few spectacular exceptions, however, a few metals such as lead and tin in which cooling steadily reduces turbulence until suddenly – dramatically – near temperatures at which helium condenses to a soft and limpid liquidity it disappears altogether, and huge electric currents begin to flow. It is these which have come to be called superconductors.

What is thought to occur in such materials is that the electrons in their currents drop to an energy level so low they can no longer travel independently. Instead, they form into couples whose members have opposite spins (Cooper pairs) and, synchronizing their action with that of every other couple, move in a series of changing patterns and partners through the superconductor.

Strangely, these whirling partners never touch, but glide through the metal bouncing a unit of energy, called a *phonon,* back and forth between them like two basketball players working a ball down court. There is none of the disorder associated with their movement in a normal metal and, therefore, no resistance to their flow. Once started, they will circulate forever, providing the metal is kept supercold.

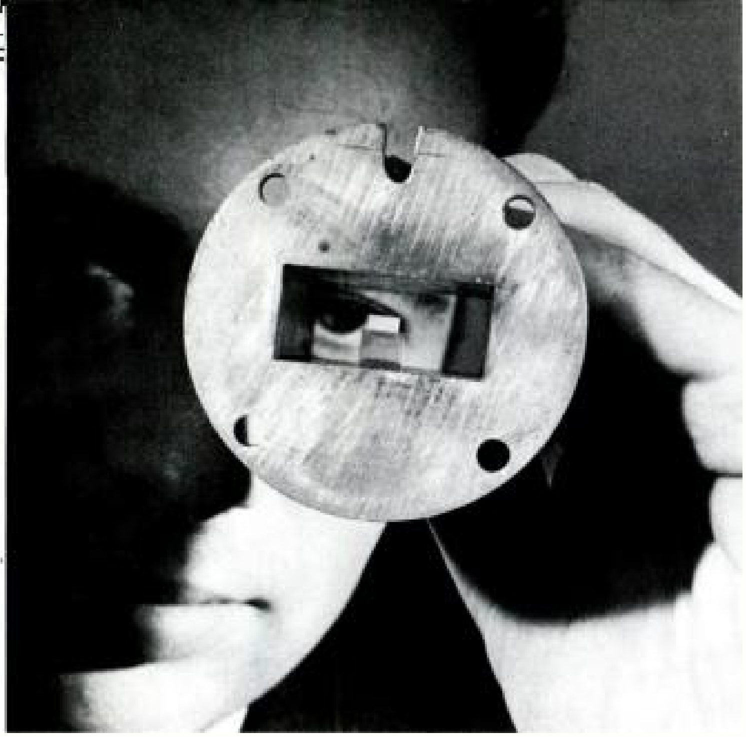
Some measure of the incredible density of these currents may be gained by realizing that a niobium-tin compound produced at RCA Laboratories in Princeton, N.J., has been known to carry up to 500,000 amperes of electric current per square centimeter, when superconductive. That compares with a maximum of 200 amperes for normal copper wire, the universal carrier of electric current.

Two significant byproducts of these high and persistent electric currents in superconductors are their electromagnetism and the inductance they develop.

Electromagnetism is a classic concept stemming from the fact that a magnetic field is generated by an electron as it moves in a conductor. This field always appears perpendicular to the electron's line of travel and, in superconductors, adds to the fields of all other electrons to produce a combined field that has been measured, in three instances, to exceed that of the earth by 200,000 times.

Inductance differs from electromagnetism only to the degree that it embodies the idea of the magnetic field of one forward-moving electron acting to oppose the forward acceleration of all other electrons. This "everybody back me first" attitude gives rise to a form of drag, therefore, a kind of inertia that must be neutralized for a net electric current to start flowing or change direction. This effect has been successfully harnessed to produce a new kind of computer switch and a new kind of microwave amplifier at RCA Laboratories.

A final and seemingly paradoxical feature of superconductors is their diamagnetism – their tend-



This superconductive microwave amplifier has detected and amplified a signal oscillating at six billion cycles per second.

Superconductive magnets like the above can generate magnetic fields that can exert 12 tons of pressure per square inch.

ency to shield against magnetic fields, including those they themselves generate.

Up to a certain point — different for different materials — superconductors will not permit magnetic fields to penetrate them. When such fields attempt to do so, they generate electric currents on the surface of the superconductor. These currents, in turn, create a magnetic field of opposite polarity to the external field and cancel it. In other words, the superconductor fights fire with fire.

If the external field is too strong, however, it induces such powerful surface currents that the superconductor becomes heated and reverts either to a "normal" or to a mysterious "mixed" state. Depending into which state it goes, a superconductor is said to be Type I or Type II.

In the case of Type I materials, the transition to the normal state is almost instantaneous, coming when the external field reaches a certain critical strength.

In the case of Type II materials, the transition to the normal state proceeds very gradually and is marked by a rising number of magnetic lines of force (flux lines) being allowed to penetrate the material without it going normal — at least for a while.

What seems to happen is that microscopic flaws in the structure of Type II superconductors go normal, piecemeal, as the external magnetic field grows. When they do, they form tiny pores through which some lines of force from this field can pass. Instead of causing the whole material to go normal right away, these lines get "pinned" in the flaws for a time and remain isolated from the stream of electron pairs whirling silently around them. If they could be seen, they would give the impression of nails driven through a board. As the number of such "flux" penetrations mounts, a point is eventually reached when they are so dense that the Type II superconductor can no longer support them and it relapses into the completely normal state.

Because of this unusual character, superconductors of the second kind are particularly suited to producing high magnetic fields. Using such a material — a niobium-tin film deposited on a stainless steel ribbon several hundred feet long and coiled like a spring — RCA engineers of the Electronic Components and Devices activity have generated a magnetic field 214,000 times stronger than the earth's.

Efforts to make use of the electron-saturated state of matter known as superconductivity did not begin in earnest in the electronics industry until after 1956. In the time since, however, they have multiplied so rapidly, and have grown to include such a wide range of potential products, that it has even been suggested facetiously that the color television set of the future may yet carry a tag reading: *For best results, keep in liquid helium.* ■

What Is a Computer?

by Ken Kizer

To many persons, a computer is a complex collection of metal cabinets, consoles, and magnetic tape stations. Here, in everyday language, is a simplified explanation of a data processing system.

Commercially speaking, the Electronic Data Processing (EDP) industry is only a scant 12 years old, and its chief product, the computer, is fast proving the faith placed in it by manufacturers and users alike.

In relatively simple, everyday language and concepts, just what is a computer, or data processing system?

Computers come in two categories: analogue and digital. The analogue computer *measures,* much as a slide rule translates logarithms into physical distances or the speedometer of an auto indicates miles per hour. First of the computers to be made, it is used primarily for industrial processing. But, like the slide rule, analogue devices have a limit to their possible accuracy. The digital computer *counts,* never responding to a greater or lesser degree but operating with discrete signals that either exist or do not exist. It is this system of electronics that is the primary concern of business today.

A digital computer – or electronic data processing system – is nothing more than an amalgamation of components which, when properly linked together by electronic circuitry, can tell the difference between a square hole or the absence of one in a punched card, a round hole or none in punched paper tape, an electrical current or no current, pulse or no pulse. It is capable of a limited number of operations, e.g., it can add, subtract, multiply, divide, and compare. It also has a "memory," or the ability to store information, in the form of numbers which it can apply to certain tasks it is called upon to perform.

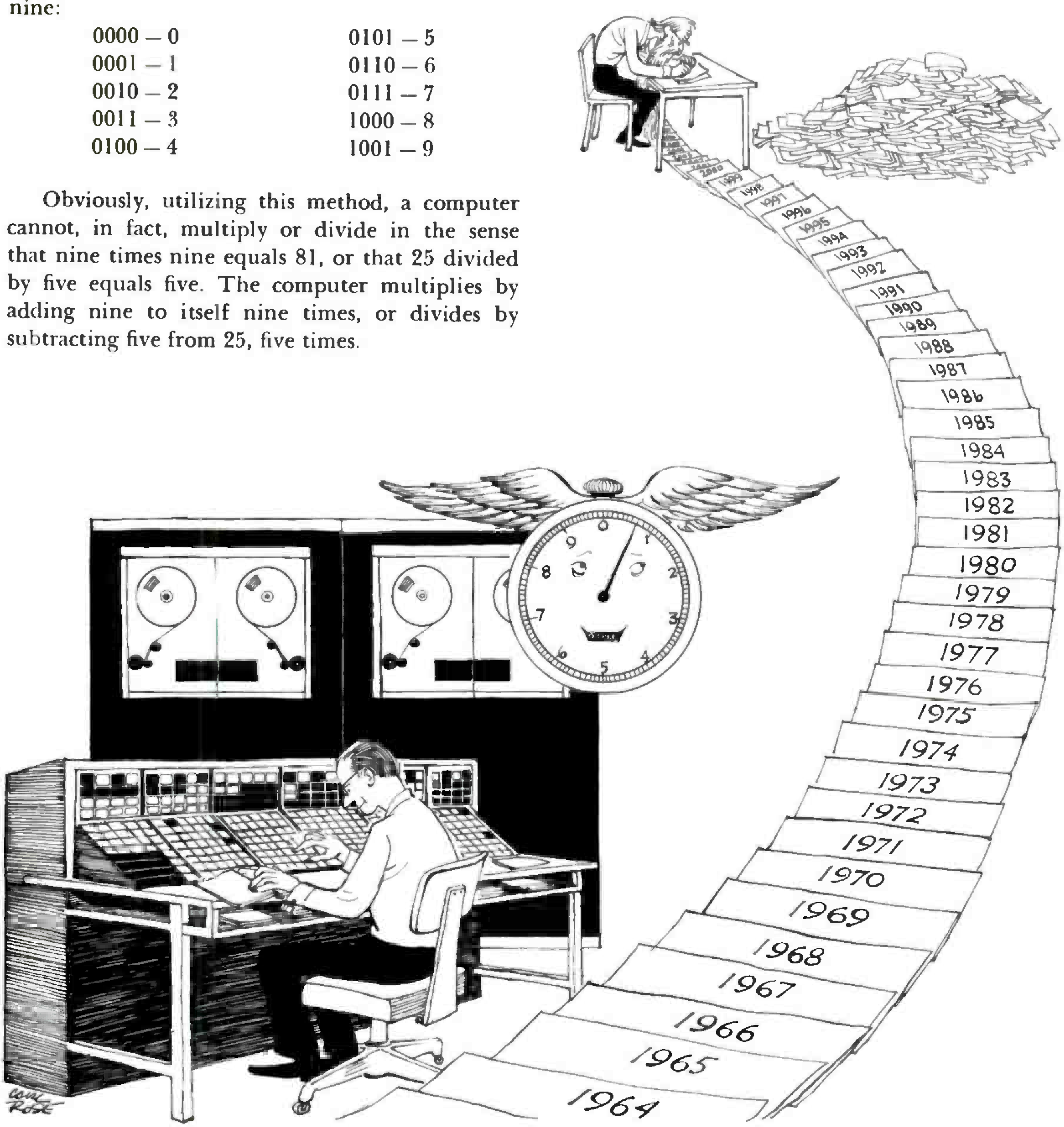
Externally, a computer is a grouping of metal cabinets linked together by electric cables to make up a system. Within these cabinets are electronic assemblies, sub-assemblies, and modules. For instance, in a typical RCA 3301 data processor of average size there are some 70,000 individual components ranging from the largest printed circuit board measuring about 50 square inches to transistors the size of an aspirin tablet to ferrite memory cores as tiny as a grain of sand.

Data processing, reduced to everyday example, is writing a check and balancing the stub preparatory to writing another check, or peering into the refrigerator and noting that the egg supply needs replenishing by a dozen. By simple definition, it is counting.

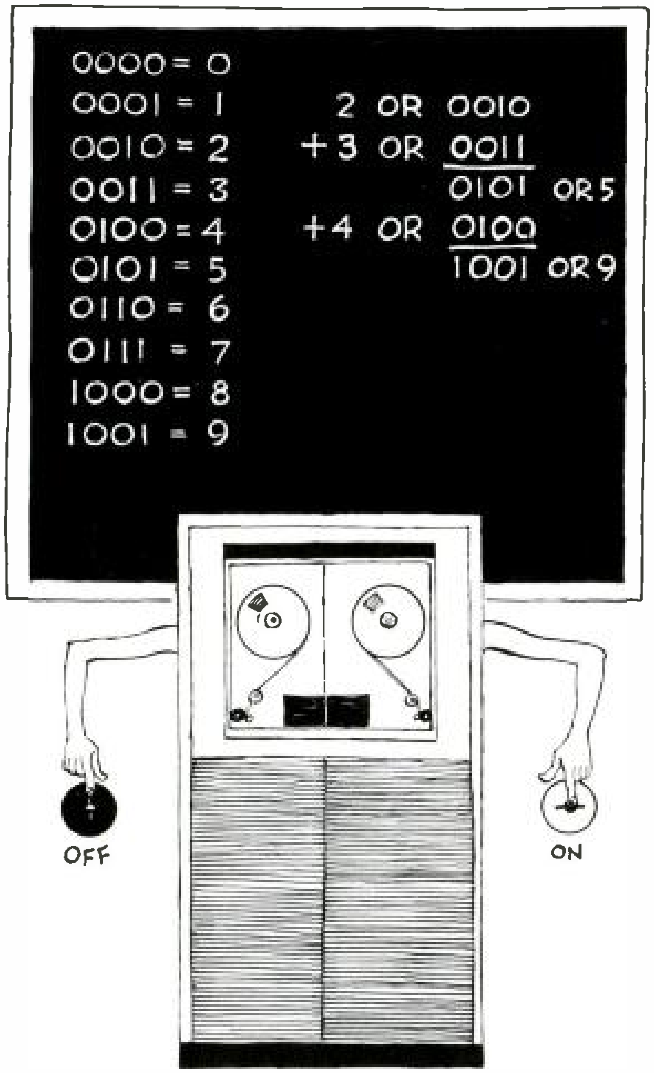
A digital computer accomplishes its counting job by using only two digits – zero and one. Although this may appear strange to the person who has been trained to read and think in terms of ten digits, the two-digit, or binary, system is quite practical since the computer operates on the basis that there is a pulse (one) or there isn't (zero). The following combination of zeros and ones illustrates how a computer counts from zero to nine:

0000 – 0	0101 – 5
0001 – 1	0110 – 6
0010 – 2	0111 – 7
0011 – 3	1000 – 8
0100 – 4	1001 – 9

Obviously, utilizing this method, a computer cannot, in fact, multiply or divide in the sense that nine times nine equals 81, or that 25 divided by five equals five. The computer multiplies by adding nine to itself nine times, or divides by subtracting five from 25, five times.



Man can't live long enough to figure out some of the problems a computer can do in a few seconds.



The computer can use only two digits – zero (switch is off) and 1 (switch is on). It multiplies by adding very rapidly. (Note: In binary arithmetic, where 1 is directly under 1, the sum is zero, and 1 is carried to the next column on the left. If there is already a 1 in that column, the sum is zero again, and the 1 carries through to the left again.)

The most important fact about a computer is not that it can record and remember numbers but that it can quickly yield these numbers in forms of data suitable to move from one part of the system to another. The "pulse, no pulse," or "hole, no hole" *modus operandi* makes it easy to transfer these data from one form to another. Data become a pattern of signals or pulses of electricity which, in turn, becomes a pattern of opened or closed switches or conducting and nonconducting transistors.

Processing data is taking a succession of facts, applying them to a formula, and obtaining new, up-to-date information in some meaningful and useful form. It means solving at high speed a simple or extremely complex mathematical formula. Actually, the computer can absorb any record-keeping or mathematical problem that can be reduced to a routine procedure.

If one keeps in mind that a digital computer basically does nothing but count and remember, speed, then, is the main advantage of the electronic data processor over the human brain. The computer cannot do a single, solitary thing unless man tells it to. The only trouble is that man can't live long enough to figure out some of the problems a computer can do in a few seconds.

A computer is elementary, so elementary that man must define precisely each step that the computer must take in order to solve even the simplest equation. These definitive steps are called a "program," and the man who figures out these steps is known as a "programmer."

After the computer is equipped with the necessary program, it can be directed to execute the instructions comprising the program, normally in a sequential manner. That is, the computer starts with the first instruction and progresses serially through the program.

A simple instruction might be: Multiply A by B, divide by C, and compare the result to D. First, this instruction must be converted to a machine language the computer can understand – something like "21081259650." The computer reads this instruction and in less than a second multiplies A by B, divides by C, and compares to D – a job that would take a person using pencil and paper several minutes to figure out.

Functionally, the computer is divided into five basic categories – input devices, output devices, memory, arithmetic-logic unit, and control.

For the sake of clarity, computer functions can be compared to the daily functions of a business office, complete with secretary.

Input devices to a computer would be magnetic tape reader, punched paper tape reader, punched card reader, communications lines, or even the output of other computers. In an office, inputs would include the telephone, mail delivery, teletype, or the "in-basket."

Computer memory is its storage unit augmented by a "scratch-pad" device, magnetic tape, punched cards, and/or punched paper tape. The "memory" is the secretary and her experience, files, "hold basket," calendar, and memos she keeps on her desk.

The arithmetic-logic unit of a computer is its capability to add, subtract, and so on, plus the ability of the machine to make the correct decision in the face of alternatives, which corresponds to the secretary's brain. The same would be true of the control unit – an electronic "traffic cop" that governs the flow and priority of the data in the computer much as the brain goes from one step to another in daily office routine or procedure.

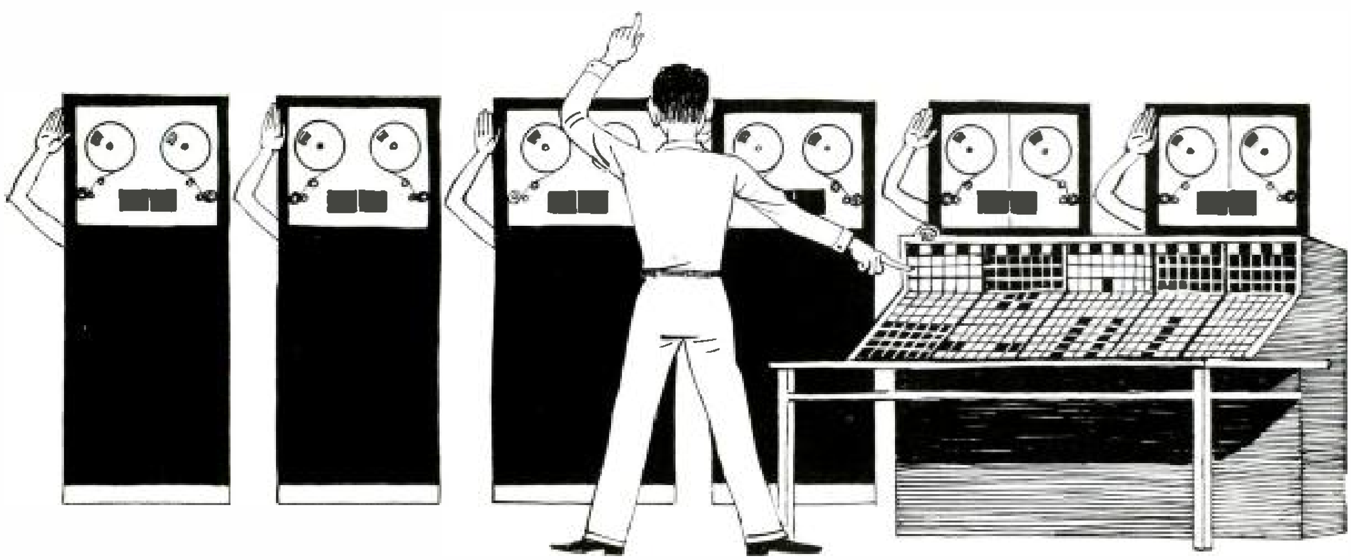
Output devices of the computer are punched paper tape, magnetic tape, punched cards, printed matter, and the like. The "out-basket" for pickup by the mailboy, directed telephone calls, and hand-delivered memos are the output of the secretary.

A secretary's daily output is small compared with the output of an electronic data processor. In fact, a computer could simultaneously schedule production, analyze sales, keep inventory, compute bills, figure payrolls, report costs, and estimate budgets, among other things.

Because it can do all this and because it can read, write, and do arithmetic with tremendous speed and accuracy, the computer is revolutionizing not only office work but also industry control as well as giving a new dimension to management intelligence.

Coupled with peripheral equipment such as magnetic tape units, high-speed printers and readers, random access memories, paper tape readers and punchers, and the like, a computer system becomes quite sophisticated, permitting people to do a variety of jobs they were unable to do before.

But there is no magic involved. Before an electronic data processor can utilize its millionth-of-a-second speed, man must tell it exactly what to do and how to do it – step by step. ■



Before an electronic data processor can utilize its speed, man must tell it exactly what to do.

New Hampshire Primary: Proving Ground for TV Election Coverage

by Howard Van der Meulen

How network television, radio, and computers combined to provide comprehensive coverage of the New Hampshire primary election in preparation for the 'Big One next November.

Early last September, on that kind of pleasant day when vacation memories seem more real than the job at hand, a small group of men from NBC News and RCA concentrated on an event six months in the future — the New Hampshire primary.

That meeting was the initial step in an unprecedented effort in scope and depth to cover a primary election on television and radio. It resulted in the decision to make New Hampshire the proving ground for the techniques that are to be employed in the 1964 general election next November. Specifically, the men agreed that computers would be used to tabulate the primary returns and project the results.

In the months that followed, NBC and the other networks poured manpower and money into New Hampshire to an extent that amazed the local residents. This first-in-the-nation primary, while always of national interest, had never before received such attention. "Frankly, we're not paying much attention to the candidates," said a newspaper editor as the various network operations reached a climax. "We're covering the coverage."

The primary was a good story in its own right. But it was more than that to NBC News. It was a severe test of the planning, organization, and performance that would be required of men and electronic equipment throughout this political year.

"The election season begins and ends with the two most complicated elections," says Robert Northshield, General Manager of NBC News, who is supervising NBC's entire political coverage. "In November, we have the advantage of having moved all summer toward the national election. We have gone through the campaigns, the primaries, the conventions. But with the March 10 New Hampshire primary, we start from a dead stop."

One reason for the complexity of the New Hampshire election was the large number of candidates. The Republican Presidential preference ballot was 19 inches long, 15 inches and five columns wide, and listed 108 names and 26 write-in spaces. One "moderator," an official in charge of a polling place, remarked that it took five minutes to mark a sample ballot, to which another replied: "It takes five minutes just to fold it up and put it in the box."

There were other complicating factors. Only six of the state's 302 polling places -- those of Portsmouth — have voting machines. The rest use paper ballots. At least four and usually five ballots had to be counted — one each for the Republican and Democratic Presidential primaries, one on local options for a state lottery, one for constitutional convention delegates, and, in many towns, one for local offices.

In mid-September, Frank J. Jordan, NBC News' Manager of Election Planning, made a three-day survey trip to Concord, the state capital, where he spoke with government officials, local newsmen, and politicians. Upon his return, he made two important recommendations. Both of them were adopted. The first was that NBC should staff every one of the state's 302 polling places. New Hampshire, unlike most states, does not tabulate votes at the county level, and it was evident that getting returns with the utmost speed would require a reporter at each poll. His second recommendation was that tabulations and projections of the vote should be based on partial returns from the polls, without waiting for final tallies. Neither of these two procedures had been tried before in a primary.

"We got together with the men from RCA Electronic Data Processing again and told them what we wanted to do," Jordan recalls. "Their job was to program the RCA 301 computers accordingly. They had to build into the machines the ability to remember previous reports when producing a new piece of information. The use of partial returns made the programming more difficult."

NBC political consultant Ed Edwin was assigned to set up the field operation in New Hampshire, organizing a poll-by-poll reporting system and gathering political and operational information. After several visits, he established residence in Manchester in early January. From mid-February on, he did not leave New Hampshire even for a week end. He seemed so much a permanent resident that it became a standing joke among NBC newsmen to ask: "Who's Ed voting for?"

On November 18, Chet Hagan, who would produce the television coverage, made his own survey trip, accompanied by technical personnel. He ordered television circuits and communications lines, and rented the ground floor of a building formerly occupied by the Manchester Savings

Bank as NBC News' Election Headquarters. Manchester, rather than Concord, was chosen by NBC and the other networks for their headquarters because it is the state's telecommunications hub.

Edwin's first move was to establish relations with the candidates' campaign aides as sources of information on the political races. He then made a complete swing around the state, examining polling places and contacting the moderators. Each moderator would decide the order in which the ballots at his poll were counted. Since the outcome of the Republican primary was the big story — there being no official Presidential candidates in the Democratic primary — the networks and wire services wanted the Republican votes counted first.

Jordan had asked the New Hampshire League of Women Voters to provide poll reporters for NBC News and, by the end of the year, the League had agreed to undertake this project. Its members would be "stringers" at 206 polls in the more heavily populated southern two-thirds of the state. It was clear from the outset, however, that the League would be unable to cover the northern polling places, and Edwin had to recruit reporters for these polls. He found them among teachers who were knowledgeable in the political processes. The NBC reportorial task force was growing.

As "our man in Manchester," Edwin also had to design a tabulating center in NBC News' Election Headquarters, deciding where desks and teletype machines would be located and obtaining long tables for the scores of telephones needed.

Meanwhile, at NBC in New York and at RCA's Electronic Data Processing facilities in Cherry Hill, N.J., computers were being readied for the big operation. Jordan's office furnished RCA with past election data and census information. From this material, the computers were set up to look at the voting patterns of New Hampshire's 302 polls in about a hundred different ways. There were nine major "deskings" delving into the state's geographical, urban-rural, and liberal-conservative differences. Combinations of these produced a multiplicity of minor deskings. (On Primary Night, the computers quickly discarded all but a few of these combinations on the basis of the initial returns, and retained only those which would give the best projection of the vote.)

Jordan and the RCA experts worked out the details of how the election returns could best be fed to the computers. "We set up Manchester in the room next to my office," Jordan said. "We installed teletype machines linked with the computers, and on five or six Saturdays we made test runs, sending figures over the teletypes and getting back tabulations and projections."

Near the end of January, with the election only six weeks away, telephone communications between the polls and the Manchester tabulating center were resurveyed and found inadequate.

"The New England Telephone Company had not expected the heavy demands that would be made on it by the networks," Jordan said. "After the resurvey, we were told that our reporters probably would not be able to get a circuit to Manchester.

"This would have ruined our entire operation. There was no choice but to put in a private line network. With fine cooperation from the telephone company, we put phones at 270 polls on private lines, seven or eight per line. The other 32 polls were in such isolated places that it was impossible to get lines in."

NBC News' Election Headquarters was officially opened February 6. Jordan, Hagan and his assistants, James L. Holton, who would produce the radio coverage, and a dozen technicians made the trip to Manchester, using the occasion for another survey and planning session. On Hagan's agenda were visits to the candidates' campaign

This building in downtown Manchester, N.H. . . . housed NBC central news desk . . . contacts with the polling plac headquarters and completion of arrangements for remote pickups from these places.

The headquarters building had been decorated with red, white, and blue bunting, and large pictures of Chet Huntley, David Brinkley, and Frank McGee were displayed in the windows. Passers-by showed considerable interest in the pictures, leading someone to remark that he wouldn't be surprised if these newsmen got write-in votes.

During the next month, NBC sent in many of its experienced election hands — from New York, Philadelphia, Washington, Chicago, Los Angeles, and San Francisco. Camera crews began traveling night and day with the candidates, filming the final flurry of campaign activity. The film coverage would be used on special pre-election programs as well as on the "Huntley-Brinkley Report" and other regular news programs.

The largest single group of NBC personnel arrived by chartered plane from New York on March 6. Installation of equipment was completed in special Primary Night studios for McGee in Manchester, Huntley in New York, and Brinkley in Washington. A master mobile unit was stationed outside the Manchester headquarters to service the live cameras inside. Other mobile units for live coverage were at the American Legion Hall, where Manchester's first votes would be cast; at the Highway Motel in Concord, which was headquarters for the state news service and the Lodge and Rockefeller campaigns; and at the Goldwater headquarters in a Concord store front.

At 12:01 A.M. on Primary Day, the nine residents of Dixville cast the first ballots in the state. The returns were called to NBC News immediately over Dixville's only telephone and were reported in a bulletin which interrupted the "Tonight" show. Films taken of the nine voters were telecast on that morning's "Today" program.

By means of the "Flashcaster" — type moving across the bottom of the television screen — NBC reported election developments throughout the day and evening. Two special programs, from 8:30 to 9 P.M. and from 11:15 P.M. to midnight, were devoted exclusively to the New Hampshire primary.

But for those who believed in the validity of computer projections, the Republican Presidential contest was decided as early as 7:05 P.M. when the RCA 301 projected a vote total for Lodge as high as 35 per cent, or approximately 34,000 votes. This was based on only 5 per cent of the vote reported. Lodge's final total actually was 33,007 votes, or 35.7 per cent of the vote. Said Huntley on the air that night: "It's certain the computer is now a definite and irrevocable piece of machinery in the reporting and analysis of an election by radio and television."

Jordan said later that "the thing that surprised me most was the speed with which the returns came in." He had praise for the League of Women Voters and other poll reporters who, in spite of a snowfall that blanketed the state and made driving difficult, reached and manned their posts.

Why "all this fuss" about a relatively small election? Brinkley posed the question and answered it. Politically, he said, the New Hampshire primary "does mean something, and it may mean a great deal." Because a candidate can do more than win "a thimbleful of delegates. He can prove to party leaders who may doubt it that he can win votes. . . . Another factor in a primary is money. A man who looks like a winner gets more of it than one who doesn't. . . . And, finally, there is the publicity. New Hampshire is all over the papers and radio and television. And since people in other, later primaries tend to vote for names they know, that kind of publicity for a politician is pure gold."

For NBC News, the New Hampshire primary as a training exercise and toughening experience for the bigger job ahead — the elections in November — also was "pure gold." ■

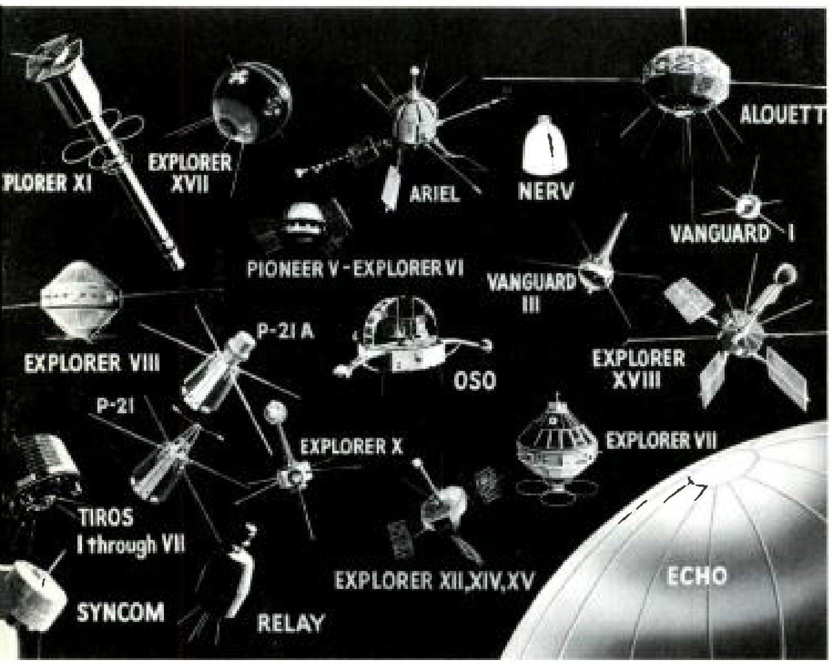
es . . . tabulators . . . direct feed into computers . . . while, in New York, Chet Huntley analyzed the election results.



Data Deluge from Space

by Romney Wheeler

Sophisticated space tracking and data acquisition networks must cope with an ever-increasing flow of information from a multitude of spacecraft functioning in outer space.



Space satellites — launched.

Imagine that the day is Friday, October 12, in the year 1492, and the place is a beach on the shores of the Caribbean.

Imagine also that an explorer named Columbus has arrived at this outpost of a new world not with three small vessels but with an armada of a thousand ships. Imagine further that the thousand ships carry a great army of scientists — geographers, botanists, anthropologists, zoologists, physicists, sociologists, meteorologists, and countless others. Their assignment is to fan out over the new continent and begin to report their findings.

The resulting flow of information produces an immediate broadening of human horizons, but it also generates a problem: the Spain of Ferdinand and Isabella is unable to receive, absorb, and disseminate this new knowledge at anything like the rate at which it is communicated back across the ocean.

This fancy serves to illustrate what is happening today in the new world of space — a vast realm that until a scant seven years ago lay entirely beyond direct human reach. Yet the analogy falls short in quantitative terms. The instruments with which we probe the unknown reaches of space are far more productive of new data than is any army of human scientists.

From the successful orbiting of the first earth satellites in 1957 and 1958, information has been pouring back to earth in mounting torrents. The deluge has risen further with each new spacecraft, taxing the capacity not only of countless men but even of the most complex electronic brains.

Perhaps the best place to grasp the immensity of this assault on the unknown is at Greenbelt, Maryland, where the National Aeronautics and Space Administration maintains its Goddard Space Flight Center. Here are the operational headquarters of most of the instrumented (unmanned) space projects. Here, too, is where the raw data from most of these space probes are received in the form of magnetic tape from tracking networks around the world. Already, this influx of stored telemetry is at the rate of 100 reels of tape each working day.

Information received by telemetry is expressed in "data points." Each point is equal to nine "bits" of data in the form required for electronic data processing. At present, the incoming volume of data is estimated at 40 million data points per day. It is expected to rise to 200 million points daily in 1965 and to 350 million in 1967. What happens after that is a mathematician's nightmare.

The problem is that satellites and other spacecraft not only are increasing in number but at the same time are multiplying in their complexity and in their ability to make more sophisticated reports on what they encounter in outer space. A small satellite like Explorer VI, which was operational between August 7 and October 6, 1959, was equipped for a half-dozen simple experiments. In contrast, the new Orbiting Geophysical Observatory is equipped to carry out as many as 50 different experiments of great complexity.

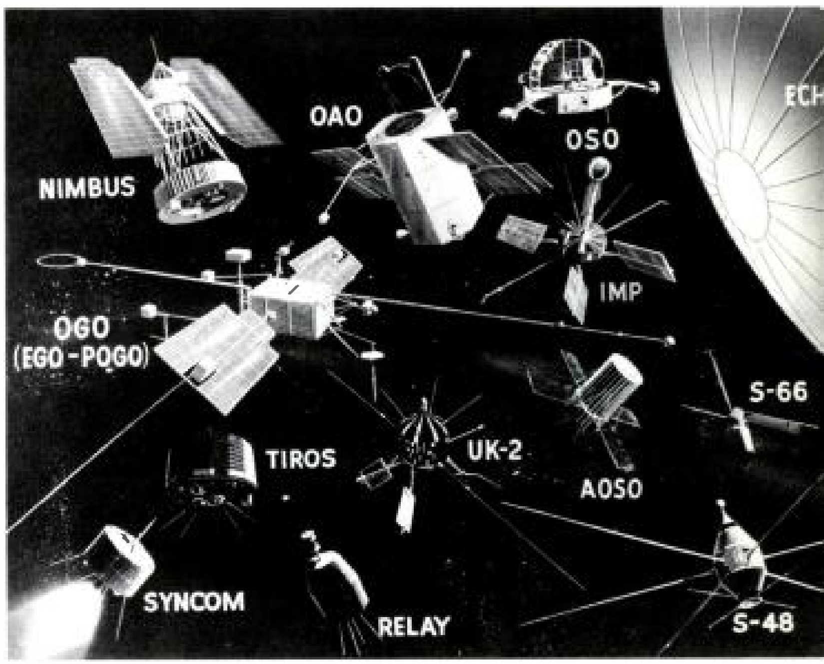
To cope with this ever-increasing flow of data from outer space, the earth-bound scientists have had to devise ever-swifter means of reading and analyzing space telemetry. The technician with strip-chart and slide rule can process one data point a minute. Semi-automation increases this to one data point per second, automation to 100 points per second, and computers to 10,000 per second.

To process the total information sent back during the lifetime of a single small satellite like Explorer VI, manual operators working 24 hours a day, six days a week, would take 1,780 years. Semi-automation would cut this to 29 years, automation to four months, and a computer could manage to process the information in 1.2 days.

Again in contrast, a single observatory satellite like OGO is designed to send back such a mass of information that it would take 500,000 years to process all of it manually. With semi-automation it would take 7,500 years, and even with automation it would require 75 years. A high-speed computer, working round-the-clock with only one day off per week for maintenance, would take nine months to process all the data received.

It may truthfully be said that, without the electronic computer, exploration of space would be impossible. It is not just a matter of processing information received from satellites and space probes. The design, building, and testing of spacecraft depend largely on the answers of computers. The launch and orbiting of a satellite, the navigation of a space probe depend on computers. Identification and tracking depend on computers. And finally, the commands and interrogation of spacecraft and the interpretation of what they have to say depend on computers talking to other computers.

As an example, take a satellite like the Orbiting Astronomical Observatory. A computer located in Greenbelt, Md., instructs another computer at a ground station in Santiago, Chile, by radio signals transmitted to the field station. The computer there automatically verifies the instruction by repeating it back instantly to the computer at Greenbelt. The Santiago computer then gets a status readout from the satellite and compares this with the predicted position given by the Goddard Space Flight Center.

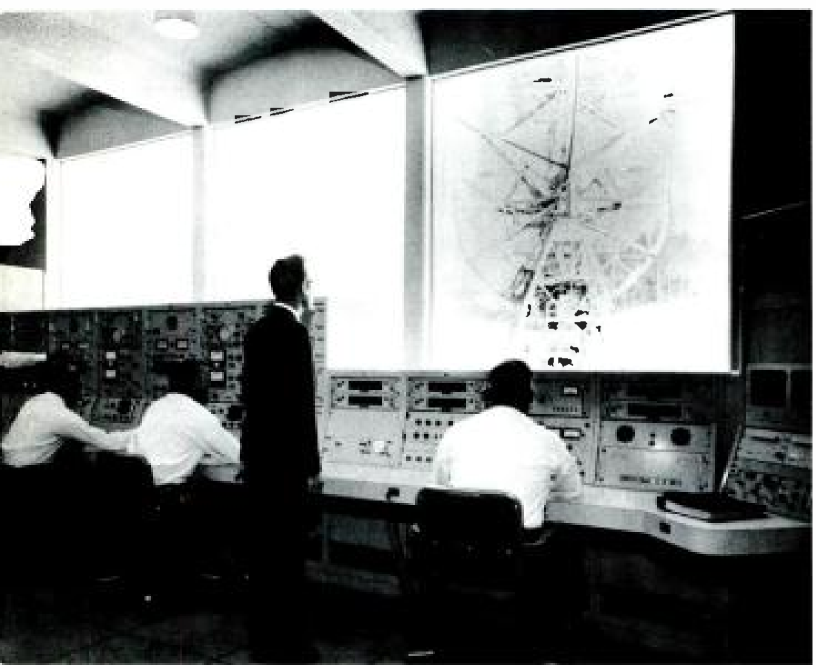


Space satellites — launched and scheduled.

Being satisfied that all is in order, the computer then "talks" to the satellite in 32-bit "words," each instruction being repeated for verification. The satellite's on-board computer checks each 32-bit "word" with the repeated instruction and, if it disagrees, it instantly sends down an alarm. Additionally, it repeats back to the ground station all the instructions it has received so that the computer below is satisfied that all commands have been received and understood. All this has occurred to carry out one set of instructions to one satellite on one pass over a single ground station.

As more and more scientific satellites whirl overhead, as more deep space probes chart the solar system, as each new advance is made in manned space flight, the demands increase for accurate and reliable command and readout facilities on the ground. There now are three separate networks in operation. These are:

1. *The Space Tracking and Data Acquisition Network* (STADAN). This has major data acquisition facilities at Fairbanks, Alaska, and Rosman, North Carolina, with one to be built at Canberra, Australia. These are linked with secondary stations, formerly called the Minitrack network, at Woomera, Australia; Quito, Ecuador; Johannesburg, South Africa; Lima, Peru; Blossom Point, Maryland; East Grand Forks, Minnesota; Fort Myers, Florida; Winkfield, England; Mojave, California; St. John's, Newfoundland; and College, Alaska.



Tracking control center at Rosman, N.C. Engineers of the RCA Service Company operate facility for NASA.

2. *The Manned Space Flight Network,* with stations instrumented primarily for aeromedical telemetry, plus high-precision tracking and command. Many stations share secondary locations of STADAN, with added facilities on ships at sea.

3. *The Deep Space Instrumentation Facility,* or DSIF network. This has its main installation at Goldstone, California, and is supported by the famous British ground station for radio astronomy at Jodrell Bank, an Australian facility at Woomera, and a ground station near Pretoria, South Africa. The Goldstone facility, operated for NASA by the Jet Propulsion Laboratory of the California Institute of Technology, is concerned only with spacecraft designed for moon probes and beyond.

The newly built ground stations at Fairbanks, Alaska, and Rosman, N.C., are designed especially for use with the sophisticated, second-generation satellites expected in the next few years. Each is equipped with two 85-foot dish antennas, plus highly automated ground equipment for tracking, command, and readout of telemetry data on an unprecedented range of experiments made possible by advanced spacecraft. They are operated and maintained for NASA by the RCA Service Company.

Scientific satellites launched or planned by the Goddard Space Flight Center and sounding rocket flights of more modest proportions required 24 pages of small print just for the listing of the projects and their experimental missions. Among the names of those already in orbit are the Explorer satellites of many shapes and functions, already nearly 20 in number; the famous RCA-built TIROS weather satellites, of which eight have been launched with unbroken success; the equally famous RCA-built Relay satellites which provided the first two-way television link with Japan as well as the first satellite communication with South America; Syncom II, the first successful synchronous communications satellite; the Canadian Alouette topside sounder to measure the density and distribution of the ionosphere; the British Ariel satellite to study ionosphere and cosmic ray relationship; and NASA's most recent Orbiting Solar Observatory (OSO) and Interplanetary Monitoring Platform (IMP). Also newly launched is Britain's UK-2 satellite for measuring vertical distribution of ozone, galactic noise, and micrometeorites.

There are more to follow: OGO, EGO, and POGO, all versions of the Orbiting Geophysical Observatory. EGO will have an eccentric orbit varying between 150 miles and 60,000 miles in space. POGO will have a polar orbit. Each may carry out no less than 50 different experiments. Then there will be Nimbus, the second-generation weather satellite, carrying advanced television cameras and automatic picture transmission equipment designed and built for NASA by RCA. Also scheduled is the Orbiting Astronomical Observatory, to make precise telescope observations from above the earth's atmosphere.

Roderick Hibben, writing recently in *Aviation Week and Space Technology,* suggested that scientific exploration of space now is in the digesting period during which massive amounts of data collected in the early years of space flight are being reduced to meaning. He went on to note that the current period is characterized primarily by the large number of theories discarded by scientists. In the six years since Explorer I discovered the Van Allen radiation belts, more than 100 theories concerning the earth-sun relationship have failed to survive the test of direct measurement.

At the same time, new knowledge has been added with bewildering speed. Five years ago, for example, no evidence existed that the sun's corona extended out to earth, or that auroral effects in the earth's atmosphere were caused by incoming energetic particles. Today, these theories are widely accepted, confirmed by data sent back by the first Orbiting Solar Observatory and by high-altitude sounding rockets.

The first Interplanetary Monitoring Platform, called IMP, has charted gigantic shock waves, produced as gaseous emissions from the sun, which pound at supersonic speed against the barricades of the earth's magnetism. Moreover, it has shown that this "solar wind" surges past the earth, leaving a wake like that formed by a boulder in swift water.

Hundreds of scientists working at dozens of universities and research laboratories, as well as the project staffs of NASA and of its industrial contractors, are daily transforming telemetry from space into meaningful discoveries about the sun, the planets, and the trackless universe beyond. What the future will unfold is incalculable, except the certainty that it will dwarf all the discoveries that have gone before. Determination of whether or not life exists on Mars and the first actual sampling of the moon's surface almost certainly will be accomplished with instrumented spacecraft long before man is able to leave the earth's gravity.

Rockets, balloons, space satellites, and probes will yield new and often unsuspected facts about solar physics, energetic particles, and magnetic fields; aeronomy and the ionosphere; astronomy; geodesy; space chemistry; and biology. New techniques and vastly greater capability undoubtedly will be developed in satellite communication and weather forecasting, including radar-borne satellites capable of reporting changing weather conditions as surface radar spots a local thunderstorm.

Meanwhile, the never-ending flood of telemetry continues to pour into receiving centers for quality control, calibration, conversion of data, reduction of data, and, finally, analysis of the information.

One housekeeping problem causes some anxiety. NASA policy prohibits the destruction of any tape with space information. Instead, it must be stored. More than 45,000 tapes already are on hand, and still more come in at the rate of 30,000 a year.

Storage itself is no great problem. Warehouses can be expanded indefinitely. What worries the scientists is that, electronically speaking, each tape

Ready for data from space. The North Carolina Data Acquisition Facility can handle the most complex experiments.

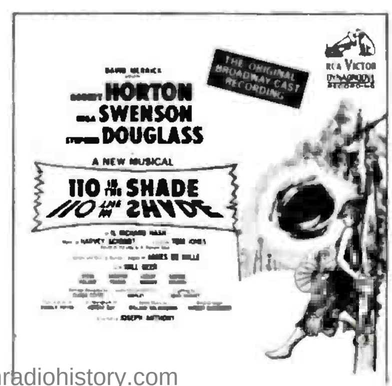
should be taken out and "exercised" periodically; otherwise, recorded signals may "ooze" from one layer of tape to another on the reel, with resulting telemetric chaos.

Just the thought of playing back 250,000 beeping tapes each year for "exercise" is enough to send an archivist twittering to the nearest box of tranquilizers. Unless, perhaps, someone discovers how to do it with computers. ■

Front-Row Center at Broadway Musicals –by Records

by Mary Campbell

Scene from Broadway's new musical hit "Hello, Dolly!" starring Carol Channing.



The story of how a hit Broadway musical becomes a hit record album.

A couple walks jauntily out of the St. James Theatre in New York, having seen the season's biggest Broadway musical hit, humming the title song, "Hello, Dolly, well hello, Dolly." They pass a man in the lobby selling record albums of the cast singing songs in the show. They join Broadway's after-theater throngs and stroll past a record shop with a loudspeaker blaring, "You're looking swell, Dolly, we can tell, Dolly." In the car on the way home, the radio picks it up, "Dolly's overjoyed and overwhelmed and overpowered." One of these days, this couple will buy the "Hello, Dolly!" album.

The biggest gamble in the recording business is paying off.

The Broadway musical has been big business in show business for a long time. These days, so is the Broadway musical original cast album. Big money goes into its production — which can turn out to be a coup or a disaster.

Salaries for the recording session average $30,000. In addition, the recording company may have sunk two or three times that much in the production of the show.

Recording companies have become the biggest investors in Broadway musicals. A company invests in a show to gain the right to cut the show's cast album and, hopefully, to share in the show's profits. It may be the biggest single investor in a show — an average of $300,000 to $450,000 is needed to bring a musical to Broadway — but it has not one thing to say about what does or does not go into the production. When "Little Tin Box" was added to "Fiorello" during the last hectic week before opening night, representatives of the company that recorded "Fiorello" were around. But they were merely timing the songs, in anticipation of recording the ones that would finally wind up in the show.

The record album comes out fast — sometimes just a week after the show opens on Broadway. If the show is a hit, it sells fast — the "Hello, Dolly!" album sold 80,000 copies its first week. And it sells for a long time, usually doing as well in its fifth year as in its third. The first Broadway cast album that was made, "Porgy and Bess," on four 78s, is still selling 24 years later, on an LP. The first one made after the LP was introduced in 1949, "South Pacific," is still selling, too.

Handsome profits can be made by a record company on a cast album and a show. The all-time best-selling album, "My Fair Lady," has sold nearly three million copies, and the parent corporation of the company that recorded it was 100 per cent backer of "My Fair Lady" on Broadway. Losses also can be enormous, since a cast album usually follows the fortunes of its show — when a musical quickly folds.

Despite the gamble, nearly every musical that runs on Broadway is recorded. And this season more record companies than ever — six — are making cast recordings.

RCA, for example, has been making cast albums for years and has rights this season to more shows than any other recording company, including a $70,000 investment in "Hello, Dolly!" and its album rights.

There is competition between record companies for rights to the big shows, but the competition is based on projection. It comes long before anyone knows for sure if the show will be a hit.

During the period when the show consists only of a song writer, a lyric writer, a book writer, and an enthusiastic producer, this quartet calls a record company and makes an appointment for an audition. The record company assembles its own quartet — usually the president, the repertoire

Record albums such as these at left bring enjoyment of Broadway musicals to millions of persons.

...careful advance planning is the most important part of making a Broadway cast album.

"Hello, Dolly!" players record in Webster Hall.

RCA Victor Record head G. R. Marek (left) supervises rehearsal.

man, and a couple of specialists in Broadway show recordings.

The producer and his writers arrive, and hopefully one of them can sing and one can play the piano. They briefly expound the plot, carefully tell how the story leads into each song, and sing all the songs.

The performance over, they'll tell whom they have cast, if they have cast anybody yet, and whom they are trying to cast; the director, choreographer, scenic, and costume people they are trying to get; when they intend to go into rehearsal; and when they plan to open in New York — usually three to four months in the future. They also say how much investment money they are asking.

Then they go to another record company and audition again.

If more than one company is interested, the parties negotiate further, mostly about promotion and advertising. The producer sees the record album as promotion for his show. If two record companies are willing to give him the money he requests, he now wants to know the answers to such questions as: Which company will advertise the cast album more heavily? Which one will issue single records of songs from the show by big name artists on its roster? Which company will put out an instrumental or jazz album of the show's tunes?

No musical can go into rehearsal until all its financial backing is secured. But when investors are lined up, sometimes including a record company, cast and crew are hired, and rehearsals begin.

From rehearsals, the show usually goes out of town. Now the cast is rehearsing all day and performing before audiences at night. The director works for smoothness, everybody makes suggestions, the writers rewrite, the musical director tries to keep up with getting changes copied into arrangements and into the show. The record company has its Broadway show album producer drop in to get the feel of the production.

The last week out of town, this record producer shows up again for three or four days to do some concentrated planning. He times the songs; he needs approximately 22 minutes of music on each side of an LP. If the show has 14 to 16 songs, he's O.K. If it has 19, like "The Unsinkable Molly Brown," he has to decide where to cut a chorus here and there.

In his mind, he's arranging and rearranging people and microphones around the hall where the recording will be done to get the best stereo effects. If a song trails off into dancing or a piece of dramatic business in the play, he confers with the song writers and the arranger who work up a resolved ending for the record.

Andy Wiswell, who does all this for show albums made by RCA, considers careful advance planning the most important part of making a Broadway cast album. When the show freezes — no more changes — and comes to New York for previews before opening night, Wiswell again attends a couple of times. He takes with him the engineer who'll work in the control booth during the recording, so they'll both have in mind what the show looks like and the atmosphere they're trying to capture on the record.

If the cast isn't too tired from its steady rehearsals and out-of-town tryouts, and if the show looks as though it will run, the cast makes the recording on the first Sunday after the show opens. With the Broadway theaters operating Monday through Saturday, it's the cast's first free day.

They arrive — everybody except the stars of the show — at 10 A.M., in casual clothes, at one of New York's big, old, chandeliered dance halls, which will provide nearly the same acoustics as a Broadway theater. Musicians arrange themselves in the middle of the dance floor in a big horseshoe around the conductor, spaced far enough apart so that the

Entire company takes a break during recording.

Players record a number.

Star Channing booms out show's title song.

mike in front of one set of instruments won't pick up sound from any other instruments.

With the orchestra set up, the singers now go on stage, to stand behind the three or four microphones. A tiny red light glows beside the conductor. Everybody quickly stops talking and moving around. The conductor lifts, then lowers, his baton. Musicians begin to play. Singers, using whatever arm motions and "body English" they are accustomed to use in the show, begin to sing. Recording for an original cast album has begun.

Inside a control booth, a technician has started two reels of tape spinning; one is for insurance. Another man sits facing a console of black knobs, quickly twisting this one and that, working with both hands. He's "mixing" — controlling the volume from each of 15 or 16 microphones. Out of the corner of his eye, he follows the various signals of the producer who has the musical score in his lap.

The conductor hears a mistake, waves the musicians to a stop, points his baton. "That's not a triple, it's a real sixteenth." From inside the control booth comes, "Take two." The red bulb glows again; the song starts again. One of the singers leans away from the mike, making his voice faint. The album producer waits until the song is over, announces just which measures he wants redone. He'll splice the tape later. Right now, he's interested in saving time and voices. The song completed, a playback is amplified through the hall. Performers listen, take five minutes for another drink of water, then quickly return to the mikes.

Union regulations allow all-day recording in three three-hour sessions, which start at 10 A.M., 2 P.M., and 7 P.M. Musicians can work all nine hours, singers only eight. The stars will arrive at 2 P.M. and do their songs with supporting players and chorus. By 5 P.M., supporting players should be finished; they can go home. Soon after the evening session begins, the chorus should finish. The stars will sing any duets or solos and then leave. The orchestra will end the day with the first piece of music in the show, the overture.

Every performer receives one week's pay for the day's work. If the recording goes even a few minutes past 10 P.M., everybody gets two weeks' pay.

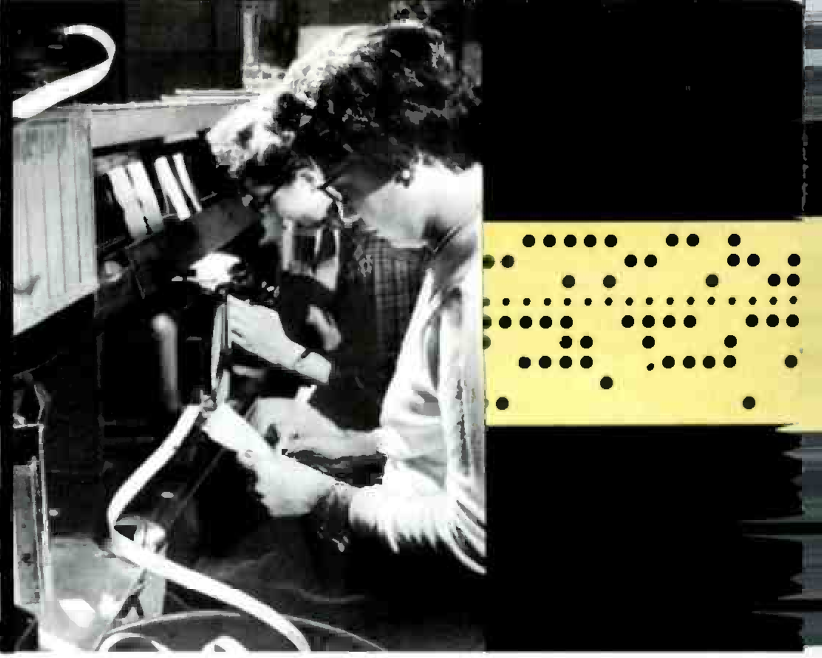
Early Monday morning, the album's producer takes all the tape — in recording "Hello, Dolly!" there were 50,400 feet of it — and begins to edit. He takes the songs, working in the order in which they appear in the show, and splices what he considers necessary. Then he does what he calls a "mix down." He takes the tape — recorded on three tracks to give him maximum control over the finished product — and spreads the middle track over the outer two for stereo. For mono, he will later combine the three tracks into one.

He has had this mix down in mind in all his arranging of people and mikes. And he has been careful to balance the volume in the various tracks and to get loud enough tones. At this stage, he can easily lower the volume. If he brings it up, he runs a risk of tape hiss.

When the producer finishes editing, he has two 22-minute reels of tape.

He sends these to the cutting room where a mother record is made, from which lacquer masters are pulled. The producer listens to the masters and, after he approves them, they go to the manufacturing plant. Prepared record labels and colorful album jackets are already at the plant.

Companies record operas a year before they release them. But they rush Broadway shows into production. When the show is a hit, they try to get the album into New York stores within a week of the opening, while people are still thinking about the newspaper critics' accolades. A week after that, when the reviews are appearing in weekly magazines, original Broadway cast albums are for sale in stores all over the country. ■

Fast-paced sales transactions on the floor of the New York Stock Exchange are recorded on perforated tape for transmission to ticker services.

Instant Wall Street–Overseas

by Frederick W. Roloff

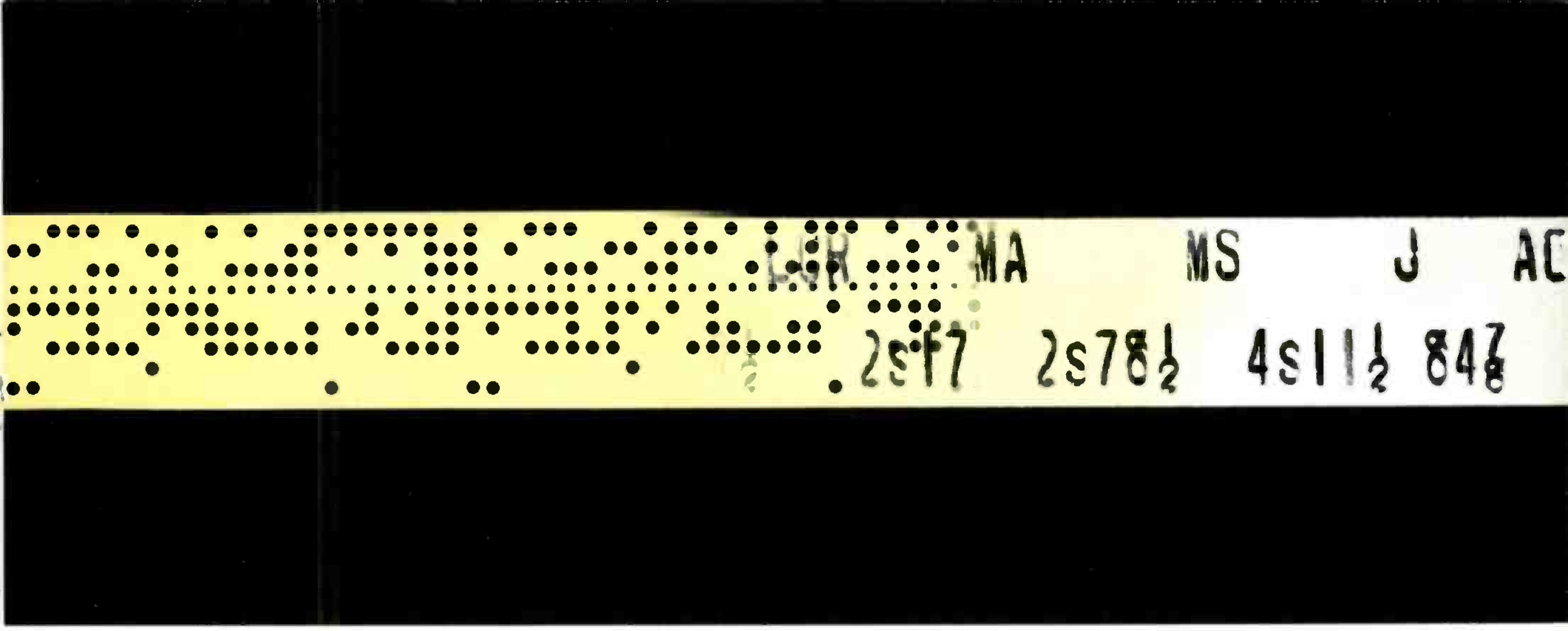
In the world's banking and financial headquarters, thousands of persons spend a good part of the day looking at a parade of stock ticker symbols and numbers on teletyped printed tape reflecting sales on the New York Stock Exchange. Since stock prices fluctuate so rapidly, speed is a crucial factor in the transmission of these figures.

Recently, RCA Communications, Inc. instituted two new communications advances in this area — Overseas Stock Ticker service and Overseas Market Quotation service. The new ticker service provides brokerage offices abroad with all the market data on the NYSE ticker as fast as it is received by brokerage offices throughout the United States. The quotation service permits brokers and their customers abroad to interrogate a computer in the United States concerning the status of specific stocks by merely pushing a button. Like RCA's Washington-Moscow "Hot Line," this overseas transmission is another electronic step forward in the circulation of critical information at the speed of light. Both services are now available with Hawaii and Puerto Rico, and the quotation service is available to countries in Europe as well. They will be extended to other overseas areas as the demand for them grows.

Before the introduction of these RCA services last March, overseas brokerage offices received information of New York Stock Exchange transactions from their New York offices at their request, either on individual issues or a prescribed grouping of stocks. At times, market information arrived overseas as late as a half an hour after it appeared on the ticker in the U.S. In an active market, stock prices can fluctuate rapidly by the time brokerage house floor representatives dart hundreds of feet to trading posts with their orders. When you add to this the delay overseas investors encounter in relying on conventional communications methods, the effect can be chaotic.

The new ticker service eliminates the previous communications time lag. In fact, right now, brokerage offices in Hawaii and Puerto Rico are receiving the same information in their offices that is coming off the floor of the Exchange — simultaneously as fast as the NYSE ticker service flashes "Big Board" figures to its customers throughout the country.

The value of the new overseas ticker service to a customer sitting in a local Honolulu brokerage office is that it permits him to observe stock fluctuations as they occur in New York and make immediate judgments to buy or sell stocks. Heretofore, this was not possible. The continuous flow



With the inauguration of instantaneous ticker and stock quotation services to overseas brokerage branches and firms, all major financial communities abroad may soon have immediate access to information directly from the floor of the New York Stock Exchange.

of market data was confined to the continental United States. Now, the investor in Hawaii has the same market information available in Wall Street brokerage offices, and he has it at the same time.

The actual mechanics of the domestic New York Stock Exchange ticker that is now being carried overseas probably constitute one of the most efficient and accurate operations for handling a continuous flow of data. When a broker telephones an order to a clerk on the floor, a slip containing information on the order is passed to a member of the Exchange. The broker goes to the post where the particular stock is traded and buys from another broker who has an order to sell the same stock. Or, he sells to a broker who wants to buy. They transact the order. The price, the name of the stock, and the number of shares are recorded by a NYSE employee known as a reporter. This transaction slip is then shot by pneumatic tube to the ticker room on the fifth floor of the Exchange where the four-by-five slips march endlessly on a small conveyor before punched-tape operators. The sale is then automatically registered on the tape as fast as three operators, working simultaneously, can punch perforator keys. At the same time that this information is transmitted to subscribing domestic brokerage houses on the NYSE ticker service, it is simultaneously sent to overseas customers via RCA's Central Telegraph Office in New York.

Besides the instant quotations received by the ticker service, another great advantage to overseas customers is the quotation service which permits brokers abroad to "interrogate" a computer in New York concerning specific stocks. Several firms specializing in the distribution of market information maintain computer storage facilities. As the New York Stock Exchange ticker reports, the computer memories store specific information on stocks. Then, by using RCA's quotation service, a subscriber at his desk in Europe, Hawaii, or Puerto Rico can push a button on an instrument, provided by the computer firm, no larger than an adding machine and obtain such information as the bid and ask price, the last sale, previous day's close, the time of the last sale, and so on. The information is flashed back immediately on paper tape or on a small screen framed in the desk-top machine.

This availability of continuous market information via the NYSE ticker service and the ability to "query" computers about specific stocks by the new quotation service prompted one broker user to comment facetiously, "Who needs a 'Board'? . . ." ■

Radio for Industry

by Desmond Smith

Mobile two-way radio has grown from law enforcement "Calling All Cars" use prior to World War II into a $100-million-a-year multi-purpose business.

Mobile radio speeds site clearing for new highway as truck driver (foreground) calls his foreman in radio-equipped vehicle several hundred feet away for instructions, and gets them immediately.

Mobile radio has always enjoyed a rather exciting connotation. Before World War II, those who used it were, in general, concerned with law enforcement or some other form of public safety.

More recently, however, one seldom picks up a trade paper without coming across a story of two-way radio in a money-saving situation. "Radio Tells Trucks Where to Go," declares a writer in the *Commercial Car Journal;* "A Block Man Radios in on Savings" shouts a front-page headline in *Concrete Products.*

Today, radio manufacturers such as RCA who make two-way radio systems are participating in a thriving $100-million-a-year boom. Although a good deal of production continues to fill public safety needs, the majority of systems are being sold to American business.

The chief architect behind this change is the Federal Communications Commission, which, with little fanfare, some time ago announced the formation of a "Business Radio Service." This action has made it possible for almost any category of business venture to qualify for a broadcasting license. The FCC's definition of "business user" encompasses firms as huge as Sears Roebuck Inc., or as tiny as the local rug cleaner. As a result, the manufacturers of two-way radios – about a dozen of them – have been enjoying a period of growth.

An example of how two-way radio is used in business can be seen at Sea-Land Services' spanking new 92-acre freight terminal at Elizabeth, New Jersey. Sea-Land, as the name implies, uses both waterways and highways for its new type of cargo transport service. Specially constructed over-the-road cargo trailers deliver freight to the pier, and the trailers are stowed aboard ships for the sea voyage. At the port destination, the containerized trailers are unloaded, tractors are hooked up, and the cargo is whisked on wheels to its delivery point.

Keeping track of the over 2,000 trailers that are marshaled at dockside parking locations awaiting shipboard loading is a task that has been smoothed with an RCA two-way radio network. All trailer movements at the loading sites are controlled by radio communication for fastest action. With radio coordination, a trailer can be removed from a ship and another trailer stowed in its place in the remarkably short time of only four minutes.

The radio system sends out messages to 40 radio-equipped cars and tractors from 12 strategically located dispatching stations at the terminal. By maintaining a constant flow of radioed instructions, Sea-Land is able to mesh parking control, maintenance, security, stowage, and stevedoring functions into a single, cohesive working unit. The success of the entire operation is geared in terms of minutes, and radio communication eliminates the snags before they have a chance to develop under these tight control requirements. The same conditions that have led to the success of two-way radio in the transportation industry exist in other areas.

In the public utility field, heavy labor costs, coupled with a necessity to maintain multiple plants, have made two-way radio very useful. For example, the Consumers Power Company, which serves all of Michigan's lower peninsula, covers all 29,000 square miles of its territory with a company-operated radio network. To provide radio coverage on this king-size scale, RCA equipped more than 1,200 vehicles with two-way radio. These, in turn, were tuned to 57 base stations located in generating plants, substations, gas-storage fields, and electric and gas distribution units. A clue to the usefulness of a system like Consumers Power's is the demand imposed upon it. Last year, this radio network handled over a million messages.

The competition between radio manufacturers for the really big customers is vigorous, and any success is hard won. First-class service and product development are important factors in marketing this equipment. For example, RCA, one of the leaders in the field, recently introduced a new line of transistorized two-way radio equipment. In the process, it took the opportunity to build in the experience gained in the nation's aerospace program. The new transistorized radios feature lower vehicle battery drain, improved reliability, and compact, modular designs. Though the big customers provide the steady income (usually through long-term lease agreements), the manufacturers are hoping to find that the growth of small-scale users in the burgeoning business-radio field will supply a sizable share of the profit.

Meanwhile, the addition of business radio to the already large land transportation radio and industrial radio services has not been managed without some growing pains. With an estimated million and a half licensees in the United States today — most of them confined within a small segment of the radio spectrum — many users have to share their frequencies with other companies operating in the same area. Technical progress and self-management of the airways by users have helped to alleviate some of the congestion. By electronically slicing many of the channels in half, manufacturers have nearly doubled the number of channels over that which existed just a few years ago. Also, groups of radio users have banded together into associations to promote better use of air time and to counsel prospective new users on frequency selection.

Surprisingly, users faced with sharing of air time don't consider it a problem at all. They've adapted their dispatching methods to fit the situation and have instituted calling codes to keep messages as short as possible. Thus, when a radioed voice crackles out "10-7," it's not a baseball score but an abbreviated way of saying, "I'm at my customer's location, and I will be out of my vehicle for 15 minutes." ■

From one of 12 radio control points, Sea-Land dispatcher asks supervisor on pier for report on loading operations . . .

. . . reply comes back in seconds, as supervisor radios word picture directly from the scene.

Educational TV Grows in Brooklyn

by Edward J. Dudley

Brooklyn College's Television Center is not only a teaching adjunct but also produces cultural programs for commercial broadcasting and offers training for careers in television.

The 42-acre campus of Brooklyn College, near the geographical heart of the bustling borough of Brooklyn, is somewhat short on ivy but long on academic energy. During a typical college day, a day that runs well into evening, a grand total of 23,000 students will crisscross its pleasant, tree-planted quadrangle.

The pace is fast, like the subways that bring students to their Flatbush campus from New York City's five boroughs. And the college and its students move with a purposefulness born of intense competition for the available places in a non-tuition institution.

Recently, Brooklyn College made what its officials describe as "a major commitment to television." In doing so, it leapfrogged much of the field and became a major factor in educational television.

The commitment took form as a Television Center that has just been installed in specially designed quarters in a new on-campus building. The Center is distinguished by its use of a full complement of broadcast-quality TV apparatus, supplied by RCA, that would be the envy of many a commercial broadcaster.

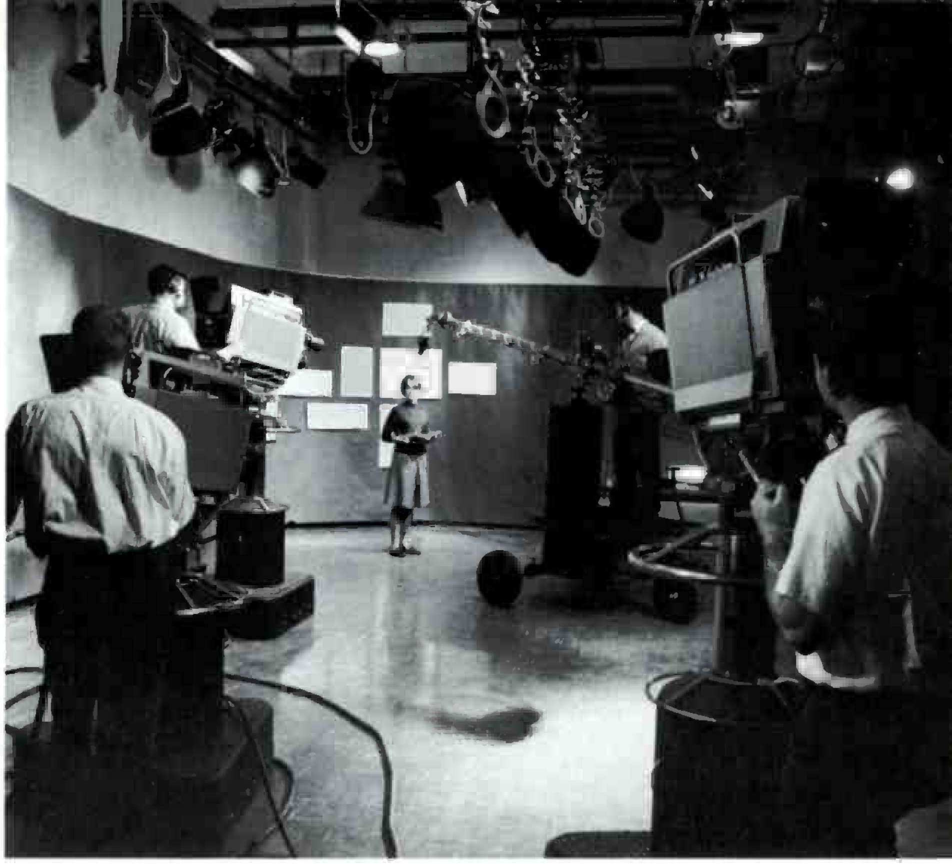
Dr. Eugene S. Foster, the Center's director, points out that the professional equipment affords Brooklyn students an opportunity to work with cameras and other TV gear identical with that used for "on-the-air" programming. Also, he says, it assures that the students' best creative efforts are accurately portrayed in the television medium.

The Center has been carefully planned as a multiple-purpose facility. It will, for example, be used as a teaching adjunct to improve and enrich academic instruction on the campus. Programs produced in the Center can be relayed over a closed circuit to monitors in a number of student classrooms.

Because of its professional equipment, the Center is fully capable of producing and tape-recording educational and other cultural television programs that can be used on the air by educational and commercial broadcast stations. Plans already are well under way to produce such shows.

A third purpose is to serve as a source of professionally trained recruits for the television industry. The Center has a complete undergraduate and graduate curriculum in broadcasting, including courses in TV production, performing, writing, staging, and lighting, among others. This fall it will offer a course leading to a master's degree in broadcasting. ■

In Center's "master control," students learn to adjust picture signal coming from studio cameras.



The College's Studio B has professional-quality RCA cameras, lighting equipment, and boom microphone.

Student directors (at table) assemble TV show from live action and slides as class (foreground) observes production.

Electronically Speaking

News of current developments briefly told.

ELECTRONIC HARMONY IN THE HOME

Thanks to a new low-cost "power control" device being produced by RCA, food mixers will no longer bog down in a bowl of stiff mashed potatoes, washing machines will whirl shirts at pre-selected speeds, and the man-of-the-house at work in his basement workshop can select the precise speed required for drilling or sawing some of the new building materials. In fact, even the home fancier of model trains — child or adult — will be able to operate electric model trains with more power at slow speeds.

This new device — a silicon-controlled rectifier — which is being produced by RCA Electronic Components and Devices, can be used to supply continuously variable temperatures, light levels, and motor speeds of appliances and power tools. To date, this type of power control is available only in expensive industrial equipment and was not previously considered economical for home appliances. The new unit makes it possible to control precisely 117-volt household power and permits finger-tip proportional control for many kinds of motorized electrical appliances — of which the average American home contains more than a dozen.

A single control knob on an appliance can provide any desired adjustment to the motor speed, temperature, or light level. Light dimmer controls, utilizing the new silicon-controlled rectifier, are being made small enough to fit into lamp sockets and may replace the "old-fashioned" off-on switches and provide a full range of light levels from bright to dim.

TV GOES TO THE MOON

A hand-held television camera, smaller than a carton of cigarettes, is being developed by RCA to go to the moon on the Apollo manned lunar mission.

The TV camera will be capable of sending back live television pictures from space, using a 70-degree wide-angle lens for on-board viewing in the command module or a nine- to 35-degree zoom lens for scenes taken through a window at distant objects.

Television transmission from the Apollo spacecraft will be picked up at a designated ground station, video-taped, scan-converted for commercial TV, and released within minutes to the public.

THE RIVER WATCHERS

Almost in the tradition of the Revolutionary War's Minutemen, 34 housewives, farmers, schoolteachers, and even a bicycle repairman located along Pennsylvania's Susquehanna River are flashing daily reports of river stage readings and local weather conditions that could warn of impending floods.

These river watchers, using RCA two-way radios, transmit their reports to base stations nearby, which in turn transmit them to the Federal-State Flood Forecasting Service at Harrisburg for analyses.

During flood season, the manned stations are expected to file radio reports three or four times a day, using the radio equipment.

THE RELAY COMMUNICATION SATELLITES

The remarkable performance of Relay I (carrying out more than 2,000 communications experiments and demonstrations in a period of 15 months) was in great measure the result of a special, RCA-designed, pressurized tube developed specifically to operate in the vacuum of outer space. These traveling-wave tubes are the key power amplifying devices of the satellite's wideband communications transmitters.

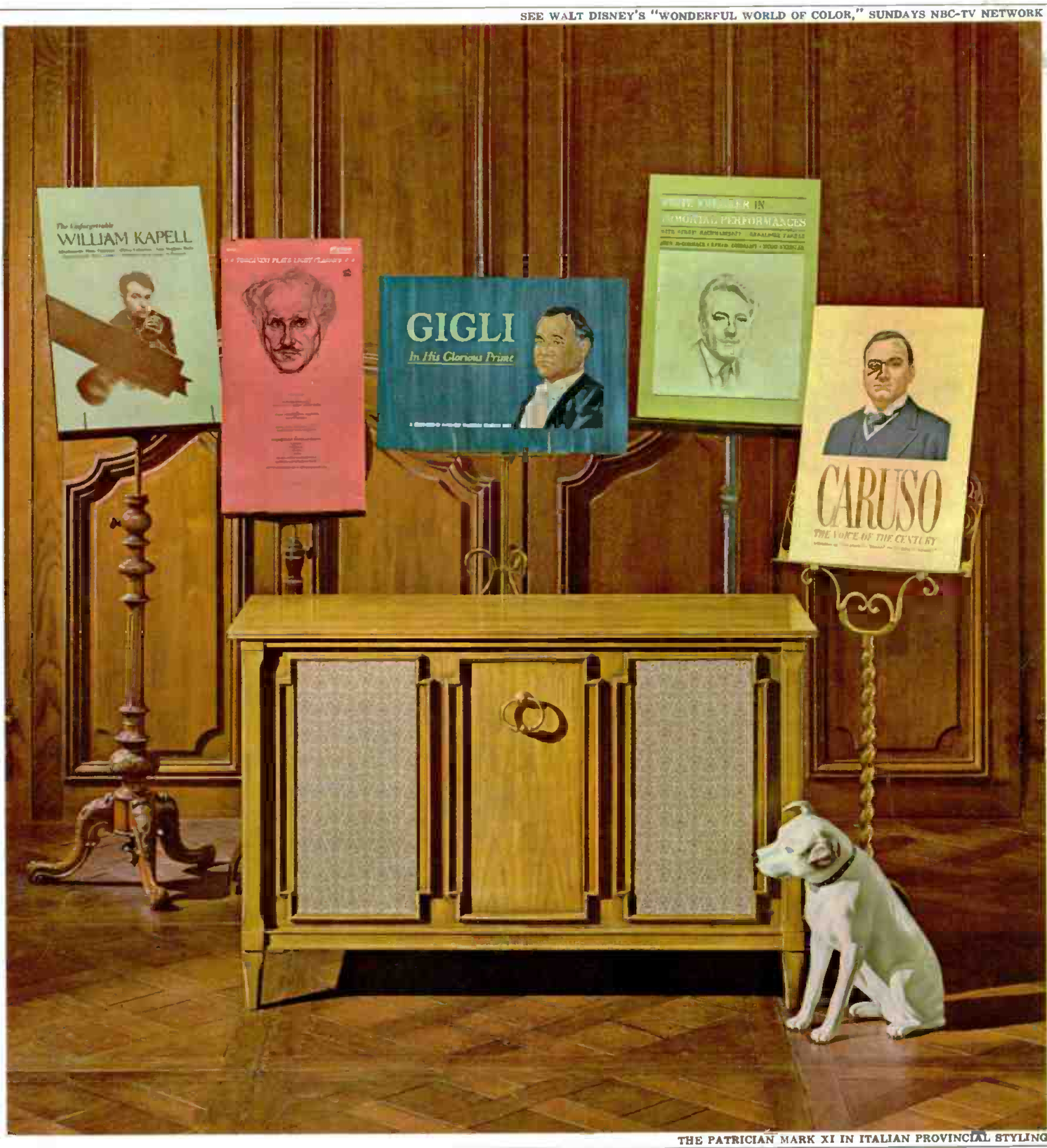
Now, a new *unpressurized* traveling-wave tube has been developed by RCA Electronic Components and Devices. It is the heart of a modified Relay II, which has been orbiting the earth since January 21, 1964. Relay I, meanwhile, was still functioning in April, despite a life that was to have expired in December, 1963. Relay II has an indefinite life.

WHEN YOU VISIT THE WORLD'S FAIR AND NEW YORK . . .

Be sure to visit the RCA Exhibition Hall, 40 West 49th Street, in the heart of Rockefeller Center. Here, in addition to such products as RCA Victor TV sets, radios, and stereos, you will see many fascinating displays and exhibits demonstrating that RCA is the world's most broadly based electronics company. You'll see push-button, motion displays of television broadcasting . . . the varied uses of RCA computers . . . the important work RCA is doing for our government in defense and the exploration of outer space. You will see yourself on TV . . . and there are many more wonders of modern electronics, showing you how RCA is part of your life. It's all free and it's open to the public daily from 11:00 A.M. to 7:45 P.M.


GLOBAL COMMUNICATIONS
RCA SERVIC
RCA ELECTRON TUBES
AND SEMICONDUCTOR DEVICES

SEE WALT DISNEY'S "WONDERFUL WORLD OF COLOR," SUNDAYS NBC-TV NETWORK



THE PATRICIAN MARK XI IN ITALIAN PROVINCIAL STYLING

RCA Victor – A Sound Tradition

The handsome instrument above is a New Vista Stereo. The posters of great artists illustrate the long tradition of quality sound reproduction behind today's fine RCA Victor product—a tradition important to you if you are considering the purchase of stereo. Because we built—and are still building—that tradition of quality in many ways. Here are just a few.

Our diamond needles are specially polished to help save your records and to hush surface sounds. Premium long-fiber spruce from Norway goes into the Diaphonic speaker cones which we make ourselves.

The Studiomatic record changer with the Feather Action Tone Arm protects your records at the spindle and in the groove. We invite you to compare the FM/AM/FM Stereo radio with *any* other. Cabinetry? RCA Victor offers you so many choices of styles and finishes, the problem's in deciding which to have.

But put it to the test. Before you buy any phonograph, compare. Compare RCA Victor's experience in sound reproduction, dating to the earliest days of the famous "Victrola"® phonograph. Compare by testing it with a favorite record. Only then will you understand why more people own RCA Victor phonographs than any other kind.

"HIS MASTER'S VOICE"

RCA The Most Trusted Name in Sound

Tmk(s)®