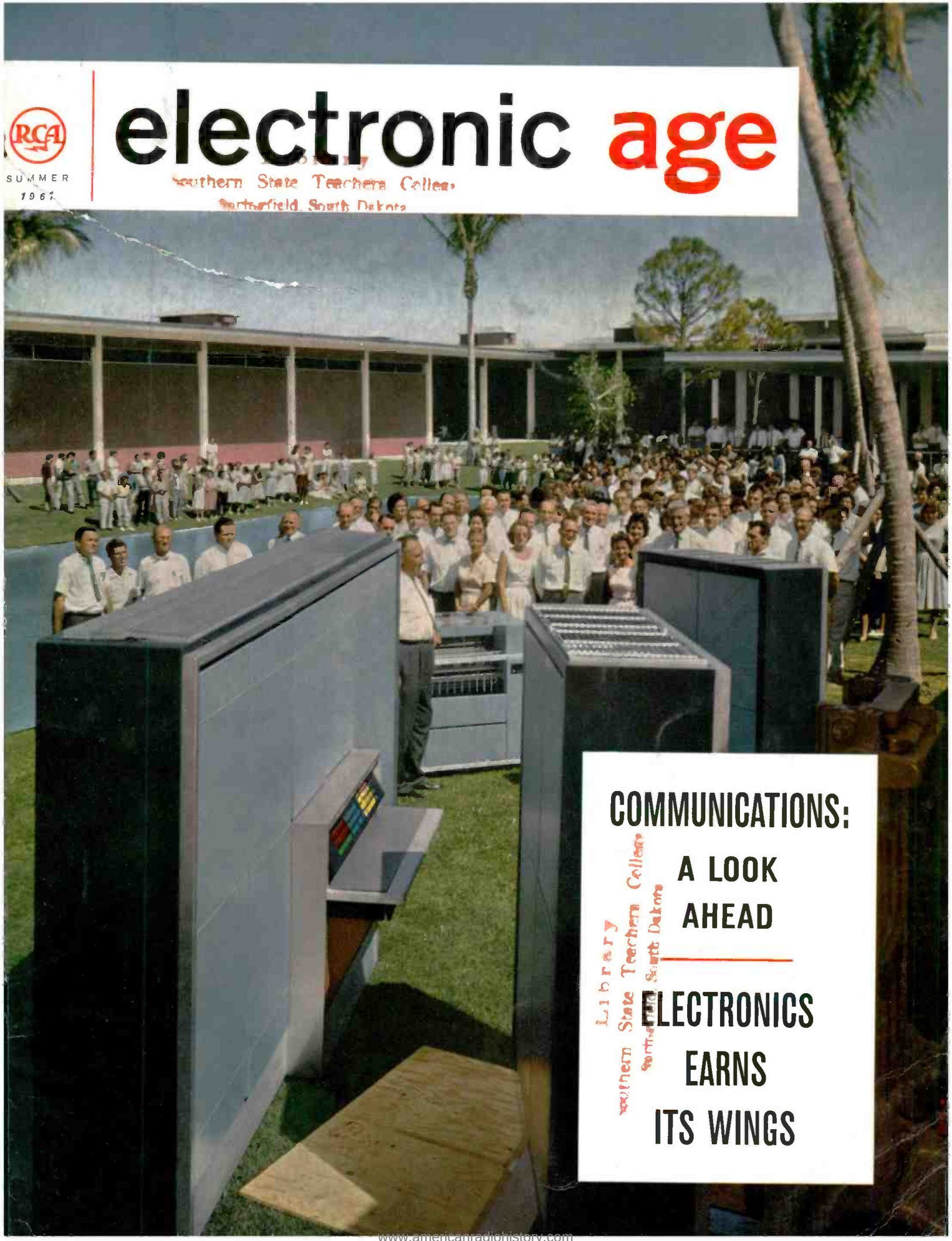


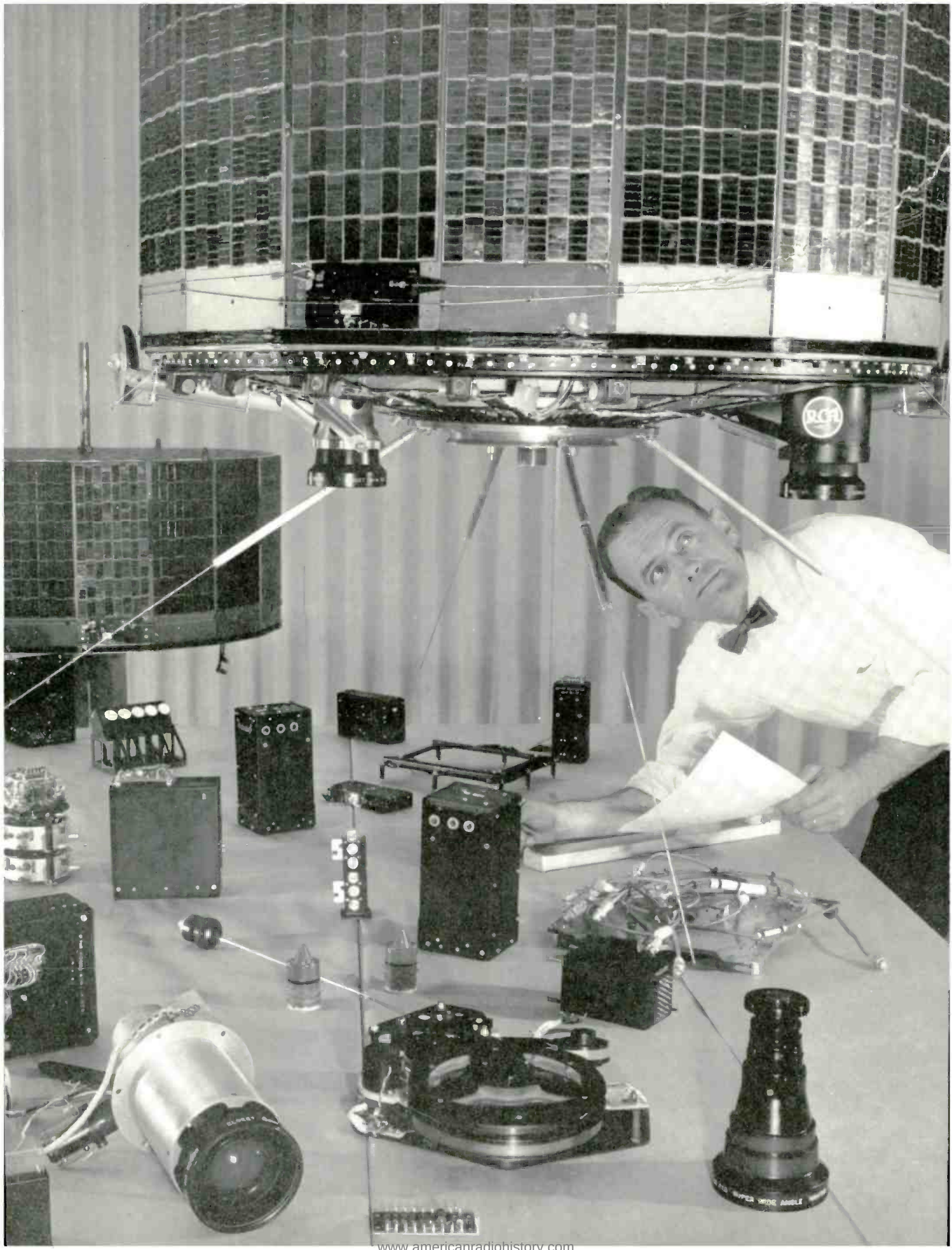
RCA

SUMMER
1961

electronic age

COMMUNICATIONS: A LOOK AHEAD

ELECTRONICS EARNS ITS WINGS



RCA electronic age

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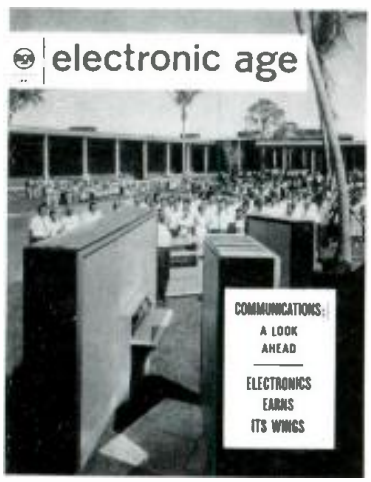


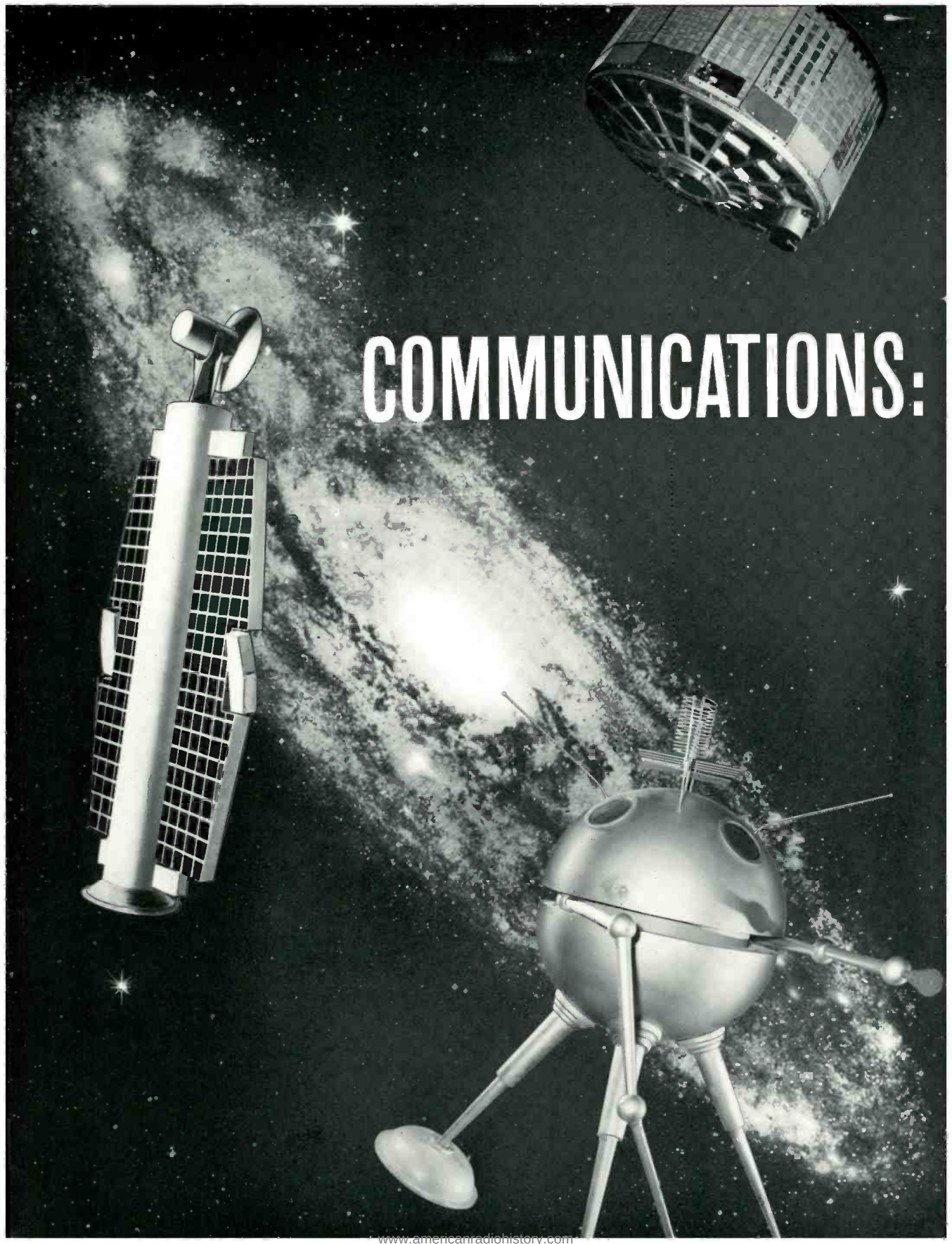
COVER: *Employees of RCA's new $4-million Electronic Data Processing Center at Palm Beach Gardens, Florida, watch the first RCA 301 system completed at the Center, loaded for shipment to the Chase Manhattan Bank in New York. Plant was dedicated May 25, nine months after the ground-breaking.*

In this issue . . .

Inspecting components of RCA's Tiros III weather satellite before July 12 launch.

RADIO CORPORATION OF AMERICA
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

DAVID SARNOFF, *Chairman of the Board*, JOHN L. BURNS, *President*,
FRANK M. FOLSOM, *Chairman, Executive Committee*,
JOHN Q. CANNON, *Secretary*, ERNEST B. GORIN, *Treasurer*



SATELLITES PROMISE
AN ABSORBING NEW PHASE
IN MAN'S AGELESS QUEST
TO IMPROVE HIS MEANS
OF COMMUNICATION

A Look Ahead

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

THE HISTORIC PROGRESS of communications across the formidable barriers of time and distance parallels man's advance on this planet. The first communications were sight and sound, man-to-man, over distances of only a few feet. Since then, our primary effort has been to *extend* that distance. We will achieve the *earth-bound* ultimate when we have direct man-to-man communications, both sight and sound, to any place on earth, regardless of distance. And we will achieve the *universal* ultimate when we have man — and possibly other species of life — exchanging communications over distances of millions of miles.

In its own way, every communications advance has moved us nearer these ultimates. The Greek, Roman and Aztec relay runners contributed to the stretch-out; and so did the shouting sentinels on Caesar's hattle towers, the homing pigeons used at Waterloo, the primitive semaphore employed by George Washington who placed a barrel, a flag and a basket on a mast and then issued orders to his troops by altering their relative positions.

In the present century, the great stretch has come though applications of radio communication. In its *first phase,* it enabled communication between a fixed point on land and ships at sea and between ships themselves, or between two land areas across the ocean barriers. Today, it is employed by all types of moving vehicles and between fixed stations and relay points on land. The *second phase* brought the human voice and instrumental music to millions of listeners through radio broadcasting. The *third phase* brought the stretch-out of sight, first through black-and-white television and now through color.

Vast progress has been made in the art of communications but there are many more promising prospects ahead. The sound of the human voice can be projected directly and almost instantaneously to any area of the world. We have extended sight, by television, so that the people of a nation, or a group of nations on the same continent, can see the same picture simultaneously. And we are on the threshold of projecting that picture between continents. In fact, we are very close to the achievement of global television as well as other forms of world-wide communications.

This will represent *phase four* of the radio communications story. I believe it will be realized in this decade through the use of relay satellites orbited in space. The challenges facing us in this area are no longer how; rather they are when, what types of hardware, what form of control, what character of international traffic?

Because of the complex and varied nature of the problems involved in satellite communications, there has been considerable confusion about the subject. So it is well to bear in mind certain fundamentals.

First, satellites will expand, broaden and speed up the services we have today and make them available to places and peoples that do not have them now. In the transmission of intelligence, a communications satellite is basically a *distance booster.* It is as if we picked up a microwave tower from the ground and hung it in the sky. This would increase enormously the range over which communications could be sent and received.

Second, satellites will not make anyone a Croesus overnight. I have heard suggestions that once a satellite system is in operation, international communications will become a one-hundred-billion-dollar-a-year business. To people whose estimates run along these lines, I would reiterate Andrew Jackson's famous order at the Battle of New Orleans: "Elevate them guns a little lower!"

The international communications business of all the American carriers today amounts to about one hundred-and-thirty-five-million-dollars-a-year. In the

Man's "long arms" reaching thousands of miles into space, top to bottom: Tiros weather-observation satellite; synchronous satellite for global communications; lunar exploration vehicle.

Seventies, with a satellite system in use, operating revenues may reach the one-billion-dollar-mark. This is a respectable amount but even if we double this figure, it would be ninety-eight per cent less than the fantastic figure of one hundred-billion-dollars-a-year.

Third, the much-debated question of satellite ownership is, in my opinion, far less important at this time than the adoption of the right system at the earliest possible moment. I believe that if we coordinate our knowledge and our skills, formulate a definite plan and concentrate on our objectives, we can be the first nation to establish and operate a global system of satellite communications. This would be a dramatic advance in the use of outer space for peaceful purposes. It would benefit all mankind and give an effective demonstration of American initiative, vigor and leadership.

In analyzing this subject, it seems to me that certain basic principles should be recognized.

Regardless of who, or how many, may own the satellites, there should be direct access to them by all present and future organizations licensed by our government to operate in the field of international communications.

The satellites should be available to all such organizations on reasonable and non-discriminatory terms for any services which the Federal Communications Commission authorizes them to provide now or in the future.

No restrictions should be imposed against such use, through contract or otherwise, by anyone who may own, control or operate the satellites.

Each licensed American organization should have the right to establish, own and operate its ground stations for transmitting and receiving signals via the satellites. The system, itself, should be designed to provide this capability.

RCA is deeply involved in this satellite development. We have proposed a concept of large capacity, synchronous — or stationary — satellites, positioned at two or three locations about 22,000 miles above the equator. Our scientists have developed specifications for the system which are within the present state of the electronics art. I believe our concept is capable of achievement in time to meet the communications demands that will overburden international submarine cable and radio circuit facilities later in the Sixties.

Other companies and agencies have come forward with other satellite concepts. Intensive research is now in progress at the Defense Department, at NASA, and in private industry. As one example, RCA is developing under contract from NASA, an experimental satellite for Project Relay which we hope will provide many of the answers we all seek.

To expedite the achievements possible in this area, we at RCA feel the time is ripe for the formation of a joint government-industry group to pursue an aggressive total effort in research and development. Through this collaborative effort, we can agree on the best satellite communications system. We can get it in operational orbit in the shortest time, and we can share with the world a remarkable technique for nation-to-nation seeing and talking.

It is most encouraging that the urgent character of this project is recognized at the highest level of our government. Recently, for example, according to press reports, President Kennedy ordered a top-level policy study into how a communications satellite system can be brought into operation at the earliest practicable moment.

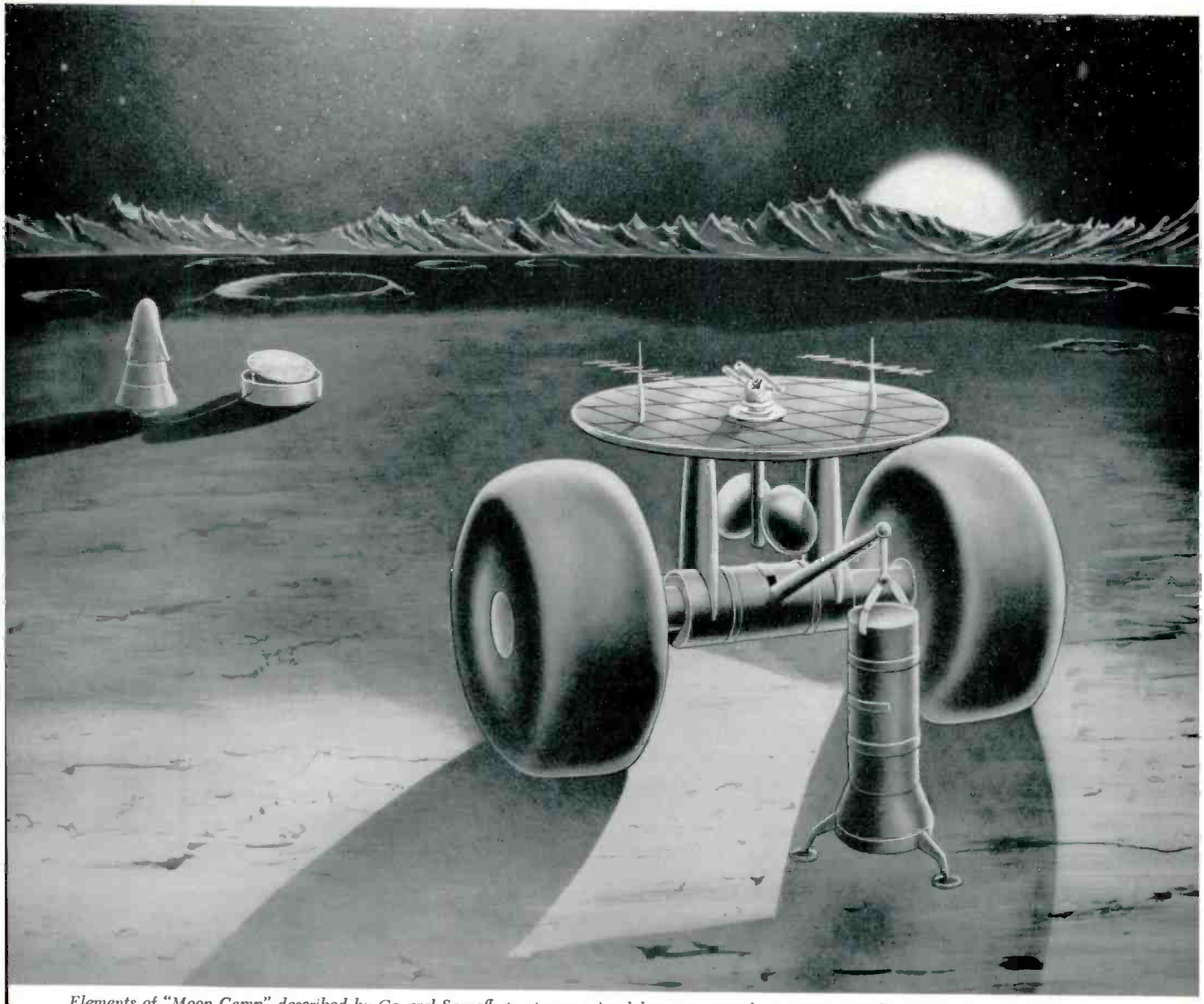
About three months ago, I suggested that the United Nations be given programming access to the first satellite television channel, so that it might project to the whole world a live picture of crucial deliberations in the Security Council and General Assembly. The favorable response to this proposal from many leaders of the Open World encourages me to urge it again.

Direct access to vital United Nations debates, it seems to me, should go a long way toward awakening those in the Closed World of Communism who have rarely been exposed to the free clash of ideas in any forum. True, the Communists can be expected to jam and black out these programs. But such conspicuous exclusion from proceedings open to the rest of mankind will generate pressures from their subjects which the Communist rulers will find it ever harder to ignore. At the least, it would dramatize an essential difference between free and enslaved societies.

As for the developing and neutralist nations, if, as we believe, the United Nations represents their best hope for establishing and maintaining their own independence, then their understanding of its aims — seen with the same impartial picture in Asia and Africa as in Europe and America — must be the best hope of the U.N. for assisting them effectively.

As we progress with the satellite project, I believe we will also move ahead with *phases five and six* of our communications blueprint. *Phase five* will be directed to communications with the moon and beyond. Here, we will be concerned initially with communications as a control and intelligence mechanism. This function will be crucial to the successful placing of men on the moon and, ultimately, on distant planets.

The proposed manned Moon Shot, which President Kennedy set as a national goal, has prompted the scientists of RCA's Astro-Electronics Division, along with others, to develop comprehensive exploratory



Elements of "Moon Camp" described by General Sarnoff: tractor carrying laboratory capsule; re-entry capsule and power unit at left.

plans. Our concept envisages the establishment of a well-stocked Camp on the moon before the first man arrives there. The moon camp would include food, water, power, laboratory equipment, an exploration vehicle, appropriate emergency survival tools and a re-entry capsule for the manned return trip to the earth.

A combination of a Saturn rocket and ground control devices, should make it possible to put on the moon's surface a roving vehicle and to conduct a survey for the most appropriate area for a manned landing. This would be based on such factors as terrain, illumination, temperature and other environmental characteristics. Then, through a series of subsequent Saturn shots, the camp could be established by sending up the necessary equipment and supplies, including a moon-crawling tractor for assembly purposes. This entire operation could be checked out by instrumentation controlled from the ground before we commit men to lunar flight.

The success of this plan would prepare the way for exploration of the nearest planets. It would estab-

lish a pattern for the construction of other advance bases. In addition, validation of the techniques for storing fuel and re-fueling vehicles on the moon would lay an effective foundation for use of the moon itself as a launching platform for spacecraft.

It is also conceivable that exploration on the surface of the moon would establish the practicability of installing there the first interplanetary radio relay station, controlled from the earth and capable of providing vital communications and navigational links for space vehicles as they move toward distant planets.

We face, of course, many unknowns – such as the nature of the lunar surface, the extent of radiation hazards from solar flares, and the effect of the lunar environment on materials. It can be generally stated, however, that the communications and controls problems in this concept fall within our present capabilities.

With our sound and sight satellites in orbit around the earth and with electronic channels opened to the planets, we will have extended enormously the communications stretch-out that started with the first man-to-man talk.

Our principal job in *phase six* of the communications blueprint, will be to come full circle and permit direct man-to-man sight-and-sound communications over the ultimate in distances.

The speed with which we accomplish this will depend, in part, upon the speed with which we can shrink electronic gear. This is another great challenge facing electronics today: make it smaller!

Through formidable advances in micro-modules, we are achieving new diminutives daily. We can now foresee a computer so compact that it will have a density equivalent to one hundred-million active elements per cubic foot – a density approaching the compactness of the human brain itself. And this computer, indeed, will perform many functions of the brain.

Our Advanced Design Center has put together the type of communications unit that will probably be the reporter's best friend in the Seventies. It is a pocket-size color TV set, with combination AM-FM radio. The date of its availability depends upon the time required to learn how to reduce further the size of certain components.

This prototype model is a symbol of our reach for the diminutive. I believe we will someday see transmitter-receiver units a half or third the size of this. Each receiver will have a decoding unit, responsive to only one of a million or more arrangements of pulses sent out from a transmitter. With complete privacy, a Foreign Editor in his office will one day be able to see and talk with a foreign correspondent in an airplane over Tokyo, in a boat on the Red Sea, or in a tractor at the moon camp. While this might make the home office seem uncomfortably close to the reporter, it will nevertheless bring us pretty close to the ultimate in news coverage, and to the ultimate in man-to-man communications itself.

The price for achieving the communications advances I have outlined will come high – in dollars, in planning, and in work.

We have the scientific manpower and know-how to meet and to surpass any Russian challenge in this area. But something else must accompany it: a firm national resolve to do whatever must be done to assure our success.

We must, for one thing, understand and properly evaluate the objectives of the potential enemy. Years before any Western nation, the Kremlin accurately assessed the psychological and propaganda values of space probes. The Communists recognized that breakthroughs in technology, a field of traditional American primacy, would have direct political impact in terms of fresh prestige for them; that it would advance their objectives in the Cold War they ceaselessly wage, and that it would cause an erosion of morale among the Western allies.

In Moscow, missiles and satellites were woven into the broad tapestry of party dialectics. In Washington, they were evaluated exclusively in the context of their scientific or military significance.

The result, from the psychological and propaganda standpoint, was that the Communists seized the priceless advantage of the initiative. They acted; we reacted. They were first with Sputnik, first with a moon probe, first with a man in space.

In communications, we possess the initiative and the leadership today – from automation to satellites. Yet, this should give us no cause for complacency. "The minute you get satisfied with what you've got," Boss Kettering once said, "the concrete has begun to set in your head." In terms of our nation's leadership posture before the world and our national policy of advancing the cause of peace everywhere, there is too much at stake here to permit any concrete to infiltrate our communications arteries.

It is my conviction that America can continue to lead in this vital field, that we can be the first to achieve practical world-wide satellite communications and that we can complete the cycle by which man will communicate with man, directly, wherever he may be. I also believe that by the time this is accomplished, it will be possible to achieve automatic translation of languages so that when we speak to each other we will *understand* each other. And that, after all, is the goal not only of our Science of Communications, but of humanity itself. ■

ELECTRONICS EARNS ITS WINGS

DURING WORLD WAR II, IT WAS CONSIDERED A SUPPORTING ELEMENT FOR AIR FORCE OPERATIONS; NOW IT IS A FUNDAMENTAL PART OF EVERY AEROSPACE VENTURE

By GENERAL CURTIS E. LeMAY,
Chief of Staff
United States Air Force

THE YEARS SINCE WORLD WAR II have been a period of dramatic advances in all phases of our national existence.

During these past 16 years, advances in military technology alone have totally eclipsed all of the progress made in the previous 6,000 years of history.

Nowhere has progress been so evident and impressive as in the military aerospace activities of our own — and other nations' — defense forces.

Recent improvements in aerospace weapons have resulted in an unprecedented increase in the speed and firepower of modern weapons and in a corresponding reduction in the time and distance which once gave us some measure of protection from surprise attack. The result is a drastic reduction in the time available to mobilize our resources to fight a war if it should ever become necessary.

One common denominator of all of these causes

With a blast of power, U.S. Air Force Titan missile leaves the pad at Cape Canaveral.

General Curtis E. LeMay, Chief of Staff, U.S. Air Force, record-setting pilot and former head of the Strategic Air Command.

and of their far reaching effects has been the remarkable progress in the science of electronics.

Today's Air Force could not perform its mission were it not for the vital capabilities provided in all phases of aerospace activity by electronics. During World War II, electronics was considered a supporting element of our operations; now it is a fundamental part of almost every aspect of Air Force operations.

Electronic devices provide warning of attack; they provide instantaneous communication; they aim guns, drop bombs, navigate aircraft, guide missiles, track satellites, compute logistic needs and perform thousands of other tasks vital to the accomplishment of the Air Force mission.

As a result of the great steps in this area of scientific activity, electronic systems are now an indispensable ingredient of modern air strategy and tactics.

The effectiveness of our offensive forces — the Strategic Air Command and the tactical forces worldwide — depends upon reliable communications and electronic systems. These not only directly affect the operational capability of the weapon systems themselves, but are equally important to support systems.

For example, inflight refueling operations, a vital part of our overall capability, depend upon electronic systems to insure the rendezvous of tanker aircraft with fighters and bombers in all parts of the world. Modern combat aircraft are also to a great extent dependent on electronic equipment for the successful performance of their offensive missions. In addition, electronic systems are the basis of timely and effective command and control of our world-wide forces — an element which provides the flexibility required to meet today's assigned tasks.

Modern aerospace defense, another key element in our deterrent to aggression, is built on a foundation of electronics — for warning, for control of the air battle and in active defense systems.

It is in the area of aerospace defense that the Air Force has its heaviest investment in electronics.

Since the organization of NORAD in the post-World War II era, the system of communications developed for the support of this complex organization has become the largest single user network in the world. The Air Force provides this command with over a thousand major items of radar equipment. Moreover, NORAD's SAGE system is the biggest single electronic project that man has ever undertaken.

With this tremendous growth and reliance on electronics in modern warfare, it was inevitable that devices would be developed to reduce the effectiveness of an enemy's combat efforts by ferreting out and

Vital part of Air Force aerospace defense network, Ballistic Missile Early Warning System depends on electronics to do its job.

These radar-guided, air-to-air Falcon missiles symbolize the Air Force's increasing reliance on the capabilities of electronics.

analyzing enemy electromagnetic emissions and by creating false or disruptive electronic signals to confuse or neutralize enemy systems. This new member of the family – electronic countermeasures – was firmly established by the end of World War II and has continued to grow in scope and importance ever since.

Closely related to this branch of electronic warfare has been the increasing use of electronics in intelligence gathering activities – a vital segment of our national security.

In the future, even more demanding uses for electronic technology will be found in military aerospace activities. The advent of intercontinental ballistic missiles has already placed heavy requirements on electronics for effective control and monitoring of these systems in the ready state at locations dispersed over hundreds of miles of territory.

This equipment assures first, that the weapon is ready to go; secondly, that it cannot be prematurely launched, and finally, that launch is positively accomplished should the need arise. The increasingly complex equipment needed to satisfy these and many other equally vital requirements makes the need for the highest degree of reliability self-evident.

The impact of modern electronics is constantly being reflected in the organization of the Air Force.

As a case in point, until recently Air Force electronics matters – both developmental and operational – were handled by relatively small support sections in the various operating units and at command headquarters. In recognition of our heavy reliance on electronics, a major subcommand known as the Air Force Command Control and Development Division was created a few years ago under what was then the Air Research and Development Command. At the same time, a companion organization, the Electronic Systems Center, was established in the Air Materiel Command. Both of these organizations were located at Hanscom Field, Massachusetts.

With the recent redesignation of the Air Research and Development Command as the Air Force Systems Command and the Air Materiel Command as the Air Force Logistics Command, the units located at Hanscom have now been combined into a single organization known as the Electronic Systems Division. This new reorganization, following closely on the heels of the previous one, strengthens Air Force management of electronic systems development. Here is substantial evidence of the increasingly important part this field of science is playing in aerospace operations.

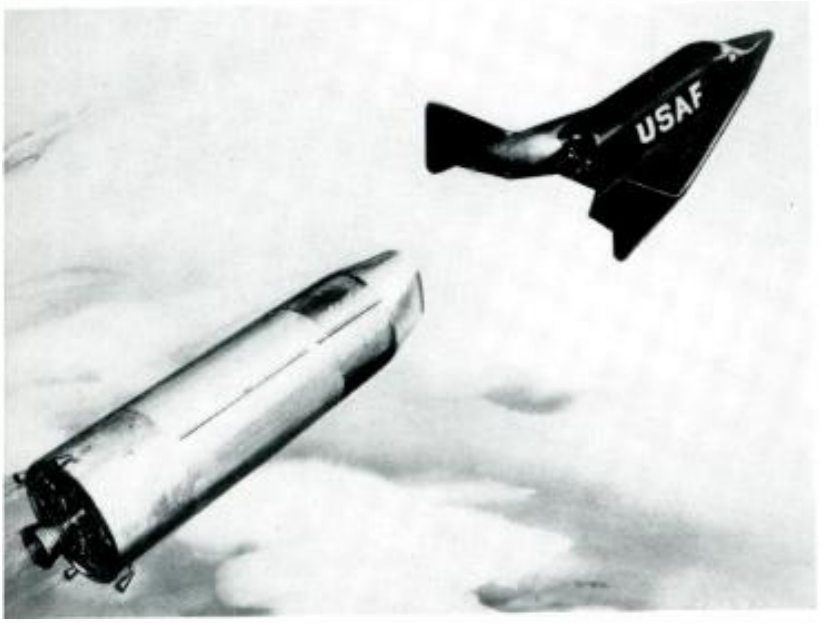
Further evidence of the status of electronics in Air Force operational activities was the activation on July

Radarscopes and information boards keep check on widespread forces, one of many ways electronics serves support systems.

l of the Air Force Communications Service. This organization is responsible for the operation of all but certain very-specialized types of Air Force communications into a single organization responsible directly to the Chief of Staff. From its headquarters at Scott Air Force Base, Illinois, AFCS provides a more efficient system at considerable savings in manpower and dollars. It enhances the Air Force's ability to function as a member of the over-all Defense Communications System, which is under the operational control of the new Defense Communications Agency.

The wonders of new weapon systems and the impact of technology upon the Air Force are in the spotlight, but it is the people who man the Air Force today who determine success or failure. Without high caliber personnel to command, operate and maintain our complicated systems, there can be little or no capability to perform assigned missions. This is particularly true in the field of electronics.

Twenty years ago, 5 to 10 per cent of the authorized strength of Air Force units consisted of electronic technicians. Today, similar units may have as many as 50 per cent of their personnel qualified in electronic specialties. By way of statistics, in 1950, a squadron of



Project DynaSoar will put a piloted glider in near-orbital flight.

F-94 interceptors – one of the most advanced at that time – included fifty-seven electronics personnel – 24 per cent of the squadron strength of 237. By comparison, an F-102 squadron today has assigned 148 electronics technicians which represents 40 per cent of the squadron strength.

Moreover, new units almost entirely composed of electronics personnel have been created to cope with growing electronics requirements. Communications Wings, Control and Warning Groups, and the recently formed Aerospace Surveillance Squadron are examples of this type of organization.

The ever-increasing reliance on electronics has had a decided influence on the Air Force training programs. Keeping pace within the various training courses has become a problem of substantial proportions. To meet the growing demand, training courses for some electronic specialties are being conducted on an around-the-clock basis. Last year, the Air Training Command graduated over 30,000 electronic specialists. This number promises to increase each year.

Future USAF electronics requirements appear practically unlimited. Even today, a major and growing portion of our effort is devoted to space operations.

The Air Force already has embarked on the task of detecting, tracking, cataloging and controlling space vehicles with ground based electronic systems. The airborne effort is equally substantial since the objective of current satellite programs is to put a payload into orbit which in all cases consists of at least 90 per cent electronic equipment. Satellites, plus manned space vehicles require a global electronic environment for tracking, for transmitting and receiving data, and for correlating all data through a computer-equipped, world-wide data processing system.

Future space programs will place even heavier demands upon electronic development.

The space goals already established, and the new ones yet to be conceived, will require ground systems as well as electronic payloads with an ever-expanding spectrum of capability. The extraterrestrial environment in which space systems must operate presents a multitude of new problems.

It is necessary to think in terms of, and to plan for, orders of reliability and accuracy never before achieved. Communications-electronics systems now operate reliably between terminals that may be separated by distances of hundreds or thousands of miles, but tomorrow the Air Force will require the capability to control systems over ranges of hundreds of thousands – and perhaps even millions – of miles.

Today, our powerful aerospace forces possess equipment and facilities whose capabilities and responsiveness are unparalleled in history. Electronic systems are the nerve system through which they are operated and controlled.

In this era of dynamic technology we must constantly move ahead, exploiting new electronic developments with imagination and urgency.

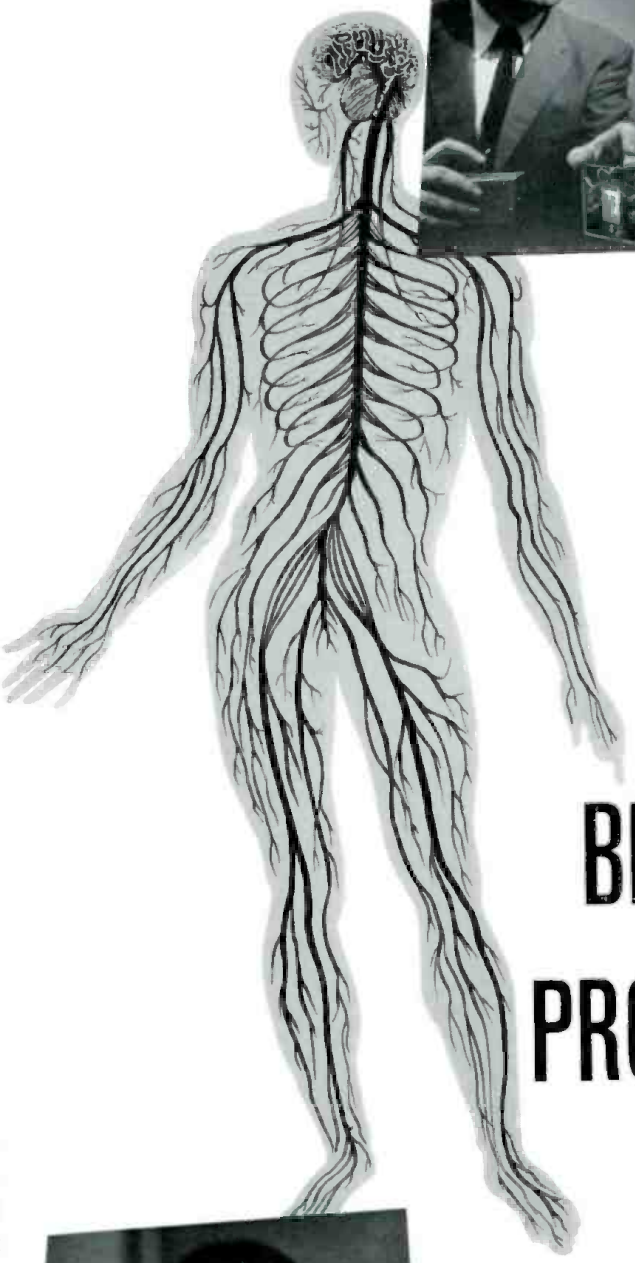
The security of this nation depends upon the vigor and initiative which mark the search for advanced electronic systems. ■

Air Force B-52 intercontinental jet bomber flies over operational Atlas missile site at Vandenberg Air Force Base in California

THE BRIGHT PROMISE OF BIONICS

By KENYON KILBON

Image recognition device may be forerunner of electronic counterpart of the eye.



BY 1975, THE CHIEF U.S. WEATHER FORECASTER, the Idlewild air traffic controller, the United Nations translation service, and the chess champion of the world may have one basic trait in common. There is an excellent chance that they will all be machines.

This prediction is rooted firmly in the new ground that is being cultivated by today's research. The trend now is toward a new generation of electronic systems that will be smart, perceptive, and able to learn. Through successive stages, they will develop ultimately into a true breed of robots combining mechanical muscle with artificial intelligence, taught by the individuals whom they will serve.

The direction signs that point to this revolutionary future are being posted now in laboratories across the nation and abroad. Much of the effort lies in the newly-christened field of *Bionics* – the study of living systems found in nature for clues that can be helpful in developing machines that can "see" and "hear," and then interpret what they perceive.

In a recent address at the California Institute of Technology, President John L. Burns of the Radio Corporation of America pointed to bionics as a prime example of the increasing collaborative effort in science which "holds more promise for human benefit than any temporal force at work in our civilization today." Applied to bionics this collaboration involves chemistry, physics, mathematics, biology, and electronics in a pooling of existing and new knowledge that is needed to create the vastly more competent machines of tomorrow.

From this growing program of bionics research comes impressive evidence that nature has neatly solved many problems not unlike those that must be overcome in creating tomorrow's machines. The combination of eye and brain, for example, is an amazingly effective mechanism for selecting instantly the information that is wanted from a visible scene, a printed page, or a photograph. The nerve network in most living creatures is a marvel of logical organization for handling different kinds of information arriving from different sources. The neuron, building block of the nervous system, is a basic circuit element of astonishing excellence.

Nature has combined these attributes in a vast array of perceptive, analytic, defensive, and decision-making systems, packaged neatly and in bewildering variety. For example, bats, owls, spiders and porpoises all carry ingenious variations of sonar-like apparatus for steering, communicating, and locating prey. Rattlesnakes possess an infrared heat detector of un-

Models aid development of new mathematical techniques for organizing bionic systems.

Intelligent machines and robot servants are ultimate goal

in new research programs combining biology and electronics

matched sensitivity for seeking prey at night. Pigeons and certain migrating birds have small mechanisms that enable them to navigate unerringly over long distances. The eyes and mind of the frog are combined in a simple and effective system that screens out all details except those that are needed to catch an insect on the wing or to escape an enemy.

Throughout nature, these special-purpose mechanisms are combined with nerve networks that can adapt to new situations as they arise, and continue to operate even if some of their elements are damaged. To scientists looking ahead to the kind of machines that are needed tomorrow, this type of performance is just what the doctor ordered.

Traffic problems in the air and on the ground, for example, are reaching a crisis stage around most major airports and on the highway approaches to the nation's big cities.

Weather satellites in orbit, adding cloud pictures and heat measurements to the rising tide of data coming in from ground stations, threaten to submerge human forecasters beneath more information than they can handle in time to make useful predictions – even with the help of present-day computers.

Commercial and industrial operations are growing swiftly in scope and complexity, gripping many human managers in a three-way squeeze generated by the demand for more comprehensive knowledge, by the need for swifter decisions, and by the rising cost of mistakes in judgment.

The kind of lesson that electronic science is now trying to learn – partly from nature – can provide machines to relieve such mounting pressures as these.

At a major airport, for instance, an electronic system that uses some of the principles found in the frog's eye-and-brain mechanism could watch patterns on a radar screen, detect the departure of any plane from its prescribed course, and flash instructions to the automatic pilot to correct the situation. Similar principles could provide a vehicle traffic controller that would watch a central display board in a highway control center and decide instantly on alternate routes and traffic light patterns to keep cars moving in and out of town.

For the harassed weather forecaster, the business executive, or the defense planner reckoning with the possibility of massive attack by missiles, salvation may ultimately lie in bionic systems of even greater versatility. The machines would absorb data from many sources in many forms – still or moving pictures, radar images, printed words and figures, spoken instructions, and coded electrical signals. They would filter all irrelevant information from the mass of data and concentrate only on the key facts. Through circuits that might be organized in a semblance of living nerve networks, they would process the essential information and match it with past experience and data stored in the machine memory. The final output, produced with lightning speed, could also take many forms – combining sound, images, printed information, or control signals in various ways to provide decisions or suggest alternative courses of action.

In physical makeup, these systems will differ substantially from today's marvelous but comparatively mindless electronic computers and data processing systems. They will have to have special-purpose sensing devices that function in the manner of eyes and ears. Their internal circuits will have to provide for vastly greater numbers of functions than do today's systems. This, in turn, will call for tiny circuit elements that can be cheaply mass-produced in arrays and linked in such a way that the failure of some will not cause failure of the system itself. These elements will, in fact, be crude electronic counterparts of the infinitesimal neuron – the standard and intricate nerve cell which nature employs by the billions in the human nervous system and the brain.

In the quest for these systems, science is mounting an assault from at least three principal directions.

Biological researchers are seeking the essential clues in nature, to determine just how and why living mechanisms and systems function as they do.

Chemists, physicists, and electrical engineers are compounding new materials and creating versatile new devices that can endow electronic machines with abilities that are comparable to those of the living systems.

Mathematicians and systems analysts are exploring intricate byways in search of logical patterns for organizing the new machines. They are guided extensively by the growing knowledge of ways in which the living mind and senses are organized to perceive, learn, and remember.

Bats have a sonar-like ability to steer and to locate prey.

The work goes on in many forms and in many places. A recent symposium on bionics at the Air Force Wright Air Development Division, Dayton, Ohio, attracted more than 700 scientists and engineers to hear technical discussions of projects under way in 25 government, university, institute, and industry laboratories. The subjects ranged from the properties of the neuron to self-programming techniques for computers of the future.

Much of the bionics research effort represents a combination of old and new for the electronics industry itself. A typical example is the program at RCA's David Sarnoff Research Center in Princeton, N. J., where new lines of research have been encouraged by the growing interest in bionics, and new emphasis has been given at the same time to studies that were under way before the term was invented.

In the laboratory, for example, are rudimentary image recognition devices that can distinguish one shape from another, ignore the unchanging parts of an image in order to concentrate on the parts that move, and, in effect, interpret what they see. The ultimate objective is an electronic counterpart of the living eye, able to read print, pictures or radar images and select the essential information for the machine that it serves.

The lowly frog is a silent partner in one key phase of the work. Knowledge of the frog's optical system, gathered by researchers at the Massachusetts Institute of Technology, is being applied by the RCA scientists to electronic techniques than can do a similar job of filtering out everything but the minimum information that the machine needs — just as the frog's system does. Other clues from biology have been combined by RCA specialists with their extensive background in developing light amplifier panels that alter the brightness and other properties of images.

Just as imaging devices may soon provide "eyes" for artificially intelligent machines, other research at RCA is leading toward "ears" that will enable them to understand spoken instructions. The principles are being tested in a phonetic typewriter than takes dictation spoken into a microphone, analyzing the sounds and comparing them to patterns stored in its memory in a manner that compares generally to the functioning of the human ear and brain. From the standpoint of the new bionics program, the importance of the experimental voice typewriter lies in its successful use of voice-control and sound analysis principles that can ultimately be applied to many key operations. Along this path for the future are machines that can be instructed verbally to perform jobs that range from computing to production-line assembly, and systems that translate from one language to another through a memory of foreign equivalents of English terms.

Progress toward the advanced bionic systems of tomorrow is geared largely to the speed with which electronic science can develop tiny active circuit elements that can be mass-produced cheaply for use in lavish quantities, and packed together in densities of millions per cubic inch. As the scientists see it, the electronic networks that can perceive, learn, and organize their own operations will have to use hundreds of millions or even billions of such elements, just as nature uses tremendous numbers of neurons to perform similar jobs in living systems.

A little over ten years ago, when electronics was still tied to the vacuum tube as the basic circuit device, the late Dr. John von Neumann, famed Princeton mathematician, gave a graphic description of the problem. He pointed out that an electronic computer rivaling the human brain would need the entire power output of Niagara Falls to operate all of its tubes, and the circuits would generate so much heat that all of the water passing over Niagara Falls would be needed to cool the system.

Since then, the swift advance of transistors and other solid-state circuit devices has given bionics a strong boost by providing a striking inventory of new materials and ultraminiature elements that cut down size, power consumption, and heat dissipation by as much as a thousand times. There is still some distance to go, but long steps are being taken today in the nation's laboratories.

RCA scientists, for example, are applying new materials and techniques to a variety of experimental elements whose sizes, according to one of the researchers, "range downward from that of a gnat's eyebrow." Among the recent laboratory achievements of potential importance to the future systems are tiny superconducting memory cells that may ultimately be packed with a density of one billion bits per cubic foot and will require only the power that is needed to send pulses of information into the array for storage and recall.

Other RCA specialists have made important advances in the development of integrated circuits, combining the functions of several components into single microscopic structures that include active and passive circuit elements and the connections between them. A computer logic element made in this fashion con-

sists of a single piece of silicon small enough to slip through the eye of a needle. Even more important than the minute size, however, is the prospect of using the same principles for a universal device that might conceivably serve for all of the myriad switching functions in an advanced system, in the way that the neuron is believed to serve as a standard switching device in living networks.

Major interest also has been generated by recent RCA laboratory success in making extremely small transistors by an evaporation process in which the active material and metal contacts are deposited successively in thin films on an insulating base. The devices can be made so small that 20,000 would fit on an area no larger than a postage stamp, while a book page would hold all that are needed to perform the complete logic circuit functions built into the largest computers now in use. The importance of the development, however, is less in the size than in the process. In the evaporation technique, the materials are vaporized by heat and collected by condensation to form thin films, much as water condenses on a plate held over a boiling kettle. Used commercially today only for such devices as television pickup tube surfaces and certain passive circuit elements, the process now seems destined to provide a means of low-cost mass production of hundreds or thousands of transistors at a time in ready-made circuits.

As the material and device specialists push closer to the goal of tiny standardized elements to handle complex logic and memory functions in tomorrow's bionic machines, intensive work continues on the key problem of organizing the networks in which the elements will eventually be used. A prime goal at RCA and elsewhere is a "self-organizing" system – meaning one that will decide for itself just how to tackle the problems that are handed to it, and will improve its performance as it goes along. Today, considerable time, ingenuity, and effort are spent by human operators to prepare detailed instructions to guide present-day computers and data processing systems.

The principle of self-organization is already being applied in a rudimentary way. An example is the overseas radio service of RCA Communications, Inc. Alternate routings are used over the Atlantic, to permit automatic switching from one to another whenever one of the paths is hindered or blocked by natural interference. The system does the job of selecting the route in accordance with the atmospheric conditions. No one can tell at any given time which path the system will choose to follow.

Organizing the bionic systems of tomorrow to program their own operation will involve a similar principle, but with immensely greater complication. The task for researchers today is largely one of applying advanced mathematical theory – including the invention of some new mathematical techniques.

With the proper kind of organization, according to researchers, tomorrow's systems will have a number of interesting properties. One will be learning ability, so that the internal organization of the machine will adjust itself through trial and error to the pattern best suited to handle particular kinds of problems. The odd but logical result will be machines that finally perform jobs for which their makers did not know exactly how to design them at the start.

The scope and diversity of bionics research today means that the results are likely to emerge in a series of rapid but modest advances rather than in one fell swoop. For example, the first fruits probably will be improvements in the organization and programming of present-day types of electronic computers, and the introduction of the first effective image recognition and voice-control techniques to feed the machines. The next stage, evolving through the coming decade, will bring radical change in machine organization and circuitry to create the first genuinely self-organizing systems of the new generation.

In the view of electronic experts, the bionic machines and synthetically intelligent systems of tomorrow will be developed in endlessly varied forms to match the tasks that will be assigned to them. The experts feel that the systems can multiply the power of the human brain just as the mechanical inventions of the Industrial Revolution have multiplied the power of human muscles. While the special-purpose bionic machines will perform highly useful but limited tasks in the manner of the robots of science fiction, the more complex systems will add a new dimension to human abilities.

An ultimate goal, in fact, is an individual "information filter," envisioned by some scientists as an electronic machine that would be taught by one person to select, process and present only that which is of interest to him from the flood of information that pours upon him from all sources.

When this day arrives, as one RCA scientist has commented, "we may find ourselves with an opportunity to develop a new and essential talent – we can teach the machines to be smart, and give ourselves a chance to concentrate a bit more on being wise." ■

The frog's eyes and mind screen out all unnecessary information.

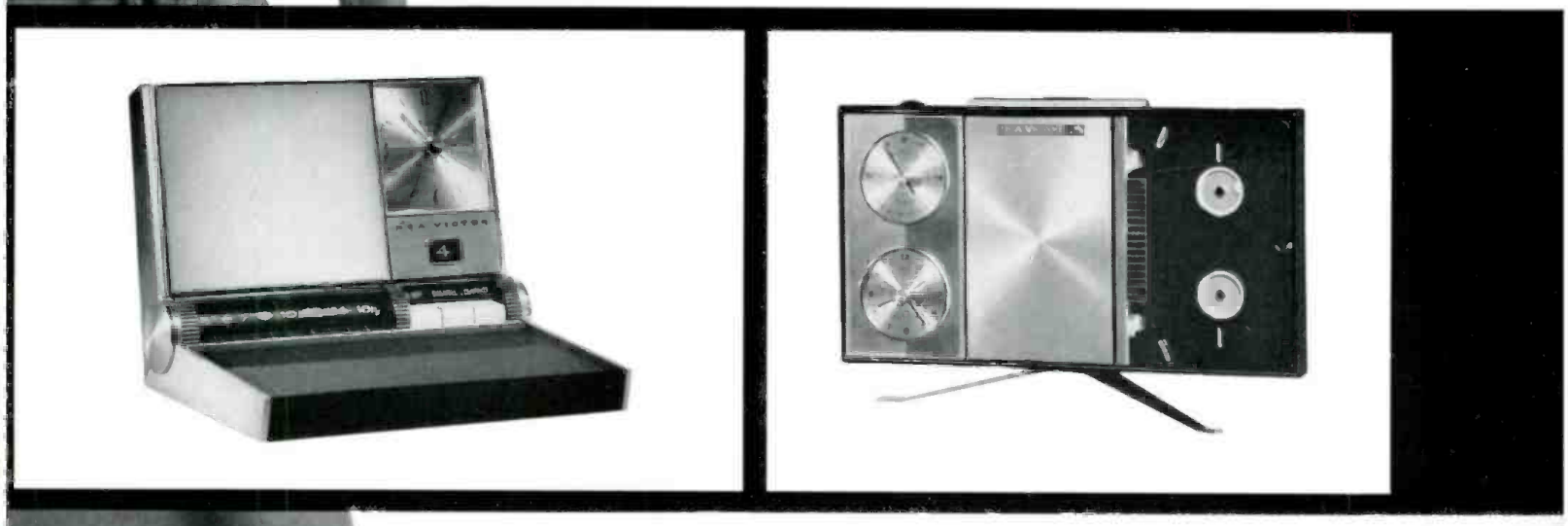
RCA'S ADVANCED DESIGN CENTER recently unveiled projections of television, radio and other consumer electronic instruments of the 1970's. The sets will be smaller, thinner, more functional and completely compatible with the home of the Seventies.

The large set on this page is a slim console combining color television, stereo radio and a video tape player. Shown in the panel from left to right:

A flip-over console with a large-screen color television set capable of reproducing signals bounced from satellites and, on the other side of the three-inch panel, an international stereo radio.

A home communications system which will allow the housewife to watch her children at play, observe visitors at the front door or watch a regular television show – all in color.

A TV-stereo radio unit with a clock-timer, compressed into book-size in a hinged travel case.

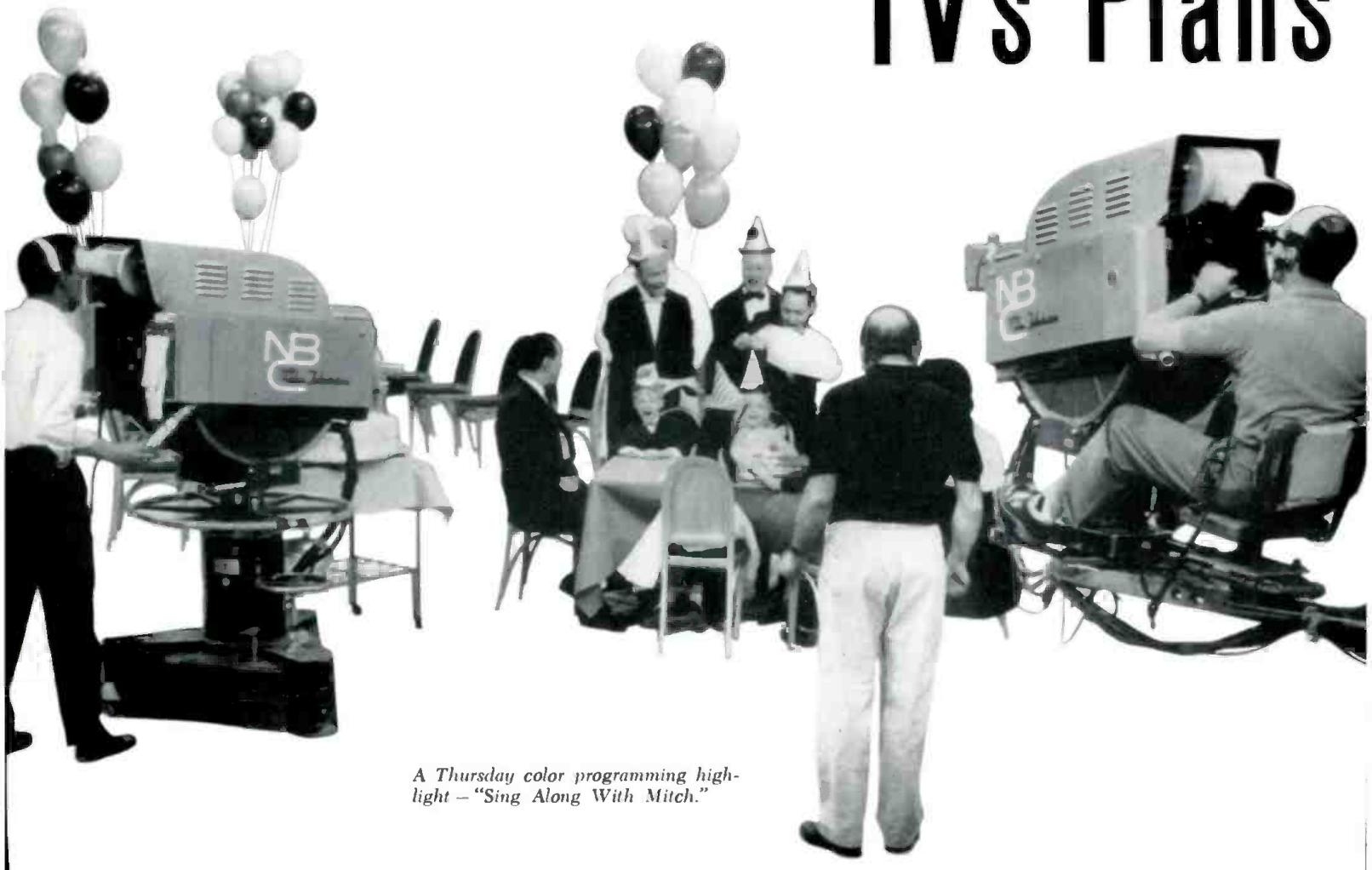


A "24-hour Secretary" that permits a businessman to dictate or give instructions to his secretary while he is away from his office and then have the taped information sent to her by radio at a pre-set time.

The Design Center was established by RCA President John L. Burns a year ago this month for the purpose of "radical experimentation with advanced styling concepts which can eventually be incorporated into the whole range of home instruments." A companion Advanced Engineering Center was set up at the same time to work on technical developments. ■

Varied schedule includes comedy, children's programs, news and musicals: (below l. to r.) Bob Newhart, "King Leonardo," Ray Scherer and (opposite) Disney's "Dances of Italy."

TV's Plans



A Thursday color programming highlight – "Sing Along With Mitch."

MORE COLOR, MORE NEWS SPECIALS AND GREATER DEPTH WILL BRING FRESH DIMENSIONS TO NBC'S FALL PROGRAMMING

By CHARLES GREGG

For The New Season

As NBC GETS SET for next Fall's TV season, it is eying the mark of the "best-balanced" TV network for 1961-62. Diversity, quality, color and an array of programs new not only in stars and titles, but in broadcasting format as well, will be the hallmark of a bold approach to programming.

New programs will dominate the schedule, with only twelve series returning in the Sunday-through-Saturday, 7:30-to-10:30 p.m. prime time spots, and just five broadcasts occupying the same day and time periods as last season.

Salient facts behind NBC-TV's new appearance for the Fall season include:

Better than 1,600 hours of color broadcasts during the calendar year of 1961, an increase of 60 per cent over 1960.

More than twenty-two weekly hours of news and information programs, an increase of 17 per cent over last season. Also, forty planned news specials on a one-a-week basis, over and above "instant" news specials, more special broadcasts of all types than the combined total of both other networks.

Balanced, diversified programs for each night of the week, ranging through the best of drama and adventure, comedy and situation comedy, news and public affairs, music and musical variety, and special features. Never more than five weekly entertainment programs of similar category.

Twelve weekly programs, of varying types, dedicated to children's enlightenment and entertainment. More children's programming than ever before in network TV history.

As the only television network with daily, regularly-scheduled color broadcasts, NBC-TV's jump to 1,600 hours of color in 1961 (an increase of 2,350 per cent over the sixty-eight hours broadcast in 1954, color's first year) embraces color programming for every morning, afternoon and evening of the week.

Donald Duck's Uncle Ludwig debuts this Fall.

New programs in color will include "Walt Disney's Wondeful World of Color," "Bullwinkle," and Fred Coe-produced adaptations of David O. Selznick motion picture classics, all Sunday night presentations; "The Bob Newhart Show" and "David Brinkley's Journal," both on Wednesday nights; a new children's entry, "Pip, the Piper," on Saturday mornings, and more than half of the full-length motion pictures to be presented on "Saturday Night at the Movies."

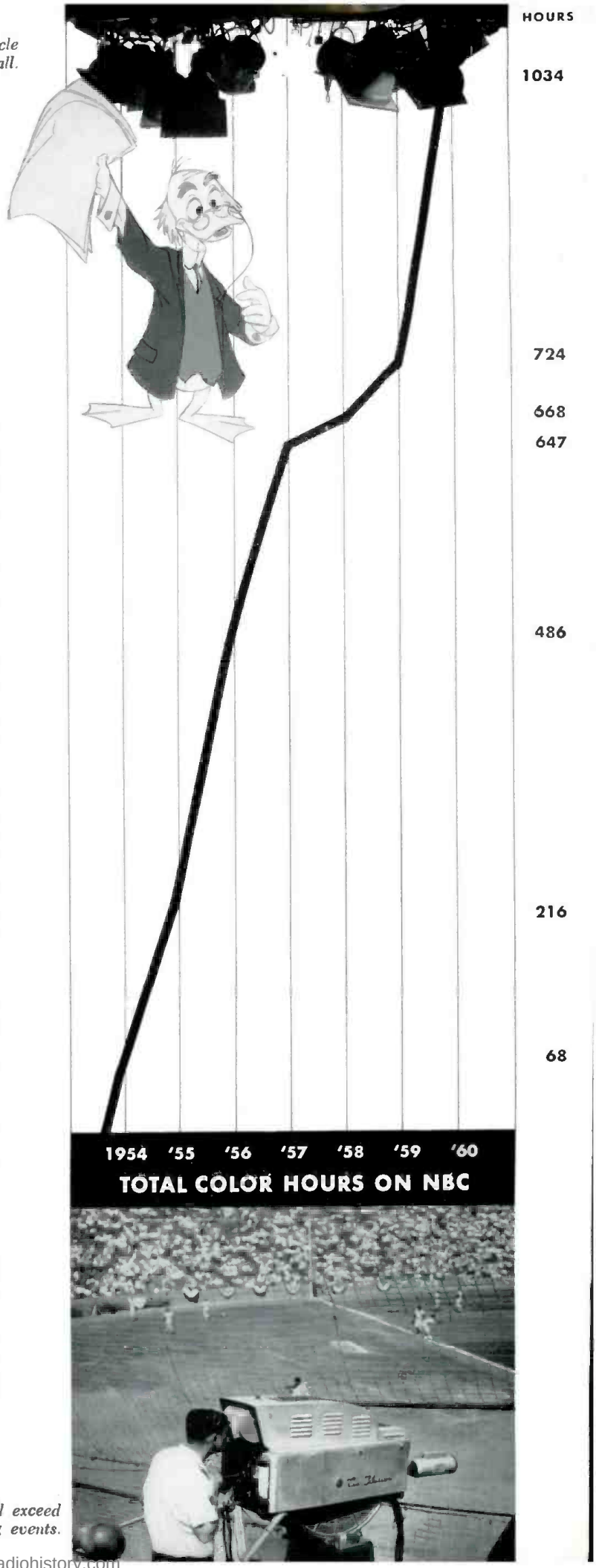
Originating in color for NBC-TV's new season will be the Tuesday and Saturday night full-hours, respectively, of "Laramie" and "Tales of Wells Fargo." Remaining as color broadcasts will be "Bonanza" and "Meet The Press" on Sunday; "The Price Is Right" on Monday; Wednesday's "Perry Como's Kraft Music Hall"; "Sing Along With Mitch" each Thursday, and "Bell Telephone Hour" and "The Dinah Shore Show," alternating on Fridays. Also returning in color: "The Jack Paar Show" Monday through Friday; daily dawn sessions of "Continental Classroom;" five daytime programs; sports and specials.

Illustrating the network's perennial leadership in the field of special broadcasts, NBC's Fall schedule will include such critically acclaimed presentations as "Hallmark Hall of Fame," "Project 20" and other NBC Special Projects events; the NBC Opera Company; "Bell Telephone Hour" and many others.

NBC-TV's continued growth and undisputed television leadership in informational programs, will have a 1961-62 lineup of such returning shows as "NBC White Paper" and "The Nation's Future" under the aegis of Irving Gitlin; "America's Music" and "Wisdom" under Donald B. Hyatt; religious programs on Sunday afternoon; the award-winning "Huntley-Brinkley Report" programs of news commentary; "Chet Huntley Reporting," and Special Projects.

Two new programs of prime time news commentary also are on the Fall schedule. "David Brinkley's Journal" will present a new concept of television news. The half-hour in color will feature television's popular newsman in programs of wry commentary somewhat in the style of the late Will Rogers. "Frank McGee's Here and Now" on Friday nights will emphasize the effect of news on people living through the events as well as pinpoint the front-page happenings.

Perhaps one of the more significant facets of NBC's new look for 1961-62 is the heavy increase in programs of quality to enlighten and enthrall children in all age brackets. The network's almost doubled schedule of children's broadcasts includes a series of Saturday morning children's news broadcasts and Sunday evening children's public affairs programs that not only are new to NBC-TV's informational programming schedule but are totally new in television concept.



Present indications are that NBC's 1961 color programming will exceed 1600 hours including baseball and other championship sporting events.

The informational programs and the new color shows will round out the schedule of old favorites such as: "Watch Mr. Wizard," with science instruction that children can grasp; a five-program lineup on Saturday morning including "The Shari Lewis Show," "King Leonardo" and "Fury," and "National Velvet" on Monday evenings. A new standard of entertainment programming each day of the week will be five-minute broadcasts of "Burr Tillstrom's Kukla and Ollie" (with occasional visits from Fran).

As part of its emphasis on quality and greater depth, NBC-TV will present twenty-one full-hour entertainment series and nine half-hours. This is a turnaround from last season's twelve hour-long programs and twenty-three half-hours. The added time will lend better story construction and character development to the entertainment programs.

Diversification — entertainment running from special features to time-tested dramas — all with an emphasis on family-type programming, will round out the new Fall concept.

Thirty Sunday night "Du Pont Show of the Week" hours, many in color, will range from dramatic actualities to Special Projects treatments of subjects such as America's love affair with the automobile. Also in the Du Pont series will be entertainment programs ranging from the songs of Harold Arlen to the work of the United Service Organizations, and historical-entertainment presentations of "America's Music."

Programmed for the entire family will be "Walt Disney's Wonderful World of Color," the new series of Sunday night hours extending from nature stories to animated cartoons, from tales of adventure to famous classics and musical extravaganzas. A major new cartoon character, Ludwig Von Drake, has been created especially for television to act as star and narrator of the new series. Ludwig will kick off the season with an animated history of color to set the mood for the programs to follow. "Donald in Mathmagic Land," an exploration of the world of mathematics; "The Hunting Instinct," "Kids Is Kids" and "Carnival Time" will be among the cartoon originals on the series. Also to be presented will be such classics as "The Prince and the Pauper" in three parts and "Hans Brinker and the Silver Skates" in two parts, both color-filmed in Europe.

Dramas in series on NBC-TV will be in the tradition of top-scripted programs with top-name hosts. "Thriller," with Boris Karloff, moves to a new Monday time period with stories of the occult. "The Dick Powell Show" on Tuesday nights will present the biggest guest star lineup of any TV drama series; and "Alfred Hitchcock Presents," one of TV's longest-on-the-air programs is back with tales of suspense.

The new Thursday night hospital drama series, "Dr. Kildare" (based on the motion pictures with Lionel Barrymore and Lew Ayres), will concentrate on authenticity of plot, setting and character development rather than violence — as will the network's three new police-mystery series, "87th Precinct" (based on the novels of Ed McBain), "Cain's Hundred" and "Robert Taylor's Detectives."

New comedians and new types of comedy will be presented Wednesday nights on "The Joey Bishop Show" and "The Bob Newhart Show." Also, on Sunday nights, Nat Hiken's "Car 54, Where Are You?" will mark the first satirical situation comedy on TV since the "Sergeant Bilko" show.

"International Showtime" on Friday evenings will have great family appeal in presenting taped-in-Europe circus, carnival, magic and skating events. This series, featuring Don Ameche as host, represents a new approach to television programming.

Still another unusual feature for the 1961-62 season on NBC-TV will be the network's series of full-length, infrequently-interrupted motion picture features, many in color, on "Saturday Night at the Movies." Such seldom-seen-on-TV stars as Marilyn Monroe, Danny Kaye, Ava Gardner, Gregory Peck, Lauren Bacall, Gary Cooper, and Clark Gable will appear in the first-run showings.

"Hans Brinker," a classic to be presented by Walt Disney.

NBC-TV weekend viewers will be treated to sports broadcasts, mostly in color, of more world championship events (in five sports) than on any other network.

Spicing on NBC's 1961-62 programming cake remains "Today," with its early morning, two-hour diet of news, information, enlightenment and entertainment, and the late night hilarity and mass appeal of "The Jack Parr Show." ■

Dial "O" For Outer

By ROBERT L. MOORA

ONE MORNING LAST MAY, a breathless nation watched a Redstone missile standing alone on a Cape Canaveral firing pad, a giant needle pointing to the skies. Eyes were focused on the Mercury capsule which formed a small bulge at the tip of the missile and hearts quickened for its passenger, seemingly the world's loneliest man at that moment.

But Commander Alan B. Shepard, Jr., and astronauts who follow are far from alone. They are watched over by a communications system described as the most scientifically advanced in the world. It is a system set up to support Project Mercury, the continuing program of the National Aeronautics and Space Administration (NASA) to loft man into space.

The system is composed of a network of sixteen tracking stations around the world, with the control center at Cape Canaveral and a data computing center at Goddard Space Flight Center, Beltsville, Md.

Through the combined efforts of all of them, continuous communication is possible between the Mercury control center at the Cape and the astronaut, with a constant flow of flight data fed back to the entire control staff.

As subcontractor to Pan American World Airways in the management of the instrumentation and communications throughout the Atlantic Missile Range, the RCA Service Company set up a separate installation for Project Mercury. Their network, manned by 3200 men, is tied into the global network and involves the handling of the Mercury Control Center at the Cape and communications down range.

During the first Mercury shot, the RCA group at the Grand Bahama Auxiliary Air Force Base had "the best track ever seen on any missile launch," according to Eugene Wilford, instrumentations manager at the tracking station. "The RCA crew went in early on their own hook to check out radar equipment and they wouldn't go home," he continued. "The men on the radar team caught catnaps on cots during their 32-hour duty to make certain the radar would function accurately."

Mercury-Redstone III boosted America's first man into space.

Space

THE PROJECT MERCURY SUPPORT TEAM RIDES WITH THE NATION'S FIRST ASTRONAUTS AS ELECTRONICS PLAYS A KEY ROLE IN MAN'S BREAKTHROUGH TO OUTER SPACE

On the day of the shot, the big radar picked up the rocket from 40 seconds after launch and tracked accurately throughout the trip, pinpointing the landing spot within six feet in the Atlantic Ocean.

This is how the world-wide network of tracking stations, of which the Grand Bahama group is a part, shapes up:

Two stations operated by RCA for regular instrumentation and tracking on the Atlantic Missile Range are located on Grand Bahama and Grand Turk islands in the Caribbean. An additional Atlantic Missile Range tracking site and control center is partially staffed by RCA personnel in Bermuda.

Beyond Bermuda, in mid-Atlantic, is a large picket ship. Ten RCA technicians aboard the vessel maintain and operate equipment which includes telemetry antennas capable of receiving signals from the capsule, single-sideband radio to maintain communications with the rest of the network, and a voice link with the capsule passenger himself.

Then, in succession, there are tracking stations with varying equipment at the following locations: Grand Canary Island, off the west coast of Africa; Kano, in Nigeria; Zanzibar, off the east coast of Africa; then another ship in the Indian Ocean; two Australian locations at Muchea and Woomera; Canton Island, in the South Pacific; Kauai, in Hawaii; Point Arguello, California; Guaymas, Mexico; White Sands, New Mexico; Corpus Christi, Texas; Eglin Air Force Base, Florida and Goddard, outside of Washington, D.C.

All of these stations except Goddard are equipped either to track the flight or to receive telemetry data sent back from instruments inside the capsule.

Six of the stations have the ability to control the flight of the capsule. However, the decisions to control the vehicle – to continue its flight, to abort in the event of faulty operation, to put it in orbit and to bring it back through the atmosphere – are entrusted only to the NASA flight controllers in the control center at Canaveral and to the astronaut.

Data from all of the stations are transmitted by standard channels of communications – radio, land line and submarine cable – already translated into computer language for digestion by the Goddard Center. From Goddard, the data from this entire world-wide network are flashed to the Canaveral center to be fed into the operations room by the RCA crew.

The Canaveral control center is located in a building that resembles a concrete warehouse, about halfway up the sandy spit that constitutes the Cape. Beside the building is a towering 60-foot telemetry antenna to receive signals from the transducers in the capsule. The prototype of this antenna was designed by Harvard University for astronomy study and was so sensitive it could pick up one watt of power from a distance of 5,000,000 miles.

Inside the building is a maze of electronic equipment such as has never before been put together, reaching out to bases all over the world – and into space.

This building – barred to the public, and even to the press except for rare inspection visits – is a fascinating structure. The operations room is approximately 100 feet long and 75 feet wide. Along one of the walls is a map of the world, 40 feet long, with

Far-ranging electronics system feeds data to Cape Canaveral.

brightly lighted circles representing the tracking stations. Most of them are green. A yellow circle denotes a station in marginal operational status; a red circle denotes one not in operation. All must be green, or operative, before a mission can be authorized.

To the left of the map is a large board which constantly reports the electro-cardiogram of the man in the capsule, his heart beat, his respiration, his pulse, his temperature. This is vital particularly to the flight surgeon who can at any time request that the flight be aborted if he thinks that the astronaut is encountering physical difficulties.

On a similar board to the right is information about the environment within the capsule – pressure, temperature, oxygen, and other factors. All this information is piped into the various displays in the operations room from the complex of instrumentation systems elsewhere in the building by RCA personnel.

Seated in the operations room are some fifteen men, each with an important duty to perform in control of the flight. These participants are seated at three tiers of consoles facing the map.

In the first row sit five operation controllers. One is an RCA official, James P. Sharkey who is the support control coordinator – the supervisor of the operation of the control center's electronic equipment and the RCA personnel in the center. Next to him is the flight surgeon. Then, there is the capsule environment monitor, a man charged with observing the conditions within the capsule. Beside him is the capsule communicator, one of the astronauts. He is in direct contact with his fellow astronaut hurtling through space.

This voice contact is monitored and controlled constantly by another RCA engineer, Charles A. Davidson, at a console in an adjoining room. He checks several different radio channels between the ground and the capsule and feeds the best signal to the astronaut in the operations room. He is the "switchboard operator" in man's "phone calls" into outer space.

Davidson also is in touch with the two downrange stations. He monitors the signals to choose the best, thus assuring the clearest possible conversation between the capsule communicator and the man in space.

Next to the capsule communicator is the capsule systems monitor who receives constant data on how the complex equipment in the capsule is behaving.

Above this first row sit four other controllers. One is a Navy officer, the recovery status monitor, who checks constantly the status of the arrangements for recovery of the capsule. He must keep in mind the location of Navy ships, planes and helicopters for the moment when the capsule will be brought back through the atmosphere and returned to earth.

In the center of the row is the flight director, Christopher Kraft, a NASA veteran, who directs the operation on the basis of the information shown on the map, on the panels to left and right and on his own console.

Beside Mr. Kraft is the network status monitor – Captain H. E. Clements, USAF – who monitors the status of each station's tracking operation to check whether the radar, telemetry and other systems are operating properly. Then there is a man monitoring the booster telemetry, checking the reliability of the data coming back from the booster vehicle.

Finally, in the top row of control officers, are three men – Walter C. Williams, Associate Director of Project Mercury for NASA, flanked by high-ranking Navy and Air Force officers. With the military officers as his advisers, Mr. Williams has final say on the control measures of the man-in-space mission.

Decisions are based on the complex information which is transmitted back from the capsule and from the tracking stations. The information shows up first on a console monitored by a crew of RCA technicians headed by William W. Saunders III. When the capsule is within radio range of the center, the most important data shown on this console is flashed instantly to the operations room. Data from distant stations is received and displayed within minutes.

Likewise, electronic instruments record the various stages of the flight itself – the separation of the capsule from the booster rocket . . . the firing of the retro-rockets to slow the capsule down . . . the release of the two parachutes to reduce the speed even further . . . and finally the gentle set-down of the capsule and its passenger on the ocean's surface.

From the beginning of the countdown all the way to completion of the mission, the data flowing through the RCA-operated center instrumentation complex is monitored by a man whose judgment is vital to the success of the entire operation.

He is Robert Walker, in charge of data selection control for RCA. He receives information through various acquisition methods – radar, telemetry, the guidance system and the impact predictor.

It is up to Walker to select what he considers the most accurate and reliable information flowing through the system to pass on to the room next door where decisions are made on the flight.

Upon completion of a flight, much of the vast volume of data is taken to a special data analysis room where, in four to six hours, tape playbacks are prepared for analysis by NASA officials and the various contractors involved with the booster and the capsule – and by the astronauts who will venture into space in the future. ■

Whether they are called *discos*, *disques* or *schallplatten*, they spell big business from Buenos Aires to Berlin.

By HAROLD QUEEN

To the Radio Corporation of America's International Division warehouse at Clark, New Jersey, recently came an urgent cable from Brazil. A missionary at the remote headwaters of the Amazon had run out of needles for his records – the heavy one-sided pressings that had long since gone the way of the crank and phonograph horn. No vendor in the country had a supply. Would RCA find same and ship? RCA did find and ship needles enough for the jungle missionary to listen to at least 1,000 playings from his vintage collection.

The request, while unusual, was not unique to a company manufacturing and distributing records around the globe for more than thirty years. Whatever the age of the disc or revolution of the turntable, recorded music enjoys a popularity throughout the

world as phenomenal as in the United States, and equal today in the volume of sales. One result of its truly universal appeal is the rapidly growing internationalization of the record business.

Thirty-one foreign record manufacturers, including RCA associated companies, currently play a part in RCA's international operations in the distribution of RCA Victor records throughout fifty countries. They do a thriving business in the RCA Victor classical and popular repertory, and frequently reap an even greater return from the recordings of local artists and orchestras which also bear an RCA trademark.

Outside the United States, recordings run the gamut of speeds and methods of playback. Although stereo is taking hold in Western Europe and high fidelity monaural records are as commonplace as in America, in many areas of the world the old 78 rpm still reigns supreme. Vast regions of South and Central America and the Near and Far East scarcely know the use of electricity. Phonographs are still the ancient hand-wound machines, even to the petunia-shaped horn. For many foreign record makers the customer frequently is a dweller in a nomad tent, a jungle or mountain fastness or a remote unvisited isle.

Moreover, while music is international, musical tastes frequently are not. Although most of the top tunes in American listings are equally successful in many overseas markets, demand is tremendous for records sung in the native language. Popular artists run into heavy local competition. In Mexico, Brazil or Argentina, for example, 80 per cent of the records bearing the RCA Victor label are of purely local origin, or a variant of an American version. Few rock-and-rollers in this country would recognize the title of a ditty currently the rage in Buenos Aires: "*Bikini Amarillo a Lunares Diminuto Justo.*" Allowing for Latin flourishes, however, they instantly would spot the opening bars as "Itsy-Bitsy, Teeney-Weeny, Yellow Polka Dot Bikini."

To play it safe though, foreign record producers often produce from the original American tape as well as the local version.

Another reason for the surge of local recordings is the speed with which a record may become a hit. In Europe, at least, the pace of popularity frequently rivals that of the United States. Disc jockeys on Radio Luxembourg, the continent's most popular commercial station, possess the same king-making qualities as their American counterparts. Safely beyond the three-mile territorial waters of Denmark and Sweden, seagoing platter-twirlers aboard floating "pirate" radio stations exercise a comparable mesmerizing effect upon their land-based listeners. The frequent result is that a record played the night before may produce a rush to dealers' shelves the following day. If the original American recording is not on hand, local companies will quickly stake out their own version.

These reasons account in large part for the growing emphasis by American record makers on overseas sources of manufacture. In the process, they have quickened the tempo of the business in ways that sometimes are startling to their foreign colleagues. As an RCA Victor executive describes it: "The day we get a phone call reporting a hit overseas, we ship a tape aboard a plane. The following day it goes into production at our associate's plant. Within a week it is in the dealer's store."

Despite the appeal of local talents, the response to American musicianship is tremendous. Japan, with the highest percentage of classical record purchasers in the world, pays awed reverence to such RCA Victor immortals as Toscanini, Rubinstein, Heifetz and Horowitz. Van Cliburn's piano concertos enjoy global authority. Mario Lanza is immensely popular in Africa. Great Britain and other English-speaking countries are boom markets for every type of American recording – classics to Western. The most expensive album ever issued in England, RCA Victor's "South Pacific," held top position on the best-seller list for a year and a half – 650,000 albums sold. Perry Como and Harry Belafonte are international best-sellers.

So is Elvis Presley. Exchange students smuggle Presley discs into Russia to meet the avid Muscovite demand. Rumors from Hong Kong have it that the records are finding their way into Red China as well. Presley's overseas sales on a record seldom dip below the million mark. "Now or Never" topped 3,500,000. By way of comparison, a record is considered a "hit" in the United States when it hurdles the 600,000 mark.

One young American singer, Neil Sedaka, is even more popular overseas than in the United States. A recording of his, "Oh Carol," sold 2,000,000 copies overseas, against 750,000 domestically. When his name first appeared on the listing, it aroused a flurry of national fervor in Japan. The feeling was that Sedaka couldn't be anything but Nipponese, or at least Nisei. The local manufacturer immediately cabled for full biographical data. Despite the natural disappointment at discovering the singer's Spanish extraction, the manufacturer nevertheless did an impressive job of promoting Sedaka's recordings.

Despite American overtones to the foreign record business, much of it continues at a pace reminiscent of the United States of earlier years. The self-service racks which flourish in suburban supermarkets and drug stores are rarities in countries where discs are sold mainly though record and radio-television stores. The newest electronic techniques, however, are speed-

"Pictures at an Exhibition," was made in France from an RCA master disc both in hi-fi and stereo which is now taking hold in Europe.

Sung in German and recorded in Vienna, record of highlights from the operetta "Countess Maritza" is a "Schlager" (hit) in Germany.

Native language records such as folk songs released by the Victor Co. of Japan, Ltd. are in as great demand as American favorites.

RCA has manufactured and distributed records around the globe for thirty years in association with such companies as RCA Espanola, S.A.

"New World Symphony" is available to Brazilians through one of RCA's many associates throughout the world – RCA Victor Radio, S.A.

Rumba in Rome? – Music as an international language is expressed by this Perez Prado recording released by RCA Italiana S.p.A.

ing up the listening and selection process. Numbers of foreign record stores today have counters equipped with individual earphones where as many as fifteen persons may line up for personalized record auditions.

As viewed in this country, the overseas market for records has barely been scratched. For a while, say RCA Victor officials, the foreign public is absorbed in the purchase of automobiles, refrigerators, TV receivers and the like. But ultimately it returns to a first love – recorded music. "Television may hurt us about a year and a half after it comes into a country," one executive notes. "But then people start buying records again. They even buy more because of something they have seen performed on the air."

While taking advantage of overseas opportunities, RCA Victor is equally alert to the vast market for foreign recordings within the United States. Records produced by RCA's company in Mexico, for example, are scoring heavily in this country, especially among the Spanish-speaking population. RCA Victor people constantly scan the artists and repertoire of overseas manufacturers for possible Stateside hits. One current hit recording is the musical score from the much-publicized Italian film, *"La Dolce Vita."* By an ironic twist, some foreign recordings are now competing in the United States with the original American version. A case in point is Elvis Presley's half-English-and-half-German rendition of an old Austrian folk song, "Wooden Hearts." Taken from a long-play Presley collection, the song was put on a single record by RCA Victor and sold more than 1,000,000 copies internationally. Then two German singers recorded local versions which are now being heard in the United States.

With the appointment of Dario Soria as Division Vice President of the recently created International Liaison Department, RCA Victor is underscoring its determination to internationalize completely its record operations. Dario Soria brings long experience, both here and abroad, in the field of recording. He has been responsible for introducing and establishing top European artists and repertory in this country and for setting new artistic standards in record packaging and presentation.

Today, when RCA Victor produces a record, it does so with its eyes fixed, not on the United States alone but on the entire world. As George Marek, Vice President and General Manager of the RCA Victor Record Division puts it: "We are convinced that in the '60's our world-wide record business will grow in size, vigor and health."

The record industry has given 20th Century meaning to Longfellow's 19th Century observation that "music is the universal language of mankind." ■

THE FASCINATING BUSINESS OF RADIO-TV NEWS GATHERING

VETERAN COMMENTATOR EXAMINES DIFFICULT AND DEMANDING ASSIGNMENT OF REPORTING WORLD DEVELOPMENTS IN A TIME OF CRISIS

By CHET HUNTLEY

THE HEART OF OUR NEWS GATHERING ORGANIZATION is the NBC Central News Desk in New York. It is manned twenty-four hours of every day of the year. Through a battery of telephones, as well as short-wave radio equipment, the editor maintains contact with NBC News bureaus around the world, with reporters at every affiliated station along the NBC radio and television networks, with special NBC representatives at foreign locations, and with the several hundred motion picture cameramen servicing NBC News

The central news desk in New York City is manned twenty-four hours every day of the year, maintaining contact with NBC News bureaus around the world.

throughout the United States and overseas. This is a sudden business we are in, a constant race with the clock; so the man in the slot must often exercise split-second judgment, sizing up the news potential in the bare bones of a wire-service bulletin, or in the first smattering of information in a telephone call . . . and then moving reporters and cameramen and mobile units to the scene of the action.

It happened one New Year's morning at 5 a.m., for example. Fortunately, the editor and his staff were among the few people in the nation without hangovers. Our man in Havana called in the news – before anyone else – that Batista had suddenly fled Cuba and that Castro had seized power. Not long afterwards, Castro's triumphal entry into Havana – atop a tank – was carried *live* on NBC television. The American people watched an event that was to change their lives . . . while it was in progress.

NBC NEWS IN BRIEF

- *A total of 613 executives, correspondents, producers and cameramen based in 75 countries.*
- *Eight and one-half hours a week of scheduled TV news. More than 17 hours a week of radio news.*
- *An average of 10 news specials a month.*
- *Forty hours of television news and information programs – in prime evening periods – will be added to the 1961-62 TV schedule.*

Among those who covered Cuba while Castro tightened his grip were Wilson and Lee Hall. They faithfully reported the island's descent into Communist control until, at last, they were forced to leave. The Halls have recently taken charge of NBC News' expanding coverage in Latin America, and have established a main bureau in Rio de Janeiro. Another major bureau is in operation in Buenos Aires. And, today, NBC News is represented in every major city in Central and South America. The recent events in Cuba and the Dominican Republic and the conclusions reached by Ambassador Adlai Stevenson on his Latin American tour (which was covered in detail by NBC News) demonstrate that NBC's concentration on the Southern Hemisphere is an important step forward.

The older bureaus remain active. John Rich has for the past several years been covering West Berlin, a chronic trouble spot and a listening post deep within Communist East Germany. He has now become bureau chief in Paris. Last winter, he was on special assignment in the Congo.

Right now, our man in Leopoldville is George Clay, an old African hand, who spends part of his time getting the news and the other part getting it out. It is no small task to ship a roll of news-film to New York from a country where the airline schedules change as quickly as the politics. Earlier, Clay was based in Portuguese Angola. He did such an outstanding job reporting the bloody riots there that the Portuguese government expelled him.

NBC News feels confident of reporting the news directly from almost any place in the world . . . with one notable exception: the massive area of land which is Communist China. American newsmen are barred from China . . . but the significant news filters through the Bamboo Curtain, brought out by refugees and spies. NBC News correspondent James Robinson maintains a permanent listening post in Hong Kong . . . a few miles from the border of Communist China, which is as close as we can get.

Coverage of the Far East is the responsibility of Cecil Brown's NBC News bureau in Tokyo. But with Japan quiet for the moment, Brown has been devoting most of his staff's attention to Southeast Asia particularly Viet Nam and Laos. In Laos, NBC News cameraman Grant Wolfkill successfully coped with a shooting war and erratic airline schedules. He was so canny about both problems that for some time his outstanding combat films were arriving in New York forty-eight hours before anyone else's. To illustrate the hazards of this business, I must report that Wolfkill, at this writing, is listed as missing and is believed held prisoner by the Communist Pathet Lao.

We are, at NBC News, in a constant battle with time and distance. Radio reporting has become instantaneous, in most cases; television reporting is rapidly catching up. We are, every day, trying to break through the time barrier. For, we are at our best, I feel, when we can bring an event to the American people while it is happening. We have been able to see, from our living rooms, Nikita Khrushchev posturing discourteously before the General Assembly of the United Nations . . . and we have learned, first-hand, some disturbing facts about this man who is, perhaps, our greatest adversary. And television has allowed us to participate in the processes of the democratic system: the conventions, the great debates, the Congressional committee hearings. Through television, the leaders of our nation can speak directly to the people in time of crisis and decision . . . live.

Working closely with engineers of the British Broadcasting Corporation and NBC, we have been sending motion pictures from London to New York through the trans-Atlantic cable. The cable-film moves much more slowly than a telephone call, but much more swiftly than the fastest jet airplane. This has enabled NBC News to lead in its field by bringing

Roy Neal, NBC correspondent who reported the nation's first astronaut shot, examines Mercury capsule. Martin Agronsky, in Israel, provided a daily commentary on the Adolf Eichmann trial highlights.

James Robinson maintains a permanent listening post in Hong Kong, a few miles from the Communist China border. (Below) NBC's veteran reporter John Rich, formerly in Berlin, is now bureau chief in Paris.

European events into American living rooms . . . a few short hours after they took place.

An extensive use of television tape allows us to present the details of such events as the trial of Adolf Eichmann in Israel. Tapes of the proceedings arrive daily in New York by plane. And from Jerusalem, NBC's Martin Agronsky adds analysis and interpretation of this awful page in human history, via RCA radio circuits from the scene of the trial.

The story of the first American astronaut was televised live by NBC News . . . and this in itself was a marvelous achievement. There were cameras at the launching pad and down-range . . . and NBC correspondent Roy Neal reported significant details of this story while it was in progress.

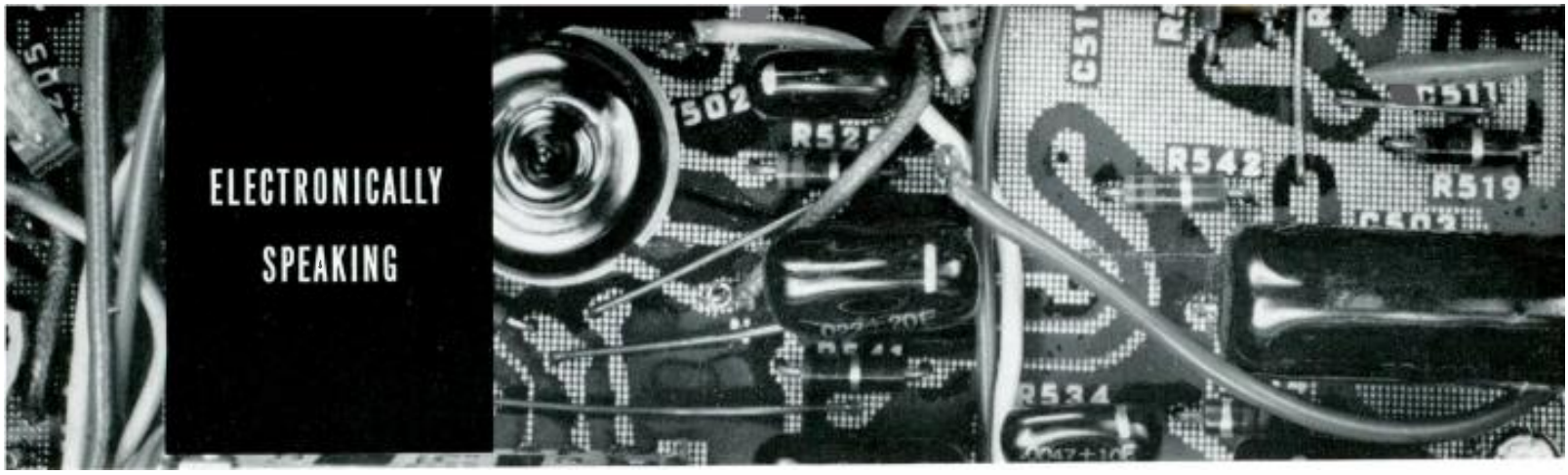
But we are not at all satisfied with this technical accomplishment. Those of us at NBC News are looking forward impatiently to the next important breakthrough: the establishment of a network of permanent communications satellites. With these devices in orbit, we will be able to relay live television pictures and sound from one end of our troubled and complicated world to the other. Perhaps, with the added information, we can make some sense out of the world we live in.

So, we are eagerly awaiting the day when an editor in New York will be able to push a button and bring in Moscow — for example — live and in color . . . as easily as we call in our Moscow correspondent today by radio.

I have tried to give, in this short space, an idea of how NBC News operates and I have, of course, oversimplified. It is a complicated, demanding business. And the responsibility for the swift, accurate reporting of the news is shared by a hundred-and-one dedicated people who operate the complex machinery of radio and television. They are called upon to exercise sound judgment at break-neck speed. For we are living in a minute-to-minute world and the events that shake and mold that world follow no established timetable.

Covering these events is difficult and, often, expensive. But I submit that the expense and effort are eminently worthwhile. For we are in the business of increasing understanding and enlightenment through knowledge.

Last year, more Americans watched the national political conventions than ever before in our nation's history. Through the campaign, they observed the principal candidates debate the issues on television. And last November, when the time came for the American people to exercise their right of decision, more Americans voted than ever before. It was, I am convinced, more than a coincidence. ■



TINY, TINY, TINY

An ultraminiature experimental transistor, so tiny that as many as 20,000 can fit on a postage stamp has been tested successfully at RCA Laboratories.

The transistor is made by depositing thin films by evaporation on an insulating base and is capable of shrinking the basic circuitry of a computer to the size of a book page. The basic circuitry of present-day computers ranges in size from the equivalent of a large hat box to a walk-in closet.

It is believed that this is the first time that transistors having useful performances have been produced entirely by the thin-film technique of evaporating all materials upon an insulating base – in this case, a glass plate.

Emphasizing the precision of the technique, Dr. James Hillier, Vice President, RCA Laboratories, points out that a complete three-stage amplifier including thin-film transistors and their connections could be produced this way on a surface only twice as wide as a human hair.

SAYING IT WITH FLOWERS

A floral float consisting of 1,300 red and white pompons, approximately one for every person in the audience, was the gift of the West Palm Beach Chamber of Commerce at the dedication of the new Palm Beach Gardens Center of the Electronic Data Processing Division.

The horseshoe of flowers, with the RCA insignia in the center, floated on a raft covered with a bed of palm fronds in the pool situated in the court of this tropical-in-design industrial complex.

Two hundred man-hours were spent preparing the float. Women, working waist-deep in water, put on the finishing touches in the wee hours of the day of the event.

ACCOLADE

The United States Army Signal Corps has presented its highest quality recognition to two plants of the RCA Electron Tube Division for "consistent production of high quality receiving and microwave tubes over a long term period."

Designated RIQAP, the award identifies the Army Signal Corps' Reduced Inspection Quality Assurance Plan. RCA is the first company in New Jersey honored with a special RIQAP flag-raising ceremony.

UP NORTH

Across the vast wilderness stretching 1,300 miles from Grand Prairie in southwestern Alberta to Mount Dave on the Yukon-Alaska border, the world's most advanced microwave communications system is now officially in operation.

Built by RCA Victor Co., Ltd., of Montreal, under prime contract to Canadian National Railway, this $25-million communications marvel – capable of handling up to 600 telephone voice channels – provides greatly improved telephone and telegraph facilities in this sparsely settled area.

Completing the project in twenty-one months under conditions that normally would have taken three to four years, engineers had to battle weather that reached unbelievably low temperatures in the rugged mountain and timber country; build two of the relay stations atop high mountains; construct year-round access roads to the sites, some as long as fifteen miles; bring in by helicopter, truck, tractor, and foot all equipment and most of the materials used in the project.

The new system basically consists of forty-two microwave stations, located at approximately five to forty-two-mile intervals.

Stations are completely equipped with buildings, towers, power plants, access facilities, and all electronic equipment, and are designed for completely automatic, unattended operation.

To date, there have been no complaints that a New Yorker calling his wife by dialing *his* local Manhattan YUkon exchange has been answered by a strange voice of an Eskimo housewife on *that* YUkon exchange.

DOWN SOUTH

RCA dealers and distributors – braving the vigorous Miami and Las Vegas sunshine – gathered in May for their first look at the new RCA 1961-62 line of consumer products.

Featured: twenty-two different models of color TV receivers and a completely new line of black and white sets, radios and stereo phonographs, including the Bosworth TV receiver, Mark XIII stereo and shirt-pocket radio (right). ■

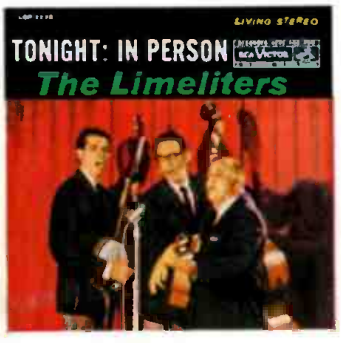
Chet Atkins, dedicated pursuer of perfection on the guitar, frequently records at home in his private studio, where he has a dream world of hi-fi recording equipment. These private recitals yield inspired albums, like this new one, featuring twelve songs we'd class as "everyone's favorites."

NEW
HEADLINERS
IN SOUND
...FROM RCA VICTOR

Living Stereo with "Miracle Surface"
...and Monaural Hi-Fi

The "riddle" of this title refers to one Nelson Riddle, outstanding arranger-conductor, personally chosen by Rosemary Clooney for this album. Rosie is, to be sure, one of the modern world's swinging wonders. Now with Nelson's brilliant backing, she is at the height of her powers. It's not to be missed!

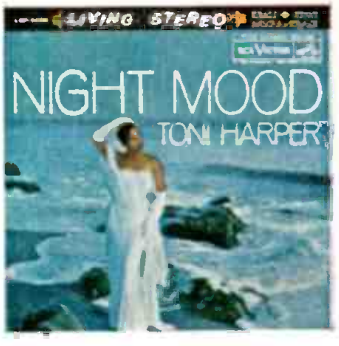
Toni Harper, swinging siren of the Sixties, has a pearly, liquid tone that infuses the old songs with rich, new, unthought-of aspects. Eight such "oldies" are here, plus four songs by alert and eloquent new writers. The whole—a vinyl reflection of the moon-lit hours—will put you into a romantic mood at every hearing. It's a delicious musical treat. Try it tonight!



Our candid mike entered a folk music mecca in L.A. to capture this great new group. The extravagantly talented Limeliters offered song after song from a brimming kit. It was a galvanic session! The trio also let fly with some prime wit. It's all here in this high-fidelity in-person recording.

Three's company, 41's a cloud! The Three Suns are wonderful company, that is, and 41 songs make up "Dancing on a Cloud," their magnificent answer for the home dancer. Song writing's Hall of Fame is well represented, and every style—ballad, waltz, Latin—gets a heavenly hearing. Ready...let's dance!

Perry Como has something extra special for us. It's a musical stroll through the sparkling land inhabited by the "Young at Heart." Such tender songs of the tender years as "While We're Young" and "Hello, Young Lovers" make this new album a bubbling fountain of youth.



the world's greatest artists are on...RCA VICTOR
RADIO CORPORATION OF AMERICA