RCA

SPRING
1962

electronic age

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COVER: *Recently announced by the Semiconductor & Materials Division, solid ceramic circuits represent RCA's latest advance in the field of microelectronics. The tiny circuits, which can perform all electronic functions from signal amplification to computer switching, are magnified here seventeen times and shown during various stages of their production.* *See article on page 2.*

In this issue . . .

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

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

Completing construction of the Stereo Lounge in RCA's exhibit at the Seattle World's Fair.

Ceramic Circuits

ELECTRONIC CIRCUITS PRINTED ON WAFER-THIN CERAMIC TILES OPEN AN INGENIOUS NEW APPROACH TO MINIATURIZATION

by **BRUCE SHORE**

ONE OF MAN'S OLDEST TECHNOLOGIES — the making and molding of ceramics — is about to revolutionize the manufacture of electronic components.

Work already done by scientists at RCA's Semiconductor & Materials Division in Somerville, N. J., points to a day not too far distant when the complex electronic circuitry of television, radio, space probes and computers will be contained in tiny, "electronic tiles" one-third the size of aspirin tablets.

Unlike the ceramic tiles in a Babylonian mosaic, however, these tiles will not use color, shape or position to determine a pattern. Rather, they will use the forces of electromagnetism to form the subtler patterns of switching, control and amplification essential to the performance of modern electronic equipment.

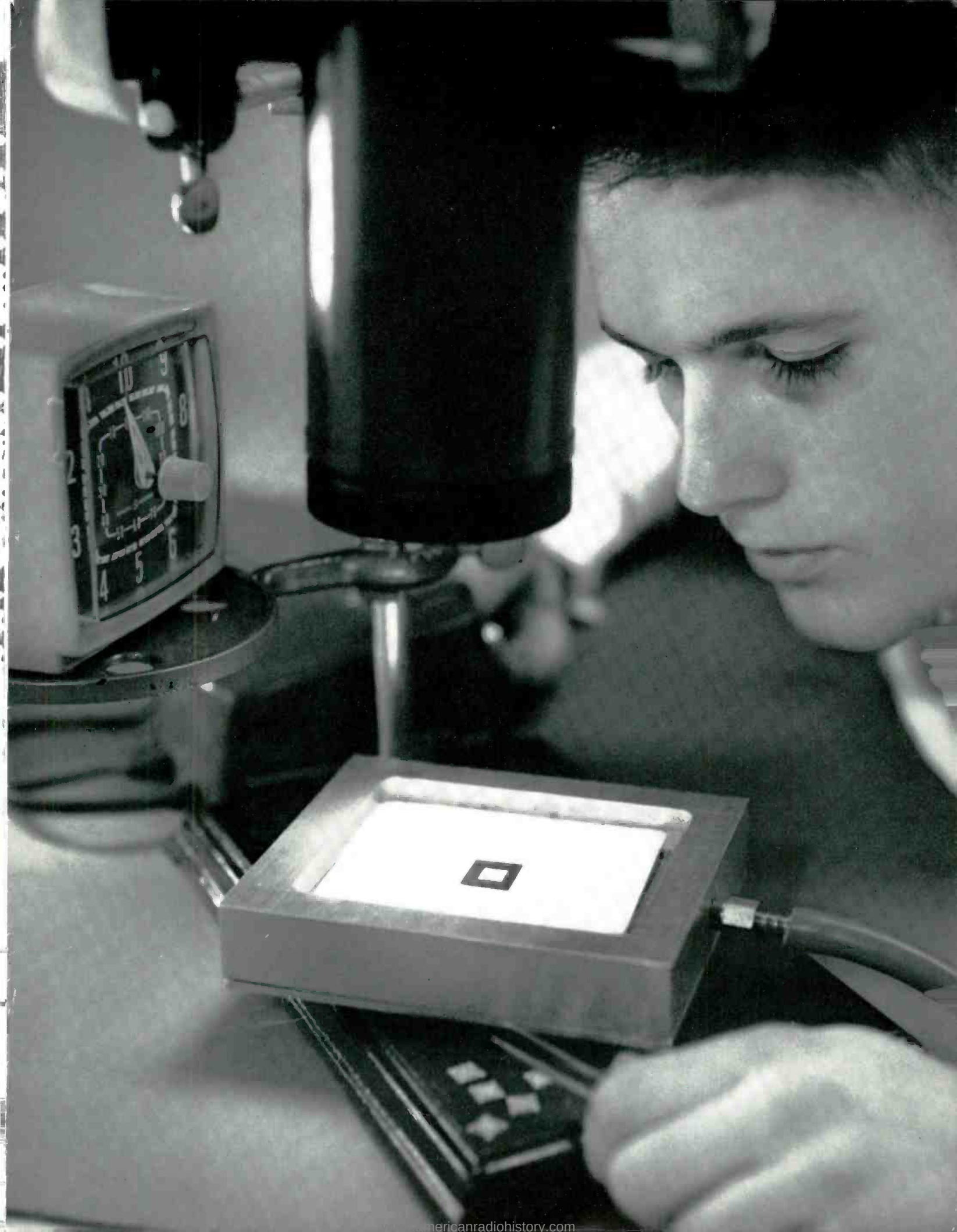
Called *solid ceramic circuits,* these "potent potsherds," as one Somerville engineer describes them, are remarkable not only for their size — one hundred times smaller than standard printed circuits — but for the way they may one day be manufactured.

"Manufactured may not be the proper word in this connection," comments Dr. Alan M. Glover, Vice President and General Manager of the Semiconductor & Materials Division. "The technique we envision for producing these circuits on a large scale is so close to that of modern printing that it may be regarded as an offshoot of the publishing industry."

The idea of "publishing" electronic circuitry may seem altogether incredible, at first, but it only serves to demonstrate some measure of the extraordinary developments that have taken place in the nation's electronics laboratories over the past half decade. It is not uncommon, nowadays, to hear electronics engineers talking casually about *printed* circuitry and components that use *silk-screening, photo-etching* and *photolithographic* techniques. For instance, the geometric outlines of the latest silicon transistors are defined by masks with a line resolution down to one-thousandth of an inch. Such transistors are, in fact, being built by processes that resemble those used to make a photographic montage.

The explanation for this unexpected turn of events lies in the growing pressure on components manufacturers to reduce drastically the size and weight of their products without increasing cost or sacrificing reliability. Much of this pressure is being generated by the

Electronics has borrowed techniques of printing and photography to produce its miniature circuits.



nation's defense and space programs in which equipment of great versatility, high performance and immense compactness is demanded.

In a larger sense, though, the invention of the transistor, with its phenomenal savings in weight and bulk over the electronic tube, probably started the trend toward microminiaturization. If components could be made so small, why not whole electronic circuits?

People were just beginning to ask this question when, in 1958, under a contract with the U. S. Army Signal Corps, RCA set out to develop a form of microcircuitry that would make possible a small, tactical computer and a new communications system for use under battlefield conditions. These circuits came to be known as "Micromodules." Today, they stand on the threshold of hundreds of practical applications. In the hands of RCA's Surface Communications Division, they have led to a radio receiver that clips to a GI helmet and a transmitter only slightly larger than a pack of cigarettes. "SurfCom" also expects to deliver to the Army this summer a micromodularized computer that weighs only a hundred pounds and looks like a large suitcase.

Micromodules are also under evaluation in other branches of the military as well as in industry. The Navy is using them in a new infra-red detector to be installed in the fire control system of an advanced, carrier-based attack aircraft. A different kind of micromodularized computer shaped like an accountant's ledger has been built and sold to a major manufacturer for test in a second-generation missile. One important manufacturer has a micromodularized radio receiver under development for possible consumer, as well as military, use.

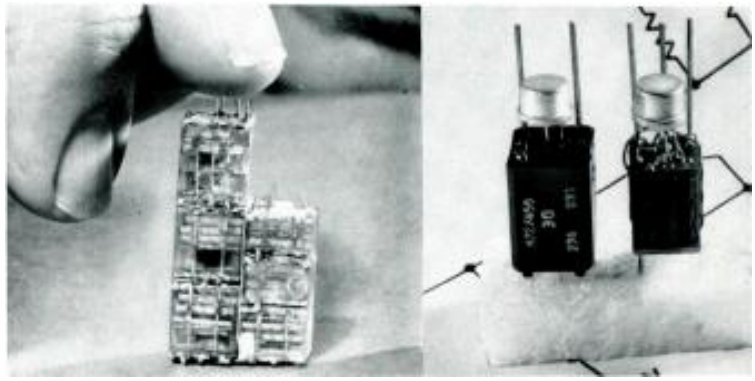
Nevertheless, with the exception of some military and aerospace equipment manufacturers, industry in general has been slow to jump on the microcircuit bandwagon. Such caution stems from many factors including the higher initial costs, unproven reliability, production problems, lack of standardization and other difficulties associated with microcircuitry. These objections can be expected to disappear in time, however, as equipment manufacturers gain more experience in the use of such circuits.

Another objection is the rash of different microcircuits currently available or under development. Without elaborating on all of them, it can be said generally that they fall into five categories, the first of which goes under the designation of "cordwood." In this approach, small conventional components are lashed together and treated as single circuit blocks. RCA Minimodules used in the U. S. Air Force's Combat Logistics Network (ComLogNet) are a good example of this technique.

A second generic type is the Micromodule, an assembly of discrete components which have been reduced to a common geometry, i.e., square ceramic wafers. These squares are stacked, one atop the other, interconnected and usually encapsulated in a protective, plastic resin.

The third group can be called multiple device packages and represents an extension of semiconductor manufacturing to include more than one active device in the same transistor container. Multiple semiconductor diodes currently manufactured by RCA's Semiconductor & Materials Division fall under this heading as do more sophisticated forms, under development, which include passive circuit elements as well.

Fourth in this listing are thin-film or integrated circuits, those types which use an insulating base on which thin, metallic films are evaporated to function as resistors, capacitors, amplifiers and the other elements which make up an electronic circuit. Intensive work in this area has been underway for some time at the David Sarnoff Research Laboratories in Princeton and was recently capped by the development of a



thin-film transistor, twenty thousand of which can be laid down in the area of a postage stamp.

Finally, there is molecular circuitry. This is the furthest from realization of all the types so far mentioned, in part, because it is the most difficult to achieve. Essentially, molecular circuitry, when and if it is realized, will consist of a single chunk of material – a crystal – which, for example, will act like a radio when a speaker is attached at one end and an AM signal is passed through the other. Individual components are non-existent in such circuitry. Their functions are taken over by atomic domains in the crystal lattice – areas that have been treated at the atomic level to amplify, regulate or switch electronic signals reaching them.

Given this astonishing array of possibilities, it is

little wonder that equipment manufacturers have been so hesitant to commit themselves. They are waiting to see which approach emerges victorious.

Actually, the situation is not as mercurial nor as confusing as it seems. Combinations of all five techniques will undoubtedly be the base on which ultimate microcircuits of the future will be built. Each approach will contribute its own special quality, where needed, and the final result will be whole new families of electronic products smaller, lighter, more versatile and more economical than ever.

In this sense, it is the intrinsic ability to combine, or be combined with, all the approaches currently being pursued in microcircuitry that distinguishes RCA's new *solid ceramic circuits*.

"In cordwood and Micromodule programs," states R. E. Koehler, Manager of Somerville's Microelectronics Department, "solid ceramic circuits can be used to enhance the performance of such units and sharply increase their packaging density. Multiple device, thin-film and molecular techniques, on the other hand, can be incorporated into solid ceramic circuits as they become practical. In addition, solid ceramic circuits ing to transistors and diodes are bonded into the circuit at the top of the chip in a tiny cavity designed for this purpose. The cavity is then sealed and the circuit is ready for use.

"When mass production of these new circuits begins, this process will be greatly simplified and will resemble the steps used in publishing a newspaper or magazine," Mr. Good predicts.

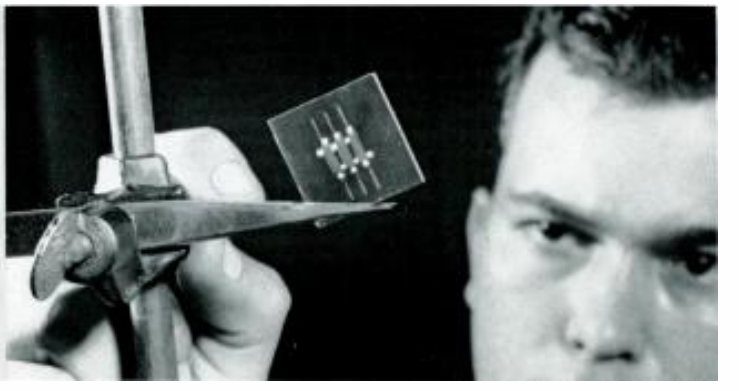
"We envisage a production line that features a continuous sheet of ceramic material being fed by rollers into presses where hundreds of circuit patterns are printed down at one stroke. Next will come a straightforward series of cutting, punching and stacking operations similar to those in a printing mill. Lastly, the circuits will be fired and tested preparatory to sale.

"By this time," he says, "even active devices will be produced in this way, probably by using an intervening metal evaporation step.

"At this time, too, it may prove possible to manufacture many different types of circuits on the same ceramic sheets.

"In that case, we would not cut the circuits into

Four basic types of microcircuits (from left): micromodule, discrete components encapsulated in plastic resin; minimodule, conventional components lashed to form circuit block; multiple device package, several active devices in same transistor container; thin-film transistor, metal film evaporated to form integrated circuit. Molecular circuitry, a fifth, has yet to be achieved.

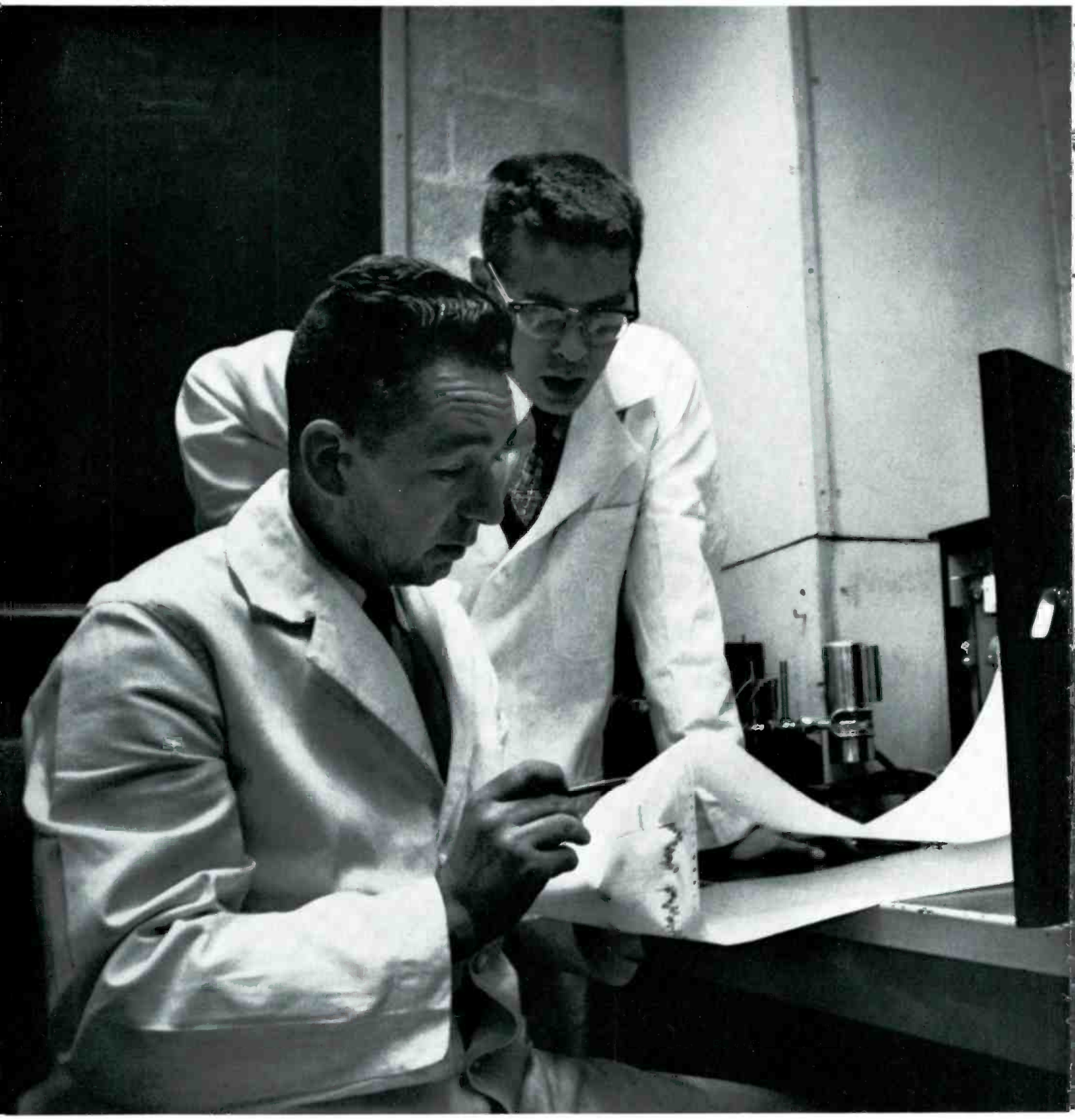


can be manufactured simply, in large volume and at low unit cost."

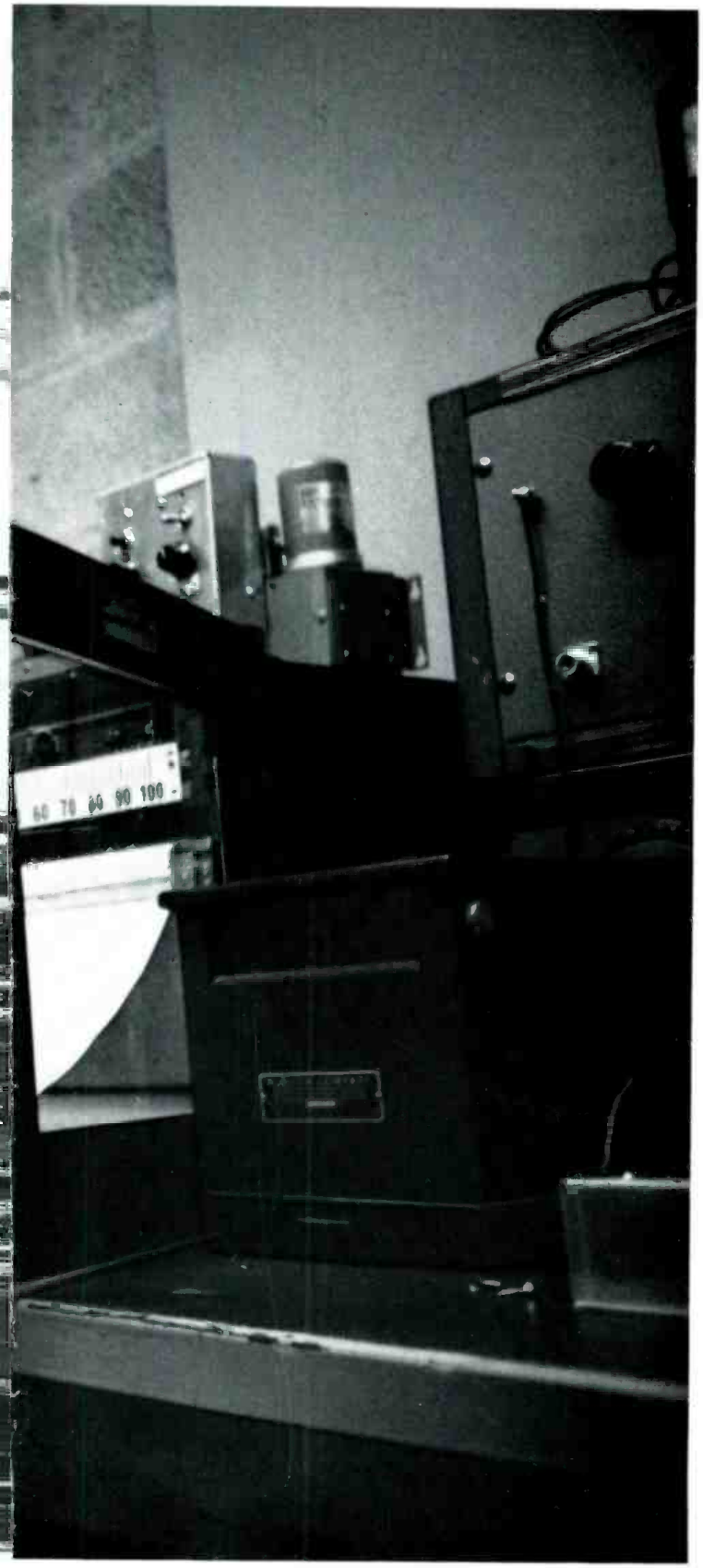
Describing present production methods, Lowell Good, Manager of Microelectronics Engineering, explains that a ceramic sheet three times thinner than the page on which this article is printed is prepared first. Next, several circuit patterns, in the form of a metallized ink, are printed on the sheet and allowed to dry. The sheet is then cut into tiny wafers which conform to these patterns, holes are punched where interconnections will be required, and the wafers are stacked in accordance with the circuit's preconceived design. At this point, each stack is fired at high temperature until its various layers fuse together to form a solid, hermetically sealed ceramic chip. In final processing, active semiconductor pellets correspondsmall chips but interconnect them by means of conductive metal paths and stack them to form small ceramic boards. In this way it might be possible to contain all the electronics of a manned space vehicle, a computer or a television set within a few compact boards of this type."

Research on these new circuits continues under the leadership of Mr. Good and Dr. Bernard Schwartz, manager of Microelectronic Components Development. Many problems have still to be overcome and many tests have yet to be made.

One thing is clear, however. If the manufacture of electronic components and circuitry ever does come to be regarded an offshoot of the publishing industry, the solid ceramic circuit may well be recognized as the electronic equivalent of the Gutenberg Bible. ■



The most critically pressing human and physical problems of our time can be grouped into five broad categories of scientific interest. The first, the study of genetics and heredity, promises control of disease.



A FREE WORLD COMMUNITY OF SCIENCE

by **DAVID SARNOFF**

Chairman of the Board,
Radio Corporation of America

On March 28, David Sarnoff proposed that the non-Communist world mobilize its research skills to form a Free World Community of Science to achieve new scientific breakthroughs in areas of greatest benefit to humanity. He made the proposal at the Golden Anniversary Banquet of the Institute of Radio Engineers, which was founded in 1912, to advance the art and science of radio and is now one of the world's leading professional engineering organizations. Stressing the international nature of the IRE, General Sarnoff suggested that the organization could play a vital role in organizing Free Science in the race for supremacy over the forces governing the universe. Here are the outlines of the organization as proposed by General Sarnoff, and his suggestions for far-reaching research goals to which it might direct the scientific talents of the Free World.

THE ELECTRON itself recognizes neither natural nor man-made boundaries, and the art of electronics has emerged as a rich mosaic to which many men from many nations have made important contributions.

As we enter our second half-century, the chief obstruction to the pursuit of our founding aims is the political conflict that dominates our times. It is a type

Weather and communications satellites require cooperation.

of obstruction inherent in the Communist system, which views science as an instrument of ideological as well as physical warfare, and which relentlessly bends it to that purpose. It is the antithesis of the Institute of Radio Engineers' founding concept of a universal and free science, a partnership global in scope and aims.

In my judgment, a clear understanding of this fact, and of its implications for the future, is indispensable not only to the membership of the IRE but to all who believe in free science and free society.

If our cherished concept is to prevail, then we must act resolutely to place it in the service of freedom itself. This, indeed, is the great challenge of our second half-century.

To meet it, we must first recognize realistically that the leaders of Communist technology are functionaries of a political apparatus wholly committed to the subjugation of free men and the destruction of free societies. Communism operates on the principle that science is a basic instrument of state policy, a policy geared to world domination. While Mr. Khrushchev and his associates change faces on many issues, they have never deviated from their relentless pursuit of this objective.

As part of their politico-scientific approach, the Communists, by concentrating heavily in the areas of space and military atomics, have cultivated the claim that their science is superior in all respects. But this is a false claim! Actually, their scientific and technological capabilities are more limited than most of the world realizes. I am convinced that we can, if we so determine, demonstrate both the qualitative and quantitative superiority of free science across the board.

To do this, however, we must have a far more systematic and effective mobilization of the Free World's scientific resources than our present informal alliance provides. We must concentrate our talents and facilities for scientific victory for peace, just as we have organized the forces of NATO for military defense. And we must do so with the sanction and support of the principal governments of the Free World.

What are the resources that can be mustered for such an effort?

Among the 500 million persons within the Atlantic Community alone there is a gigantic reservoir of scientific and technological strengths unmatched in aptitudes, skills and creativity.

Over the past quarter-century, there have been thirty-four Nobel Prize winners from the United States in the fields of physics, chemistry, medicine and physiology; forty-four from Western Europe, and only five from the Soviet Union. Since the beginning of the century, the ratio of Nobel Prize winners is 175 to six in favor of the West.

Western Europe today possesses an impressive array of gifted men devoted to searching out basic scientific principles. Its universities and scientific centers — Goettingen, Oxford, Cambridge, the Sorbonne, Milan, Delft, Upsala, Copenhagen — are wellsprings of creativity in key research areas. To pace its own economic growth, Western Europe also is moving swiftly into the development and industrial application of basic knowledge.

The United States in recent years has contributed a substantial share of the world's finest creative thinking. It excels today in the experimental approach, in the richness and variety of its facilities, in unrivaled opportunities for putting concepts into application.

These diverse strengths on both sides of the Atlantic complement and support each other. On the one hand, few European nations, even collectively, possess the resources to pursue such vast and expensive undertakings as the exploration of space. For lack of opportunity, immensely talented scientists in these countries are consequently not utilizing their abilities to the utmost.

Two-thirds of world's peoples live in areas that are water-starved.

The ocean, an untapped food source for world's hungry nations.

On the other hand the United States, largely because of its own swift advances, is gradually depleting its storehouse of fundamental scientific knowledge — the springboard for further technological progress. The demand for basic principles seems to be outpacing the supply.

Through more extensive basic research, we must expand our scientific knowledge, and channel its flow into other areas of the world for the support of freedom's needs.

This can best be accomplished, I believe, through the creation of an organization which I would call the Free World Community of Science — an organization where competence is the only visa, and capabilities are fitted together for maximum results without regard to nationality.

The United States might properly take the lead in establishing such an organization, which initially could embrace the nations of Western Europe, North and South America, Australia and Japan. Any countries which permit free scientific inquiry unhampered by political ideology, would be welcomed.

This Community of Science could include scientific leaders in the major areas of the physical and life disciplines from each participating nation. Established on a permanent basis, it could be responsible for proposing key research areas, initiating specific research and development projects, coordinating the resources essential to their implementation, and creating, wherever desirable, specialized international research institutes. It should function with a minimum of political direction, and with its financial support contributed by the member nations.

Organizations such as the IRE could play a vital role in the development of the Community of Science; first by proclaiming their support of it and then by counseling on organizational problems during the formative phase. It would also be within their province to propose suitable projects, to recommend the most qualified scientists and engineers, to help evaluate progress, and to suggest promising avenues of exploration. There are many organizations here and abroad which possess the qualities of technical competence, objective appraisal and political independence necessary to make useful contributions.

Even today we could place certain areas of research under a canopy of common Free World scientific interest. In each area, breakthroughs would change human life for the better and would manifest to all mankind the scientific leadership of the West.

I have grouped them into five broad categories which range across the natural laws of life, matter and energy, and involve some of the most critically pressing human and physical problems of our time.

1. *Genetics and heredity.* We have begun the assault on the innermost mysteries of the life process — decoding the nucleic structure of the living cell, its activities, differentiations and transmitted characteristics. Knowledge of these basic life functions might make it possible ultimately to alter or modify cellular structures. This could lead in turn to the elimination of bacterial or viral diseases, and conceivably to more useful strains of plant and animal life.

2. *Communications and space.* In our own area of primary interest — communications — we are now in the planning and early development stage for a cosmic system of interconnected high-level synchronous satellites, low-level satellites, ground stations and networks. Such a system will enable us to furnish every type of communication to every place on earth, to space vehicles and to the planets beyond. Whenever man ventures from this planet, science is challenged with the supreme task of providing him with the means of seeing and talking with his fellow men wherever they may be.

Recently the National Aeronautics and Space Administration, through Colonel Glenn and Project Mercury, dramatically demonstrated the potentialities of

New sources of energy may transform deserts into irrigated gardens.

space for peaceful purposes. It is axiomatic that when a vacuum is unsealed, there is an inrush of air. As the vacuum of outer space is unsealed by our intrepid Astronauts, we must mount a Western team effort to insure an inrush of freedom.

Another area of infinite promise for scientific collaboration in this general category is weather control. The success of the four Tiros television weather satellites has already indicated the possibility that we can vastly strengthen the defense of person and property against the turbulence of the skies and the seas.

Where there are resources and individuals in the Free World capable of significant contributions to these new dimensions of science, they should be joined to the sum of a united effort.

3. *Conversion of saline to fresh water.* Two-thirds of the peoples of the earth live in areas that are water-starved. For millions of them, the presence of a few feet of water spells the difference between life, bare existence, or death. The nations which offer an efficient, low-cost process for large scale purification of salt or brackish water will possess a weapon as potent as space ships in the battle for men's allegiance. President Kennedy has said rightly, that this is an important as landing on the moon.

4. *New sources of food.* Barely one-sixth of the world's people are well fed, and nearly half exist in a state of subnutrition or malnutrition. In the areas where food deficiencies are greatest, the rate of agricultural production has been slowest.

In twenty years the population of the earth will increase by one billion, and forty years from now it will total six billion. For every plate of food on the table today, there must be two plates by the year 2,000 — and most of that second plate can come from the world's oceans.

Acre per acre, the oceans can sustain at least as large a plant crop as the land; yet, the harvest of the sea today provides less than one per cent of the human diet.

The oceans offer an immediate challenge to our proposed Community of Science for improving food supplies by transforming fishing from a nomadic pursuit to an organized farming activity, including the scientific processing of highly nutrient algae and plankton for food purposes.

5. *New sources of energy.* Research in atomics, electronics and other fields, is now providing us with the means to convert solar energy, fossil fuel energy and atomic fission energy, directly into electric power. And through further research we shall ultimately learn how to make practical use of nuclear fusion energy. When that day comes, we shall be able to tap the limitless energy sources in the oceans.

Before too long, many isolated parts of the world will have sources of electricity that will not require large central power stations and extensive transmission systems. When we learn how to convert all forms of matter into energy for practical uses, we will have at our disposal the maximum force in nature. It will then be possible to cleave new coast lines, level mountain ranges and transform the Sahara or our Southwestern deserts into irrigated gardens.

To quicken the pace of these explorations, I suggest the establishment of an international data processing center to assemble, digest, translate and make available promptly the essential data contained in the volumes of technical papers being published around the world. This year alone, the total of such papers will approach 60 million pages. Concealed in this mountain of information are thousands of ideas for new materials, products and processes that could be invaluable to the Free World's progress in science and technology.

I have attempted to outline only a concept and the directions it might take. I realize that the implementation will require time, effort, a degree of willingness to forsake parochial interests, and a firm faith in the future of free nations. While it would be necessary, for security reasons, to exclude certain activities of a scientific nature that relate to national defense, this would not contradict the broader and peaceful purposes of the new scientific alliance.

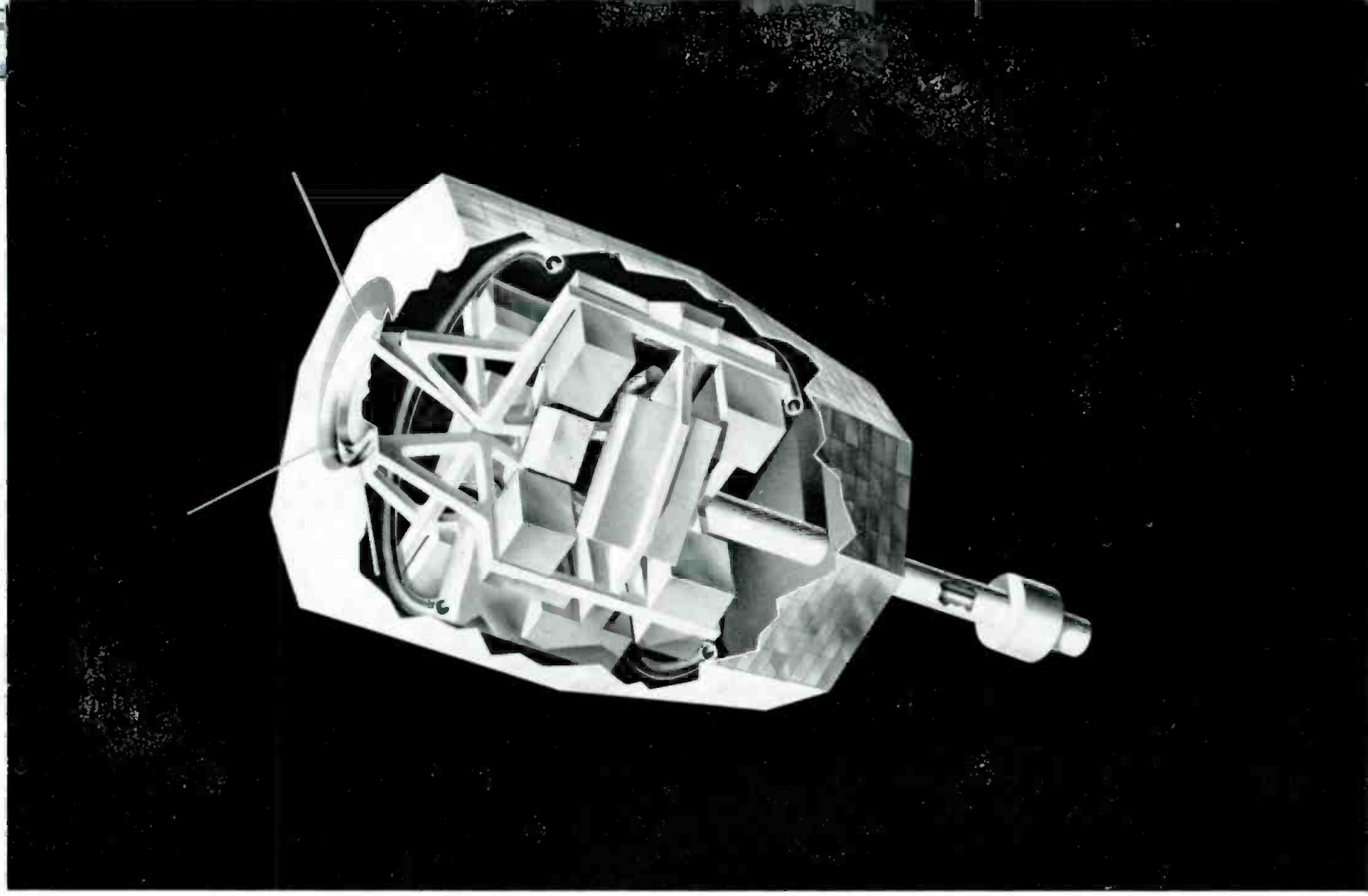
In January, President Kennedy told the Congress: "The Atlantic Community is no longer concerned with purely military aims. As its common undertakings grow at an ever-increasing pace, we are, and increasingly will be, partners in aid, trade, defense, diplomacy and monetary affairs."

To these, I believe, we must now join the partnership of science.

As the founders of the IRE recognized half a century ago, the concept of isolation in science is illusory and in the end self-defeating. We can no longer afford the luxury of American science, or British, French, Italian, or German science, if the individual parts are smaller than the sum.

We must mobilize all of Free Science into the race for supremacy over the forces governing the universe. We cannot afford to fall behind in this race. The Communist challenge to the Free World on the military, economic, political, and psychological fronts demands that we hold first place in science and technology.

Four centuries ago, Francis Bacon said: "Knowledge is power." Amended for the Twentieth century, his words might read: "Scientific knowledge is world power." ■



NASA's Project Relay will demonstrate transatlantic television and microwave service via satellite shown in this cutaway sketch.

RELAY STATIONS IN SPACE

Communications satellites in orbit will link the continents with live TV and high-capacity microwave services

by **KENYON KILBON**

ONE DAY THIS SUMMER, a television picture will flash onto viewing screens in Europe at the end of a journey that no image has traveled before – a high-jump from one side of the Atlantic to the other through a space relay station speeding in orbit a thousand miles or more above the earth.

The dramatic impact of the program is assured even before its content has been finally determined. The pioneering transmission, and the reciprocal broadcast that should follow from Europe to North America, will provide the first visible evidence of success in conquering a formidable physical barrier to instant communication by sight and sound around the world.

The barrier is the wide expanse of ocean separating the land masses of the earth and presenting until now an insuperable obstacle to the high-capacity radio relay systems that span the continents. The instrument of conquest is the communications satellite, in which electronics and space technology are joined to bridge the ocean in a single leap with the equivalent of a radio relay tower high enough to be "seen" simultaneously by transmitting and receiving stations thousands of miles apart on the ground.

In the swift evolution of electronic communications, the orbiting satellite appears on the scene with a fine sense of dramatic timing. The rising demand for

international communications in business, diplomacy, news-gathering and private affairs has raised the specter of a serious shortage of channels via conventional cable and radio circuits in another three to five years. The experts estimate, for example, that international telephone calls will increase from about 4 million this year to 10 million by 1970, and 100 million by 1980. Major increases are anticipated, too, in the demand for international business teleprinter, telegraph and data services to accompany growing industrialization and expanding world trade.

Giant horn antenna at the Andover, Maine, ground station.

Beyond the heavier requirements for these conventional types of communication is a further desire for new services that lie beyond the technical capabilities of today's cable and radio facilities. In particular, the worldwide expansion of national and regional television systems has generated a lively interest in transoceanic links to provide live television service around the globe for both broadcast and communication.

The solution to these needs and desires is the establishment of intercontinental wideband microwave facilities — communications "superhighways" — of the type that now provide these services over land. And this is where the satellites enter the picture.

Microwave systems operate at billions of cycles per second, making possible the transmission of vast amounts of information in a short time. Moreover, these frequencies lie in the uncrowded upper portion of the useful radio spectrum where there is room for channels of far greater bandwidth than can be allocated in the congested lower-frequency regions. These wide bands are required for television and for high-capacity telephone, telegraph and data services in which thousands of conversations or messages are handled simultaneously over a single circuit.

Until now, wideband microwave services have been confined to overland traffic because of the tendency of the radio waves at these high frequencies to travel in a straight line, in the manner of light. To carry them over the curve of the earth between points hundreds or thousands of miles apart, it is necessary to employ chains of relay stations on towers erected every twenty to thirty miles within each other's line of sight. Passing from station to station, the microwave signals are amplified to maintain their original strength and at the same time are bent along the curvature of the earth to reach their destination.

But relay towers cannot be erected every twenty to thirty miles across the oceans, and thus the wideband services have ended at the water's edge. Submarine cables have provided channels for a relatively limited number of telephone circuits, but those now in use lack the bandwidth needed for standard television signals or for the high-capacity voice and data facilities in overland service.

The situation is made to order for space technology. Microwave relay equipment is relatively uncomplicated by comparison with many electronic systems that already have been lifted into orbit, such as the television camera and tape recording systems in the Tiros weather satellites. A relay station of useful capacity can be designed in sufficiently compact form to fit into a satellite for launching by presently available rockets into orbits several thousand miles up.

Passing over the North Atlantic, the satellite microwave repeater would be simultaneously visible to transmitting and receiving antennas in Europe and North America. For communications between New York and Paris, for example, it would provide a facility comparable to a chain of relay stations at the earth's surface. Electronically, the principal difference would be the absence of amplifiers at twenty- to thirty-mile intervals to maintain signal strength. To compensate for this lack, the satellite system would employ far greater power and sensitivity in the transmitting and receiving antennas at the ground stations communicating through the single repeater in the satellite.

These basic elements are to be put to their first actual test in space during the coming months with experimental satellites that will demonstrate the feasibility of television, voice and data communications over the Atlantic and will determine effects of space environment, including Van Allen radiation, on satellite power supplies and electronic equipment.

One of these is Project Relay, the government's first experiment in active satellite communications between the continents. The Relay spacecraft itself is

The Relay satellite in assembly at RCA's Space Center, Princeton, N. J. Projecting from upper part of payload is pipelike transmitting and receiving antenna.

nearing completion for the National Aeronautics and Space Administration at the Space Center of RCA's Astro-Electronics Division at Princeton, N.J.

Designed for launching this summer into an elliptical orbit ranging from 900 to 3,000 miles in altitude, the Relay satellite contains duplicate systems for receiving and retransmitting wideband television, telephone and data signals, and electronic assemblies for command control and tracking from the ground. For experimental purposes, the satellite repeater can handle a television transmission or twelve two-way voice channels. And as satellites go, it forms a relatively small package – an eight-sided cylinder with a twenty-nine-inch diameter and a length of fifty-one inches, including a pipe-like transmitting antenna extending from one end in the manner of the stem on an apple.

Another entry in the test program for this year is the spherical Telstar repeater satellite developed by the American Telephone and Telegraph Company as a privately-sponsored experiment conducted in association with NASA. Telstar is expected to begin its mission in late spring, with an orbit and a series of transoceanic tests similar to those scheduled for Relay.

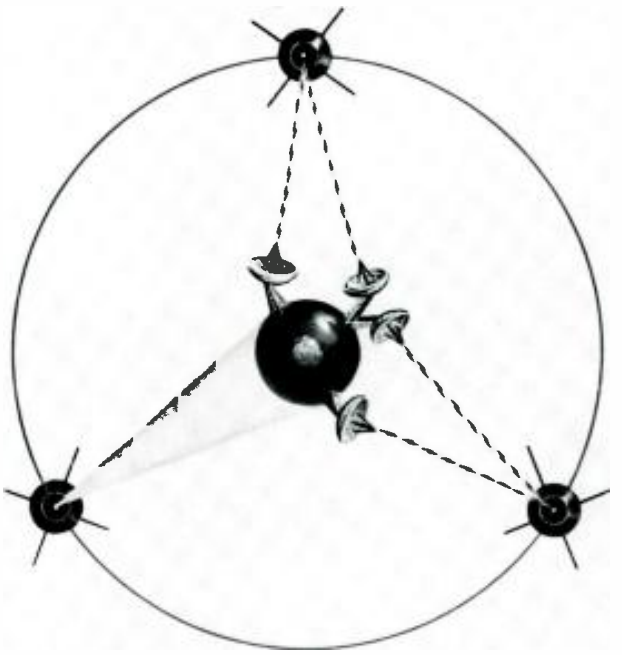
A healthy round of international cooperation is involved in the planned experiments. The Relay program, for example, will include television, voice and data transmissions between ground stations in the United States and overseas facilities operated by the British and French governments, and voice and telegraphy experiments between the United States and a ground facility of the Brazilian government. Ground stations also are being built by the West German and Italian governments for further Project Relay experiments in 1963.

These initial experiments should accomplish two major objectives, in the view of communications and space experts. One will be to provide an early demonstration of United States' leadership in the promising new field of satellite communications. The second will be to furnish needed data and experience as the basis for progress toward practical operating systems.

As they look to the future toward complete global wideband services on a scale to meet long-term needs, communications experts eye with lively and growing interest an advanced concept that appears to offer major advantages of simplicity and flexibility. The idea is to use a satellite in synchronous orbit, 22,300 miles above and parallel to the equator, moving from west to east.

At this altitude, a satellite will take twenty-four hours to complete a full orbit. During the same time, the earth will complete one full revolution in the same direction on its own axis. Thus, to transmitting and receiving stations on the ground, the satellite would appear to be fixed always in the same position in space, just as though it were mounted on a tower.

From its great altitude, the satellite repeater would be visible to ground station antennas over a tremendous area. One synchronous satellite in equatorial orbit over the Atlantic, for example, would be accessible to stations everywhere in Europe, the Middle East, Africa, South America, and the eastern half of North America. A synchronous system of only three satellites in equatorial orbit over the Atlantic, Pacific and Indian Oceans would cover virtually all of the inhabited areas of the world.



Three fixed, or synchronous, satellites can cover the world.

A second major attraction in this concept is the fixed position of the satellite in relation to the earth. For all ground stations, the repeater would be accessible through a single fixed antenna, dispensing with the computing and tracking equipment needed for lower altitude systems of moving satellites. Furthermore, as the experts point out, the fixed satellite repeater would be directly and continuously accessible to all stations throughout its vast area of coverage, offering a stable pattern of inter-station connections and enabling every user to put his ground station at the location most convenient to him.

At the moment, the synchronous satellite concept is a highly developed theory for which there is as yet no experimental proof. As the low-altitude experi-

ments go forward to gather initial experience in satellite communications and to demonstrate both feasibility and national leadership, however, programs also are under way for testing the synchronous concept next year with the initial launching of small spacecraft into high equatorial orbit.

One of these is NASA's Syncom project, under construction by the Hughes Aircraft Company, involving a small drum-shaped satellite containing a limited amount of communications equipment. As a pilot project, Syncom is designed to evaluate techniques for placing a satellite at the required altitude and keeping it on station. Success in the project would pave the way for more advanced and heavier synchronous satellites, launched by the more powerful rockets that will be available in coming phases of the space program.

Nuclear-powered satellite is a future communications concept.

The ultimate promise of synchronous satellites for full global communications has inspired a number of detailed system studies and proposals by space and communications engineers. One of the most interesting of these is the concept of a nuclear-powered synchronous communications satellite envisioned by research engineers of RCA's Advanced Military Systems group at Princeton.

Increasing the level of power in the satellite repeater can provide important benefits. It would, for example, permit the use of a transmission technique that would provide room for more voice and data channels within a given bandwidth. High power in the satellite also would make possible a reduction in ground station costs, especially of antennas, since the cost and complexity of the antennas is related directly to the amount of power that has to be transmitted and the strength of the signal to be received.

The satellite design proposed by the RCA specialists would employ a sixty-kilowatt atomic power package of a type that is now in development in another phase of the space program. The power output of the nuclear generator, far greater than that which is available with the solar cell power techniques now used generally in space, would be sufficient to operate relay equipment for as many as 8,000 two-way voice channels or three to five television channels.

The satellite, fifty-one feet long and weighing slightly over three tons, could be placed in synchronous orbit by a special launching technique aided by its own nuclear power unit. Boosted to a "parking orbit" 300 miles above the earth by the powerful launching rocket, the satellite could be raised gradually to the required 22,300-mile level by electric propulsion units. Several different types of propulsion devices already are in development and would be suitable for such operation with the power provided by the nuclear generator in the satellite before it is called upon to power the communications equipment.

According to the RCA scientists, most of the components required for this advanced satellite are either available today or are under development for various space projects. They believe that the atomic-powered synchronous satellite could be achieved by 1966 if an integrated program were undertaken.

Whatever the technical shape of the future systems, the specialists are generally agreed that the introduction of satellites for international wideband microwave relay service will usher in a revolutionary new era of electronic communications.

They can foresee such possibilities as these: direct telephone dialing to points overseas; live television transmissions of major events in all countries to worldwide audiences; and the growing use of international television as a powerful tool of education for raising standards of literacy, health and economic activity in the less developed regions of the globe.

Among the intriguing prospects is the availability of a practical global relay service through which all people may share by sight and sound in the great achievements that lie ahead in the new age of space exploration. In 1962, all of the United States watched Astronaut John Glenn take off for his historic orbital flight around the world. By 1970, the whole world may be watching together as television transmits the arrival of men on the moon. ■

by **GEORGE AVAKIAN**
Manager, Popular Artist and Repertoire
RCA Victor Record Division

JAZZ IS ON THE RISE AGAIN, the fans have been telling each other for the past year. Dave Brubeck, Cannonball Adderley and other jazz artists have been hitting the pop music best-seller charts. Benny Goodman has been invited to play in the Soviet Union. Sonny Rollins has come out of retirement.

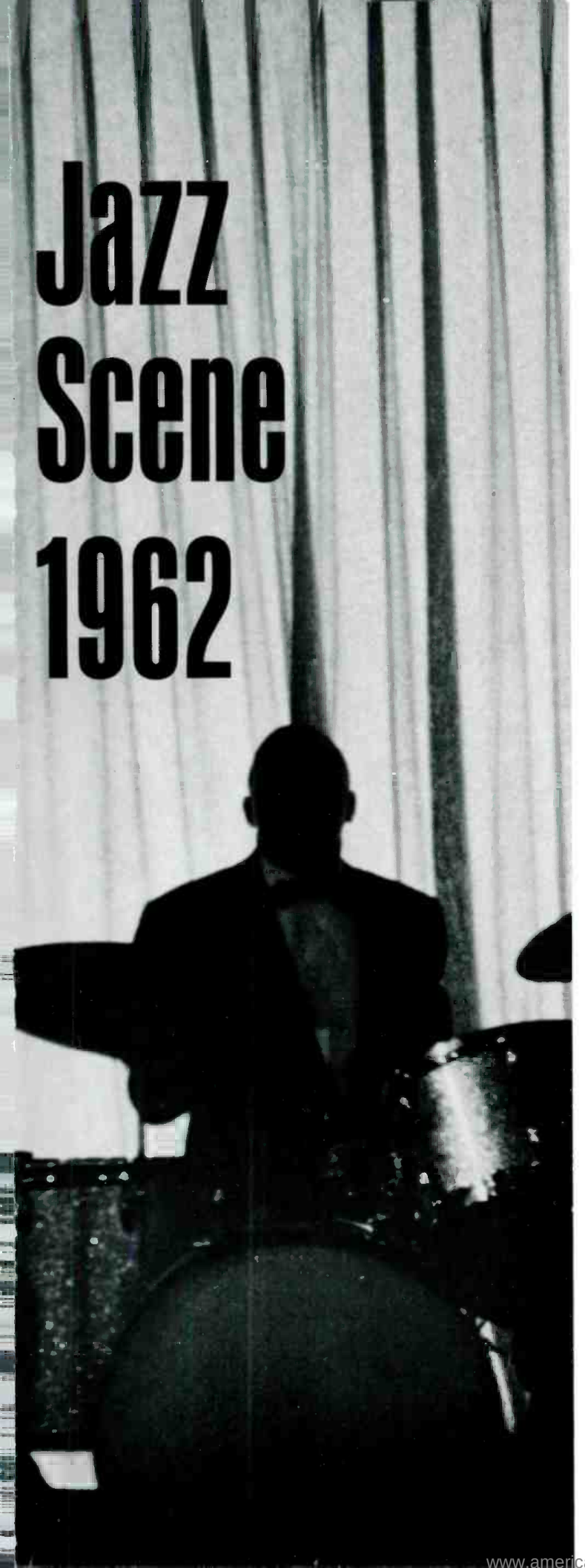
An International Jazz Festival is scheduled for Washington, D. C. where members of the United States government and representatives of foreign governments the world over have indicated keen interest. A jazz ballet has been performed at the White House; members of the President's staff have researched the matter and discovered that it was the first musical composition of any substance by an American composer to have been heard in the White House. And there's an article in *Esquire* saying that modern jazz is phony and the jazz critics are phonier. Success, excitement, drama, controversy! What more could one ask?

One could ask "why is all this happening?" And there's really a rather simple answer: jazz is vital, constantly on the move, generating its own action. Nothing in jazz ever stands still. They say you can sit at a sidewalk cafe in Paris and eventually see everybody in the world. Stick with jazz and you'll see and hear everything in music.

Until a year or so ago, jazz had been drifting through one of its periodic calms in which nothing decisive happened. Business was slow, night clubs were closing all over the country and the rich jazz artists were getting only a little richer while the poor were dropping out of sight. In this atmosphere, no youngsters were able to break through with the dazzling successes that lead to stardom and a comfortable, if always busy, living in jazz.

Ten years ago, a whole school of musicians kept pouring out of Detroit alone; there was a circuit of work for musicians that covered eight or ten cities, each of them hungry for jazz talent.

Then came the decline in work that coincided with the over-production of meaningless and downright bad jazz albums. These albums so glutted the market that dealers scarcely knew what to do to sell to jazz fans, other than to stick to a few tried and true names. This was fine for musicians with name-power, but it was an impossible situation for newcomers and even for musicians who had reputations but were not in the swim of the moment. Great established jazzmen already had been having a rough time. Now it became harder than ever, for in the settling down process, the modernists consolidated their domination and narrowed their circle to a few major names.



Jazz Scene 1962

The result has been that only two "new" jazzmen have broken into the upper rank in the last few years — Ahmad Jamal, a pianist who has been around for over a decade but finally "happened" on a commercial scale, and Cannonball Adderley, a saxophonist of undeniable talent and intelligence, who rose to a position of prominence even more slowly and painfully. Both have slipped back from their respective high points of four and two years ago, but they are part of the minority of jazzmen who know where their next job is coming from.

In between the rise of Jamal and that of Adderley, it began to look as though a big forward leap into jazz abstraction was the answer. Ornette Coleman burst on the scene via the West Coast and won a small but devoted following with a kind of music that few people seemed to understand, but which won listeners on several levels. Among them were those whose jaded ears needed something really new, those who had to get with the latest at all costs and couldn't afford to admit they didn't know what was going on, and those who even *liked* Ornette's super-free free-wheeling. But the jump was too great. Like an army that plunges forward and creates a salient that the supply troops can't follow, Ornette now seems to have been cut off — his audience is not expanding rapidly although his fans remain as loyal as ever. With the appearance of the equally wild competition of John Coltrane and Eric Dolphy, and a quieter kind of wildness from Don Ellis, some of the play has been taken away from the pioneering Ornette.

Jimmy Giuffre, now an established, if uncommercial veteran with great talent as a composer, arranger and performer, has come up with another kind of abstract jazz. As a result, Coleman's impact and public has been diluted, and the question now is whether there aren't too many abstract attractions obstructing each other — a question with an interesting sound when spoken aloud, at least.

Inevitably, the squeeze which put unpleasant economic pressure on most musicians resulted in a new surge of popularity for a very few musicians. After a year or more of talk and many releases — but no real action — about jazz on single records, a British modernist named Johnny Dankworth broke into the American trade-magazine charts with a record called "African Waltz." Cannonball Adderley "covered" it promptly, and became the first real jazz musician to make "the charts" on a solid basis — as opposed to, for example, pianist-singer Ray Charles, who is really a rhythm and blues man overlapping into jazz. But this was still a modest invasion. The record fluttered a

Manny Albam;
Recording session at Webster Hall;
Paul Desmond.

long time, never climbed up high enough to create a trade trend, and finally dropped off with no follow-up until one of the most Established of the Establishment, Dave Brubeck, quietly but impressively hit the charts with a Paul Desmond composition, "Take Five," originally part of an album. The record lasted on the best-seller lists for months, rising into the Top Ten. The ice had been broken, but not the dam. There has been nothing since to compare to "Take Five," although Dave's follow-up "Unsquare Dance," reached the bottom of the charts before it went the way of most follow-ups.

Perhaps the way to do it again is that suggested by a little-known Chicago saxophonist, Eddie Harris, who made the charts with a semi-jazz version of the "Theme From Exodus," promoting a hit movie theme in an offbeat interpretation. The point is that a jazz performance made it to the Top Ten of the country's single record charts, in direct competition with such popular artists as Elvis Presley, Connie Francis and whatever vocal group is riding highest as you read this. And, considering the dynamic nature of jazz, this will inevitably happen again – possibly when RCA Victor breaks the tradition of assigning the recording of a major motion picture theme to a musical descendant of Andre Kostelanetz, and gives it instead to jazz saxophonist Paul Desmond. The picture is Otto Preminger's "Advise and Consent."

What about Benny Goodman going to Russia? It was inevitable, too. Willis Conover's Voice of America broadcasts have long been getting through to the Russian people. When I was there last summer, several young people asked me if I could let the Voice know that the recent time change from ten to eleven p.m. was playing hob with their sleep, and could I please ask Willis to go back to ten? I jokingly told them that this was America's secret weapon against Soviet production, but I was more interested in asking how the government felt about their listening to jazz on the Voice of America.

"They don't jam it as often as they used to," was the answer. "The government realizes that the people want to hear jazz, and since it's impossible to black it out entirely, they've decided it's safer to let us blow off steam listening to the broadcasts than to build up more resentment than there already is."

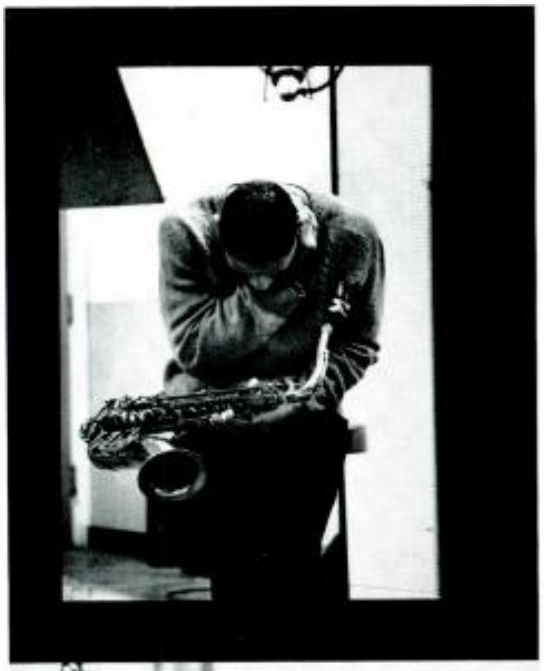
That seems to be the basic reason for the Soviet invitation to Benny. Again, it is the sheer vitality and excitement of jazz that is at the heart of the matter.

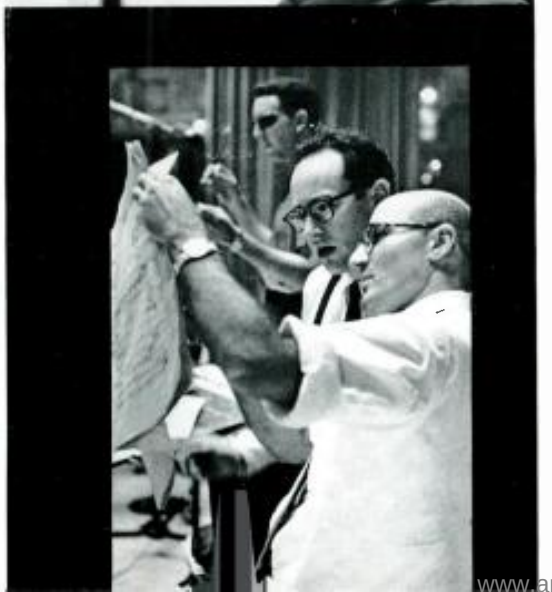
Of course our officials in Washington have realized the value of jazz ever since Louis Armstrong, Dave Brubeck and Dizzie Gillespie made a series of highly successful foreign tours for the State Department. The First International Jazz Festival in Washington, which has as its Sponsors' Committee Chairman, Secretary of State Dean Rusk, will present everything in jazz from a night with the National Symphony Orchestra and jazz soloists (including a concerto grosso with the Symphony and Duke Ellington's entire band), a jazz ballet program, and historic jazz films to a Saturday morning youth concert and afternoon of chamber jazz and a Sunday gospel program. Naturally, there will be programs of straight "jazz-on-the-rocks," too. All this takes place May 31 to June 3, and is planned to demonstrate to key people of the governments of the world the strength, and universality of jazz.

As for jazz in the White House, it came in the form

of a performance at an entertainment for the Shah of Iran, of Jerome Robbins' ballet, *N.Y. Export: Op. Jazz,* with a score by the brilliant young jazz musician and composer, Robert Prince. It was the thrill of a lifetime to hear President Kennedy, with obvious warmth and sincerity, express his delight that a work of such vitality and quality had been heard at the White House.

Jazz has had its folk heroes. Bix Beiderbecke, Bunk Johnson and Charlie Parker were all dramatic figures who had color, personality and the good luck to symbolize a whole generation of colorful personalities.





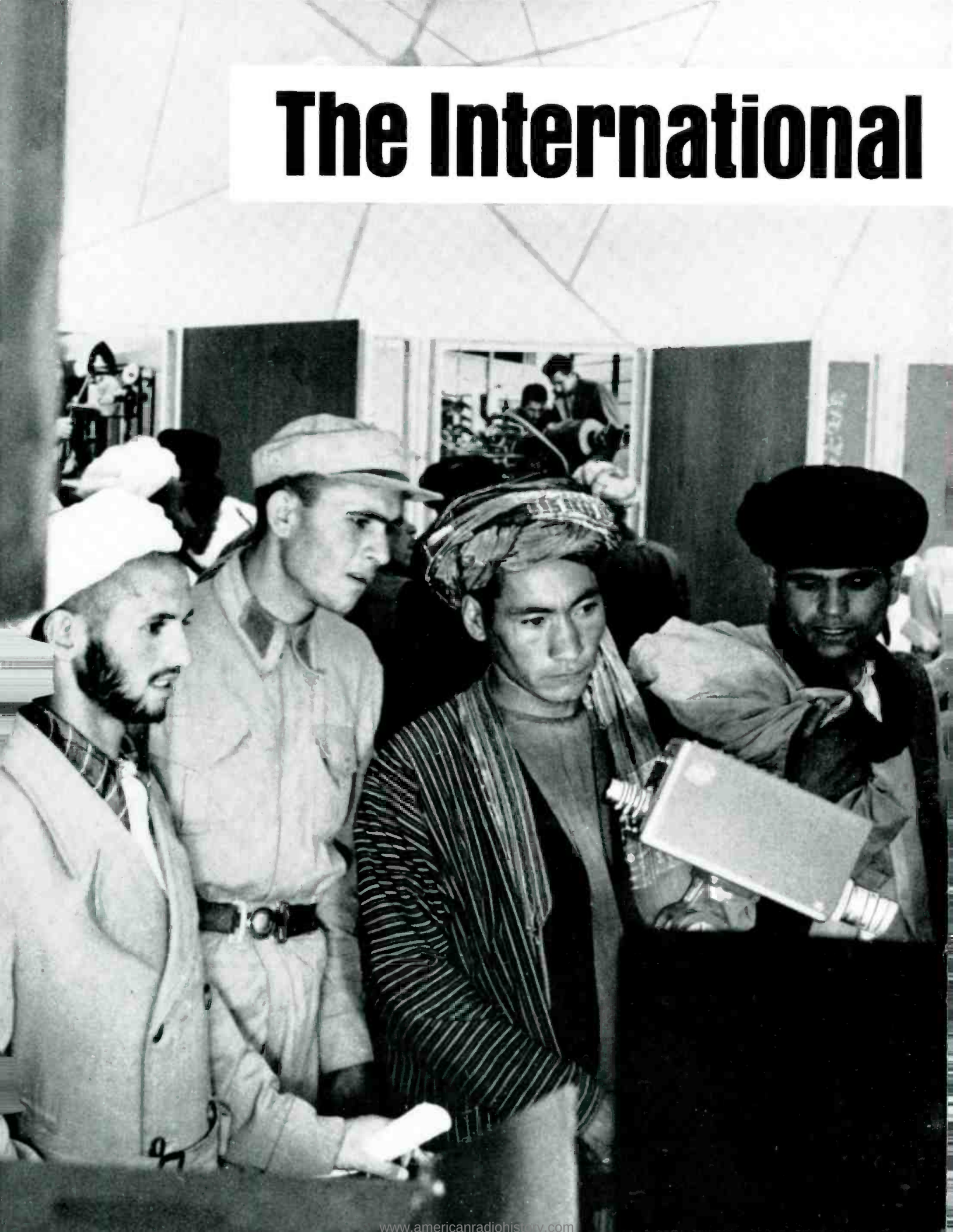
Sonny Rollins;
Jeanne Lee;
Paul Desmond and George Avakian.

Sonny Rollins, a quiet, thoughtful musician who had been acclaimed by his peers as the greatest saxophonist of our time, suddenly retired from the scene in 1959, and has just as suddenly returned in recent months. The complex story of his unorthodox behavior is the very meat of which legends are made, and Sonny has the other characteristics to go with it – a magnificent, almost mysterious appearance, and the ability to play the tenor saxophone with the widest emotional range since the great Hawkins. He is just "far out" enough to be properly called semi-abstract, but not so far out as to lose the commercial touch. Many musicians are quaking these days because The Boss is back, but Sonny has already indicated that he is creating excitement not just for himself, but for the whole field. And that can help everybody.

An article in the April, 1962, issue of *Esquire,* written under the pseudonym Jean P. LeBlanc, blasts the press agentry that has created modern jazz stars, the arrogance of certain musicians, the "bad" music of many star musicians, and the kaleidoscopic and apparently unreasonable flip-flops of the critics. It's difficult to argue against the writer's documentations of one of the most prevalent tendencies in critical jazz writing – to boost a man while he is on the way up and to knock him when he has arrived. It is difficult, too, to quarrel with his observations about the derogatory comments that a critic presents in a magazine article and the glowing praise that will be showered upon the same musician when the same critic is hired by a record company to write copy for an album liner. Despite the devastating facts in this area, the rest of Mr. LeBlanc's article sounds highly subjective and will stir enormous controversy. Controversy has become almost a tradition in jazz.

The new wave of excitement will pay dividends to both musicians and fans. There are signs that the pot is starting to boil again and that an era of opportunity and development is coming. RCA Victor, for many years out of the modern jazz scene but in a prominent historical position thanks to its great store of jazz classics, has stepped into the picture in a commanding fashion with new albums by such established stars as Paul Desmond, Joe Morello and Sonny Rollins. A regular schedule of jazz releases is on the way, interspersing new faces and classic reissues with the strong names. This will, in turn, create a reaction in the business which will shake up the field and stir further activity. Put it all together and the result is a built-in chain reaction. The cycle has been overdue, but is now heading toward an exciting decade with new heroes, new horizons, new arguments and happily, a goodly share of the old ones, too. ■

The International



Screen

Seventy nations can't be wrong, but NBC International must keep a fast pace to serve their varied and expanding needs

by **STANLEY A. LEVINE**

On March 17, 1962, in his hotel room in Lagos, Nigeria, Jack Burrell turned the switch on a cathode ray tube. He received a signal transmitted from the skeletal steel beams of a building under construction nearby. This was the sneak preview for the April 1 inauguration of the Nigerian Television Service, the Federal network of the Government of Nigeria.

Burrell, a top-flight engineer, is a member of an NBC International team of consultants that includes seven Americans, four Englishmen, three Canadians and two Australians. The building under construction will be a modern, air-conditioned, fully equipped studio for the new network. Under the contract between the Nigerian Government and NBC International, Burrell and his teammates will remain in Lagos for two years as managing agents. They will supervise installations, administration, transmissions and the training of Nigerian citizens for the complete takeover of the nation's network.

Meeting the April 1 deadline required equal parts of know-how, hard work, cooperation and enthusiasm. The NBC International (NBI) team had arrived less than two months in advance. Nigeria, a new nation of forty million people, beset by all the problems of a belated industrial revolution, recognized television's potential in the general modernization process. The Government acted and the people responded. Even before the announcement that the contract had been signed, NBI received offers of help from two thousand Nigerian volunteers.

J. Robert Myers, NBI's Managing Director in Nigeria, fully appreciates the Government's desire to use its new medium as a cultural force. He will supervise a schedule built extensively upon Nigerian artists, news and educational programming.

Nigeria is located in only one limited area of the globe. International television involves as many different aspects as the earth contains national, cultural, ethnic, linguistic, economic, technological, geographic and political differences. In its complexity, the infant industry is confronted with vast potential, vast problems and a world of contrasts.

The growth of international television has been so rapid that statistics are obsolete by the time they are published. A year ago there were 1,639 TV stations divided among seventy nations, excluding the United States. The number of TV sets overseas was listed as 47,800,000. Current estimates indicate there will be 53,000,000 sets overseas by the end of this year, a figure that matches, for the first time, the number of sets in the U. S. This is a ratio of approximately one set for every thirty persons, while the U. S. ratio is one to four.

Within this framework of an expanding industry, NBC International, which was founded in 1957, continues to pioneer in four principal operations: the distribution of NBC television programs in foreign markets; the provision of services to management of foreign television stations and networks in the areas of planning, installation, programming, training and administration; the maintenance of liaison between NBC and foreign broadcasters, organizations and governments; the provision of capital for foreign television operations.

Cooperation, enthusiasm, hard work built Nigerian TV Service.

Television holds a fascination for people of all national, cultural, and ethnic backgrounds, as evidenced at this exhibit in Afghanistan.

Thus far, all NBI activity has been related to electronic communications, but some forms of diversification are developing. For example, the licensing of properties (related to NBC-TV shows) to foreign book publishers, record companies, clothing, toy and novelty manufacturers, etc. is being spearheaded by NBC Merchandising.

Program preferences overseas are as varied as the seventy countries involved, but frequently resemble what American audiences want. Westerns, for example, are internationally as well domestically popular, but seem to be producible only in the U. S. "Laramie" and "Bonanza" are engaged in a neck-and-neck race across the Argentine pampas for top ratings.

As in the U. S., there is a tremendous demand in foreign markets everywhere for news and public affairs programming. Series such as the "NBC White Papers" and "Project 20," and news "specials" such as NBC's "American In Orbit" account for sizeable percentages of NBI's billing.

In Germany, the Canaveral countdown of Colonel Glenn's orbital flight was seen by West Berliners on their home screens before photographs of the event appeared in their local press. This scoop was accomplished by NBI with the aid of a special "hot kinescope" technique, jet air transportation and a time differential of six hours between New York and Berlin.

Virtually every nation this side of the Iron Curtain is represented in NBC International's clientele. At this writing, the leading foreign customer for NBC programs is Australia, with forty-two entries, exclusive of news and public affairs shows. NBC International, which does not distribute theatrical motion picture features, leads the competition in a majority of the overseas markets. In 1961, some 7,500 cans of NBC film prints, duplicates and sound tracks were shipped overseas as NBI claimed a very respectable share of the international television industry's 25 million dollars in program sales for that year.

There's more to supplying a foreign market with an American program than merely shipping out a can of film from New York. The show must be understood by the audiences at destination point. This calls for dubbing — the incorporation of a native language sound track that accords with the action, sounds and speech of the original film.

"Bonanza" already is seen and heard in five languages. Ben Cartwright and his three sons, all hearty pioneers of the primitive frontier, now speak English, Spanish, German, Italian and Japanese. In addition to Lorne Greene, Pernell Roberts, Dan Blocker and Michael Landon in the leading roles, sixteen more actors have joined the family, and when in the near future the series is dubbed in French, another quartet of Cartwright voices will enter the clan. The same is true for every other role, major and minor, in every episode — so that it is possible that the international cast of "Bonanza" may outnumber the cast of one of C. B. DeMilles' epic motion pictures, including the armies of extras.

Dubbing is done overseas by independent studios located in the various language areas. Much progress has been made in the techniques which require highly skilled specialists and talented actors. Casting, in which NBI participates, is a crucial matter with important considerations given to voice qualities, per-

sonalty compatibilities and true interpretations. Translators must take care to match the original scripts, not only in meaning but in length, and still retain the spirit. They have succeeded remarkably well.

A service as well as sales organization, NBC International offers its experience, resources and cooperation to any legitimate broadcasting endeavor, any place in the world. Teams of experts have functioned in dozens of nations in all stages of television development. Some have highly developed network systems with administrative or programming problems. Others, who have reached the half-way mark, feel a lag in facilities. A few are in the process of initial installation and many are just thinking of TV for the future. The NBI teams are research groups as well as consultants and they may remain in a country for two weeks — or for two years, as in Nigeria.

Development of foreign markets calls for capital. Overseas financial arrangements vary from country to country, according to potential and local laws. NBC considers it improper to assume control of any operation as sensitive as foreign television, and takes a minority position in all of its services and transactions overseas. Controlling interests remain in local hands, be they governmental or commercial.

In Argentina, NBC International has financial arrangements and associations with Cadete's channel in Buenos Aires (the largest private station in a market of 7,000,000 inhabitants) and in Mar del Plata, and is working toward arrangements with stations in the interior soon to be on the air. In Mexico, there are arrangements with the Tapatia station in Guadalajara and with Television del Norte in Monterrey. There is an equity investment in the Radio Caracas radio and television network in Venezuela.

NBC television programs are enjoyed in all parts of the globe but its international activities touch many areas other than that of liaison with foreign broadcasters. NBC International helps foreign television management with programming, installation and administration; provides capital for foreign tv operations; trains native personnel. Shown are results of efforts in Japan, Venezuela and Nigeria.

A 10 per cent investment has been made in the QTQ television station in Brisbane, Australia. An association involving programming, production and news was formed with Fuji Broadcasting Company's television network headquartered in Tokyo, Japan.

On the African continent, in addition to its role as managing agent for the Nigerian Television Service, NBI has been licensed by the Government of Kenya to invest in a corporation that will operate a series of radio and TV stations, still in the organizational phase.

In 1957, NBC International signed a seven-year contract in London with TWW, independent TV program contractors, to supply them with management services and to represent them in the United States. A representation agreement has been signed with Regie No. 1, the advertising representative of France's major commercial broadcasting interests. Italy's only radio-TV network, RAI, has an arrangement with NBI that involves plans for the development of a second RAI network. NBC International will cooperate with RAI in such areas as studio design, layout, facilities, planning, programming and color television.

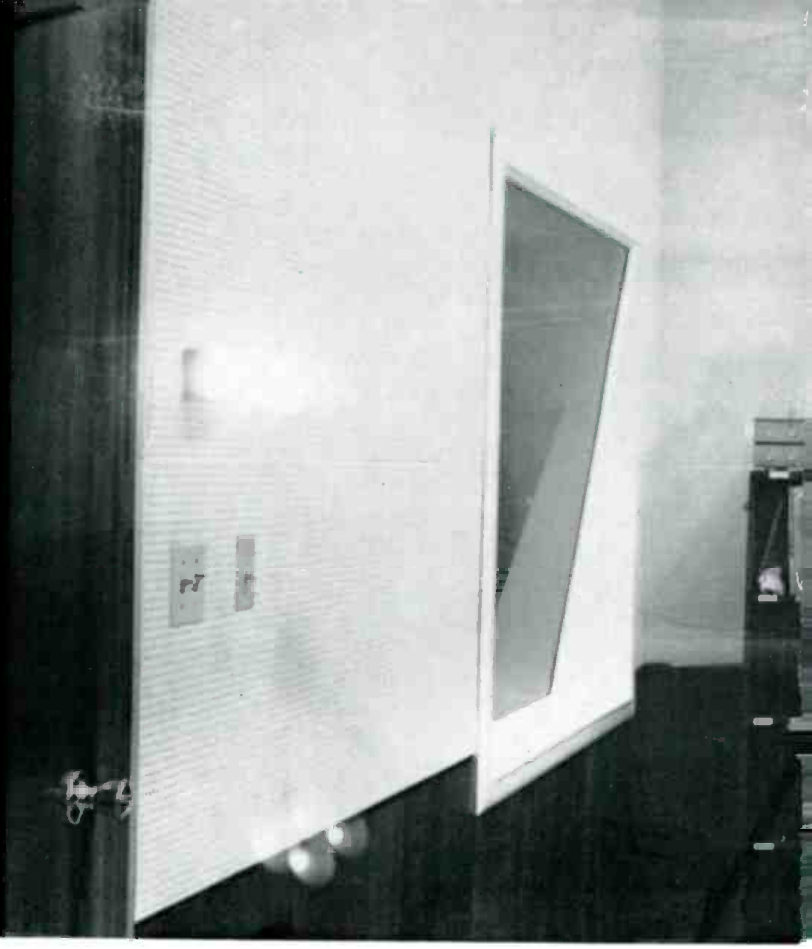
In addition to these various arrangements, special services have been supplied to Peru, Sweden, the Philippines, Germany, Saudi Arabia, Finland and others.

Liaison is a vital and varied function of NBC International. A constant scouting operation is carried on to spot overseas programs that might have potential in the United States for the NBC-TV Network, its owned-and-operated stations and its station affiliates — or for foreign markets other than the point of origin. (NBI is the representative for the National Film Board of Canada in Latin American markets.)

All is not completely rosy in the field of international television. There are more problems than there are markets, and as some are solved, new ones arise. The problems have as many thorns for the local interests as they do for distribution and service organizations such as NBI. Internal politics and attitudes towards the United States are frequently determining factors in doing business. Some nations have quotas regulating the proportion of local programs to imported programs. In many countries there are restrictions on the form and amount of foreign participation. There is increasing competition to be met in the international market, not only among the U. S. firms, but from foreign TV organizations that are also expanding their horizons. It's an open race with no finish line and the brightest green light for international television is the very simple truth that people everywhere want it. ■

FM STEREO

A report on the beginnings and the future of this remarkable new concept in radio



by **BEN FRENCH**

ONE OF THE POPULAR GAMES of fifteen years ago was guessing how radio could survive the glamorous appeal of television. The game was perhaps a sequel to one played twenty years earlier – guessing the fate of phonograph records when radio provided free music over the air.

The guesswork seems to be academic today. Millions of Americans are sitting before phonographs and radios, listening as never before to their favorite music.

One of the vital contributing factors in the increasing popularity of both the phonograph and the radio is the new sound of stereo. Stereophonic sound, which offers the sense of the depth and breadth of music in the concert hall or theater, has been available for home music lovers for several years . . . first in tape and then on phonograph records. Within the past year this new sound has come to radio in the form of FM stereo. Mid-1962 will see a minimum of 150 FM stereo stations operating in one hundred different U. S. cities. Only the phenomenal early days of television witnessed a greater interest on the part of broadcasters for a new development.

The first FM, or frequency modulation, broadcasts just before World War II seemed to many radio listeners to be of superior quality. FM broadcasts seemed quiet, virtually free of the sound interference associated with lightning, electric motors, telephone dialing, etc.

FM transmits sound by varying the frequency of the broadcast radio waves instead of varying their strength, or amplitude as AM does. In addition, FM's character makes possible the broadcasting of sound in a far greater range of frequencies. This range is even greater than the human ear – and certainly far greater than that of the phonograph records available before and immediately following World War II. For that reason and the fact that there were relatively few live music broadcasts, the advent of FM radio was less than an overwhelming success. It wasn't until the development of the high fidelity phonograph record

New York's WTFM, the nation's first twenty-four-hour FM Stereo station and one of eighty-one newly converted stations in range of 70 million persons across the country.

in the early 1950's that FM had "quality" sound to broadcast.

"Hi-fi" was a notable step forward in the quality of music reproduction in the home . . . but the sound of the concert hall still had something the best high fidelity record – or FM broadcast – lacked. The missing ingredients were depth and separation.

When you listen to music in a concert hall, you hear with both ears. The complex web of sound comes to you from all sides. Your ears, hearing independently and yet as a team, tell you from what direction the sound is coming. Regular high fidelity – as good as it is in quality – gives sound only from a *single source*, not from all sides as in the concert hall. It's like looking at a landscape with one eye shut – the scene flattens out, loses its depth, resembles a flat photograph.

The development of stereophonic sound added the missing dimensions of depth and separation to high fidelity to complete the illusion of realism. At first available only in tape recordings, stereo required at least two microphones, two carrier channels and two amplifiers and speaker systems. Sound from the right side of the orchestra was carried through one microphone, channel, amplifier and speaker system while the other set accommodated the left side sound. The effect was astonishing. Suddenly the human ear could "see" a singer walking across the stage or the exact location of the drums or brass section.

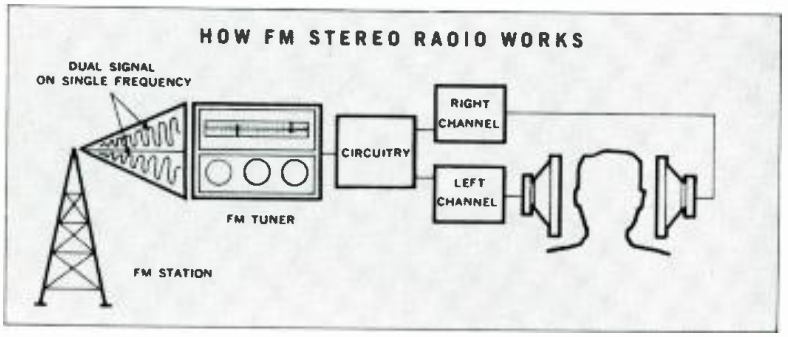
Immediately radio broadcasters and set manufacturers saw the great benefit of adding stereo to their service. The first stereo radio broadcasts – by necessity – involved two separate stations, usually one FM and one AM. These broadcasts added an interesting effect to radio but suffered the handicaps of requiring simultaneous use of two different types of transmitting and receiving circuits, and of missing the full benefit of FM capability. Above all, while an FM-only listener could hear the whole sound, it was not complete or correct since the microphone feeding the

FM station was not positioned for a single pickup. The same trouble bothered a listener to the AM side only. What was needed, obviously, was a system of broadcasting two channels over one FM station. The Federal Communications Commission, after studying a number of proposed systems, approved standards for FM stereo broadcasting on June 1, 1961.

The nation's FM stations began a rush to start dual channel broadcasting. Last July 11, Seattle's station KLSN became the first station to go on the air with RCA's new FM stereo transmitting equipment which had been type-accepted by the FCC a day earlier. The following day station KIXL-FM in Dallas began stereo programming. Nine months later there were eighty-one stations beaming the bi-channel sound of FM stereo to an area covering 40 per cent of the population.

Industry observers expect the number of stations to pass the 300 mark by the end of this year, covering most of the leading cities in the United States. One station already is operating in Canada and stereo generating equipment will soon be on its way to Venezuela and Saudi Arabia.

What about receivers for this amazing sound of radio? Several years before the FCC approved FM stereo standards last June 1, RCA began equipping some console high fidelity radio-phonograph instruments with radio tuners capable of picking up AM-FM stereo radio if it was available locally. The sets were also engineered for an all-FM stereo system by including a jack which would accommodate an adapter once



the specific system was decided. These adapters went on sale shortly after Labor Day 1961 at a recommended price of about thirty dollars. RCA has been hard put to keep up with the consumer demand ever since.

RCA's lowest priced "Victrola" radio-phonograph equipped to take an FM stereo adapter has a retail guide price of $229.95, bringing the price of an instrument providing stereophonic sound in both record player and radio as low as $260.

In addition, six RCA Victor consoles are equipped to pick up FM stereo radio without increase in price.

How does FM Stereo radio work? Reduced to its simplest terms, it comes about through an engineering development which permits the broadcast of two separate sound tracks on the same radio channel — and their separation into left and right channels at the radio receiver.

Technically, FM stereo radio begins with the pick-up of sound by microphones spaced an appropriate distance apart or by stereo pickup equipment playing a record. The separate signals are transmitted over two channels on a single FM carrier wave at the same time. Two signals are fed by separate channels (lines or microwave relays) to the FM station transmitter.

At the transmitter, the left hand and right hand signals are processed separately. They are then fed into a "matrix" in which the sum (left plus right) and the difference (left minus right) are produced. The left-plus-right portion is fed directly to the FM transmitter, producing the whole signal. The left-minus-right signal is fed into the transmitter as a sub-carrier, producing a signal which rides piggy back on the main FM signal. In this way two different signals fit into one FM channel.

Received in combination by the listener's set, these two different signals from the left hand and right hand channels are separated, put through a dual amplifier and fed into separate speakers, one reproducing the left channel and the other the right channel.

The new stereo sets must, of course, have two speakers. These are usually located as far apart as possible within a single cabinet. Some sets have speakers which can be moved to widely separated locations or aimed to bounce the sound off two walls but this is not necessary for the illusion of depth and separation.

The result heard through an FM stereo radio is as close to the actual sound as broadcasting can be — with all the depth and breadth separation possible. The listener with an ordinary FM radio still receives a complete signal — just as he did before the station converted to FM stereo — although the stereo element of sound separation is omitted by the limitations of his equipment. This makes the system as compatible with non-stereo broadcasting as color television is with black-and-white.

With the advent of FM stereo radio, another giant step forward has been taken in the attempt to reach the ultimate in the enjoyment of music in the home. With almost half of the nation's population now within range of an FM stereo system, by year end virtually every major market in the country will be covered. With interest in music of all types at a peak, the success of FM stereo radio seems assured. ■

Report cards and class schedules prepared by computers, exemplify the many areas in which electronics is identified with education.

SCHOOL GOES TO ELECTRONICS

Electronic services and equipment from RCA's new Educational Services Department add a new dimension to education

by **HENRY J. BECHTOLD**

POSTMEN IN COLLINGSWOOD, NEW JERSEY, have started delivering an odd new item of mail to the homes of local high school students this spring. The item: an envelope bearing the return address of the RCA Service Company in nearby Cherry Hill. The contents: a high school report card.

The new service represents the first phase of a pilot program employing an RCA 501 computer system at the Cherry Hill data processing center to prepare and print report cards of the Collingswood Senior High School. The program, undertaken by RCA and the school, is the first such application of a major data processing system.

The operation began with the preparation and printing of 1200 mid-March report cards — a task which normally requires a teacher to spend one full day every six weeks. The computer finished the 1200 cards in only fifty minutes, with time to spare to:

- Prepare separate listings of all honor roll students, students who failed any subject, and students who progressed or slipped by one grade mark or more in any subject.
- Compile a master record on each student, including everything from his or her test results for the current year, grades by subjects and period during the current year, credits for current courses, credits for previous years, and health and physical character.

Through the wonders of electronics a minimum of

75 per cent of teacher time on report card marking can be eliminated and put to some other good use.

Crawford Lance, Principal of the Collingswood School, described the new RCA system as "a good example of how a machine can move in and save teacher time in a legitimate way. At no point does the machine do anything except what it is told to do by school personnel. The computer does not determine grades; the teacher does that."

The next major step in the Collingswood computer program is the scheduling of classes for the 1962-63 year — a project that last summer took the school's staff eight weeks to complete but will take the RCA 501 computer only about three hours.

The Collingswood application of electronics is only one of many areas in which electronics has become identified with education. Electronics is fast becoming a byword in education, and RCA, with its technological capabilities and broad electronics background, is playing a big part in the establishment of this trend.

The RCA Educational Services Department was recently formed to make available custom-designed and packaged educational programs, materials and equipment for schools, industry and government. This new department is keyed to the demands of the nation's rapidly changing requirements in science and technology, and will provide a focal point for all of the Company's traditional educational efforts, introduce new elements, and bring to bear all of its resources on the many opportunities in the diverse fields of education and training.

A unique feature of RCA Educational Services is its "package" concept which includes audio-visual materials such as slides, tapes and records; instructional materials such as programs and texts; equipment such as projectors and television; development and consultation services; and systems design.

The new department, under the guidance of Harold Metz, Division Vice President, combines the long-established RCA Institutes organization with the new Educational Operations and Educational Advisory Services activities.

RCA Educational Operations headed by Ernest W. Lareau, is comprised of four sections: Educational Data Processing, Educational Programs, Educational Methods, and Vocational Education.

Educational Data Processing has started activities with the Collingswood computer program, and now can offer similar services to other high schools.

Educational Programs is primarily concerned with analyzing, developing and implementing educational and training programs. This group's philosophy is that every problem of an educational nature faced by industry, government or other organization is unique. The Department can apply, modify or devise methods that can be employed not only to accelerate a training program but improve the interest level, comprehension and retention of its participants as well.

A client's needs are thoroughly analyzed before Educational Programs utilizes any one or a combination of techniques and methods such as programming educational television, mathematical courses, design, modification and programming of auto- and group-instructional workbooks and devices, conventional instruction and seminars.

One of the more advanced techniques is RCA's Auto-Text, a workbook utilizing a unique combination and modification of the major programmed-instructional techniques. A book usually contains a full course or part of a course on a wide variety of subjects such as physics, chemistry, mathematics or any of the electronics fields.

Industry, faced with the challenge of training more than one million new workers each year during the next decade, is beginning to accept the growing accumulation of evidence proving the worth of programmed instruction. RCA is receiving an increasing number of requests from industry to have product information programmed in Auto-Text form.

The Federal Government, long a leader in the development of new and better methods of training, also is gradually changing its emphasis from conventional teaching techniques to make use of the highly effective programmed instruction method. One area where this new teaching method could play a very important role is in the Federal Government's responsibility for the re-training over the next four years of 1.8 million unemployed.

While RCA Educational Services believes its Auto-Text program will accomplish desired learning more conveniently and inexpensively than teaching machines, it does agree that there definitely is a place for machines. It has developed an audio-visual, self-instructional device called the Auto-Guide, which is being used successfully to instruct individuals in many manual skills such as soldering, wiring and assembling. In this instance, an individual hears and sees, on a machine in front of him, how a particular manual project is undertaken, and proceeds to do it himself.

A coal miner, railroader or bank clerk out of a job could, with a little initiative, find occupational readjustment relatively simple through use of programmed learning. As the Auto-Guide will be useful in teaching the manual skills, so will the Auto-Text be useful in presenting subjects such as computer programming, chemistry, physics, languages, product line information, and courses on missile systems.

Highlight of the Educational Methods function is the creation and development, in cooperation with noted educators, of visually-aided high school courses in physics, chemistry, biology, trigonometry, drafting, geometry, logarithms, and slide rule.

This unique method, using overhead transparencies, should prove a valuable asset to the formal education field which is confronted with a soaring school population, now just short of 50 million students, but by 1970 expected to be approaching 60 million. Add to this a government-forecasted teacher shortage of more than 900,000 by 1970 and an expected classroom shortage of 600,000, and the need for RCA's Educational Services Department is clear.

Mr. Metz emphasizes that in offering services in the field of formal education, RCA "plans to limit itself to techniques, methods and educational aids, for we recognize that the determination of curriculum content is, and ought to be, the province of the professional educator."

The Educational Methods section also will prepare technical and non-technical manuals and brochures for business and industry, as well as outline courses, plan lessons, and prepare visual aids and narrations for electronic data processing service, adult education, special presentation and seminars.

of electronics knowledge in the area and to enhance the attractiveness of specific areas to outside industry.

Other functions already underway or outlined for Educational Operations include:

- Design of courses, seminars and programs — complete with teaching tools — for the extensive government education and training field, both military and non-military.
- Development of specialized programs and consultation services in programmed instruction, language instruction to illiterates, courses and seminars in American industrial practices to foreign nationals and scientific selection of personnel.
- Research, development and application of psychological principles and test procedures to behavioral problems in learning.

RCA Educational Advisory Services, the other major new segment of RCA Educational Services, is a unique activity that is finding increased acceptance in the education field. Under the direction of John W. Wentworth, this group is the focal point in the Corporation for advance planning of large educational projects involving many RCA products and systems.

It works with potential educational customers who are interested in comprehensive systems involving such products and systems as television and radio,

COLLINGSWOOD HIGH SCHOOL
COLLINGSWOOD, NEW JERSEY

REPORT CARD

Grade 10 Year 1961-62 Date 3-15-62

Home Rm. Teacher J EDSON

Counselor A BUFFINGTON

Subject	D	Room No	Pd. No.	Pds. Wk.	First	Second	Third	Fourth	Fifth	Sixth	Final Exam.	Final Grade	Credits
ART II	1	221B	7	5	3	3	4	4					25
BIOLOGY	1	214	2	5	2	3	2	3					50
CLERICAL PRAC.	1	220	3	5	2	3	3	2					50
ENGLISH II	1	221	5	5	3	3	3	3					50
MODERN LIVING	1	319	8	5	3	3	3	3					50
PHYS. ED.	1	GYMG	6	5		1		3					10
TYPING I	1	218	1	5	2	2	2	3					25

												Final Aver.	Total Credits
Days Possible								28					
Days Present								27				Ranked	
Days Absent - Excused								01					
Days Absent - Unexcused													
Days Late												of	

BARBARA A BENSON
Students Name

WILLIAM A. BENSON
230 POHATTAN AVENUE
WOODLYNNE NEW JERSEY

RCA SERVICE COMPANY—EDUCATIONAL DATA PROCESSING

RCA 501 computer prepared and printed 1200 report cards for New Jersey high school, saved teachers a full day of valuable time.

The RCA Technical Institute and Vocational Education activity has a tremendous potential during these times of high unemployment. Currently, this group has submitted proposals to several states offering courses in Basic Electronics to the under-employed and unemployed.

Mr. Lareau explains that these courses are designed to assist a community in broadening the base

audio-visual equipment, programmed instruction and teaching machines, and data processing.

RCA Educational Advisory Services also acts as the promotional arm for all broadcasts and closed-circuit television products in the educational and military training market and has established itself as the corporate source of information concerning all aspects of the educational market. ■

WORDS FOR THE WORLD

**WHEN LEADERS OF NATIONS TRAVEL THE GLOBE,
RCA COMMUNICATIONS, INC. SPEEDS THE NEWS TO AN EAGER WORLD**

by **GEORGE A. SHAWY**

THE INCREASING IMPORTANCE of "personal diplomacy," and the press-covered journeys to the foothills and the summit, have brought unprecedented demands for rapid, efficient communications facilities.

When President Kennedy made his recent trip to Latin America, more than one-hundred members of the press went with him. The eyes and ears of the world were focused on San Juan, Bogota, and especially on Caracas where former Vice President Richard M. Nixon had encountered trouble on a similar visit a few years ago.

To be certain that the news of this trip could be transmitted the minute it broke, from wherever it might happen, RCA Communications alerted its representative in Venezuela and Colombia, George Blackmore, to meet the "advance party" of State Department officials and the President's Press Secretary who surveyed the three cities a week ahead of time. It was on this scouting trip and at these initial meetings that exact requirements were determined. Blackmore acted as the RCA Communications liaison man between U. S. Government officials and the Ministry of Communications in Caracas and, in Bogota, with the Empresa Nacional de Telecomunicaciones. In Puerto Rico, where RCA Communications maintains its own telegraph offices, San Juan Manager Abraham Deutsch also conferred with the advance group.

RCA telegraph facilities connecting official Washington with Caracas — the heaviest traffic volume was expected from there — were made available to the Government. To this facility were added voice broadcast and radiophoto circuits connecting Caracas and Bogota with RCA in New York. Transmitters, receivers, and associated channel equipment on the New York to San Juan, Caracas, and Bogota circuits were checked out to assure signal quality. RCA's Central Telegraph Office operating personnel in New York were given full instructions and alerted for the "Kennedy" traffic.

After advising correspondents of available facilities, Edward A. Grunberg, RCA's Assistant District Manager in Washington, was aboard the "Press Jet" when it took off from Andrews Air Force Base. In San Juan, Press Headquarters were established at the Intercontinental Hotel where a battery of typewriters and direct RCA telegraph and telex circuits to New York awaited the correspondents. Similar press rooms and facilities had been set up at the Hotel Tamanaco in Caracas and the Hotel Tequendama in Bogota, from these locations the world learned of President Kennedy's every move.

At one point, a communications problem arose when President Kennedy visited the small town of Maracay just outside Caracas where extensive wire and radio facilities were not available. To alleviate this situation, commentators made arrangements to fly by helicopter to a communications cruiser anchored off the coast of Venezuela, for unusual seaborne broadcasts. These programs too were picked up by RCA in New York and fed to radio and television stations throughout the country.

The American Broadcasting Company was so pleased with the communications support that it gave RCA's telex service full credits for its up-to-the-minute coverage. They interrupted their regularly scheduled programs several times with Presidential bulletins "... brought to you via RCA telex." Their cameras zoomed in on the RCA teletypewriter clicking away with the Caracas story via a direct connection.

When the four-day tour was over, RCA Communications had handled almost a quarter of a million words by telegraph and telex, as well as the program broadcast spots. Even Associated Press and United Press International, who had flown down their own radiophoto transmitting equipment, sent over one-hundred photos "Via RCA."

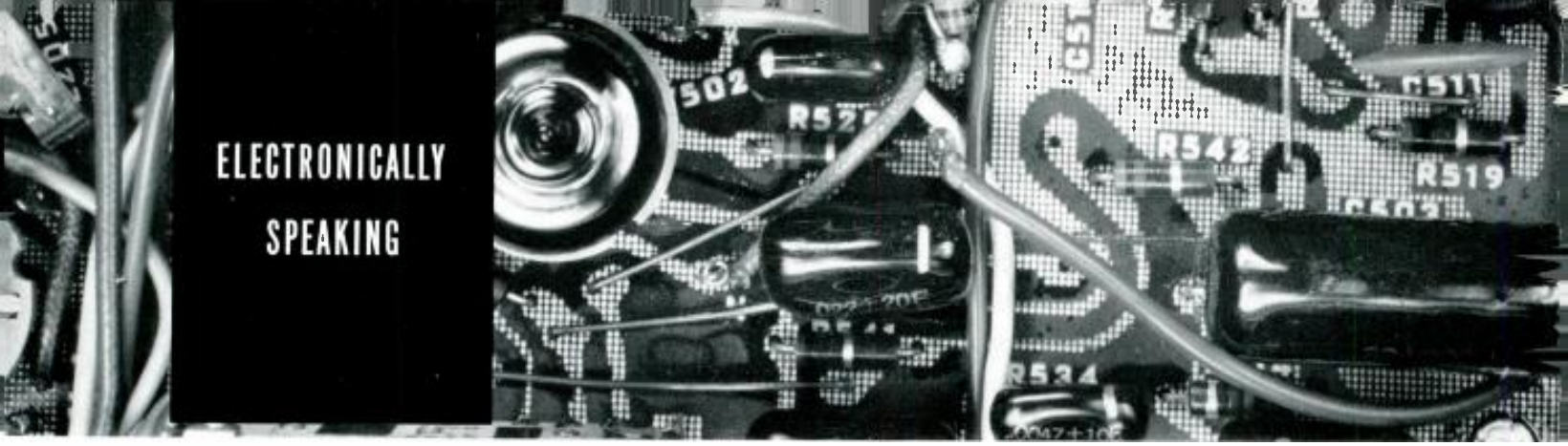
Paving the way for the news is a practised art for RCA Communications. It played the behind-the-scenes communications role on President Kennedy's visit to London and Paris, and to Vienna for the talks there with Soviet Premier Khrushchev. When Vice President Lyndon B. Johnson took off last spring on his 29,000 mile good-will trip around the world, RCA's Ed Grunberg again was aboard to assist the newsmen and to serve as communications liaison man with the Government officials.

Crowds of newsmen and the use of foreign facilities aren't the only problems presented by travel-minded officials. During the 1959 visit of Soviet Premier Khrushchev to the United States, the largest contingent of correspondents was from the foreign press corps, reporting the events to readers in countries around the world. Because of the time differences between the United States and their home cities, deadlines came at all hours of the day and night. And many of the correspondents could not speak English!

The twenty-five-man Soviet press team which included leading journalists from Pravda, Izvestia, and Tass complicated matters by their insistence on paying cash on-the-spot. At the high-point of frantic press room activity, the Russians would generally unload urgent 2,000 word telegrams which had to be counted, rated, and paid for before they could be transmitted to Moscow.

When the twelve-day visit was over, RCA had handled almost a half-a-million words and hundreds of radiophotos and program broadcast transmissions acting once again as a silent partner in the service of a news-hungry world. ■

Communications must work fast to keep pace with traveling officials: President Kennedy in Venezuela (above) and with Premier Khrushchev in Vienna (below).



TITANIC ANNIVERSARY

On the eve of the fiftieth anniversary of the sinking of the S.S. Titanic, RCA's David Sarnoff was honored by the Radio-Television News Directors' Association with a "Distinguished Service Award for fifty years of dedication to the advancement of broadcast news."

In presenting the award, Richard E. Cheverton, President of the Association, recalled how General Sarnoff, as a young wireless operator at the Marconi station atop the John Wanamaker store in New York, received and transmitted the news of the disaster to an anxious world.

Mr. Cheverton remarked, "it was on this night, April 14, 1912 — and for seventy-two hours continuously thereafter — that you set a lasting example for all broadcast newsmen, an example of dedication to duty in the greatest tradition of the profession. You have been in the forefront of every movement to make both radio and television the great media of information you envisioned years ago."

General Sarnoff called attention to "the vital role that radio has played, and continues to play, in times of emergency and in daily broadcasts of news and special events throughout the nation and around the world."

THE GOOD SHIP

The lives of two men now in the RCA organization were greatly influenced by the same ship, but it took a trip to London from opposite ends of the earth for them to meet.

Cecil Brown, presently chief of the NBC News Bureau in Tokyo, was rescued by the British destroyer *HMS Electra* when the British battleship *Repulse* was sunk shortly after Pearl Harbor.

Later in World War II, when the *Electra* was sunk in the historic naval battle of the Java Sea, an American submarine commanded by Captain Henry G. Munson rescued fifty-four crew members.

Recently, Mr. Brown and Captain Munson, who is now a member of the Technical Staff in Advanced Military Systems at the David Sarnoff Research Center, took part in a London television program dramatizing the story of the *Electra*; and learned there of their coincidental connection with the *Electra*.

"CHEECHAKOS"

When the RCA Service Company took over the management, operation and maintenance responsibility of the White Alice communications network in Alaska, the Alaskans decided to look before they leaped into any kind of welcome for the "cheechakos" or newcomers.

As the RCA employees settled into their daily routines, the native Alaskans were surprised at the effort made by the new citizens to become a part of their community with the obvious help and encouragement of their employer. Either individually or as members of the RCA Civic Club, virtually all of the 200-plus contingent at the White Alice Headquarters have pitched in on community projects. RCA personnel helped clothe a family of nine that was burned out of its home, they supplied water to an isolated community that had run dry in the middle of the winter, and even housed an entire Eskimo village when the weather endangered their lives.

At least one Alaskan has been convinced to accept the cheechakos. She's the lady mayor of the town of Bethel and she recently *married* the RCA Site Supervisor there!

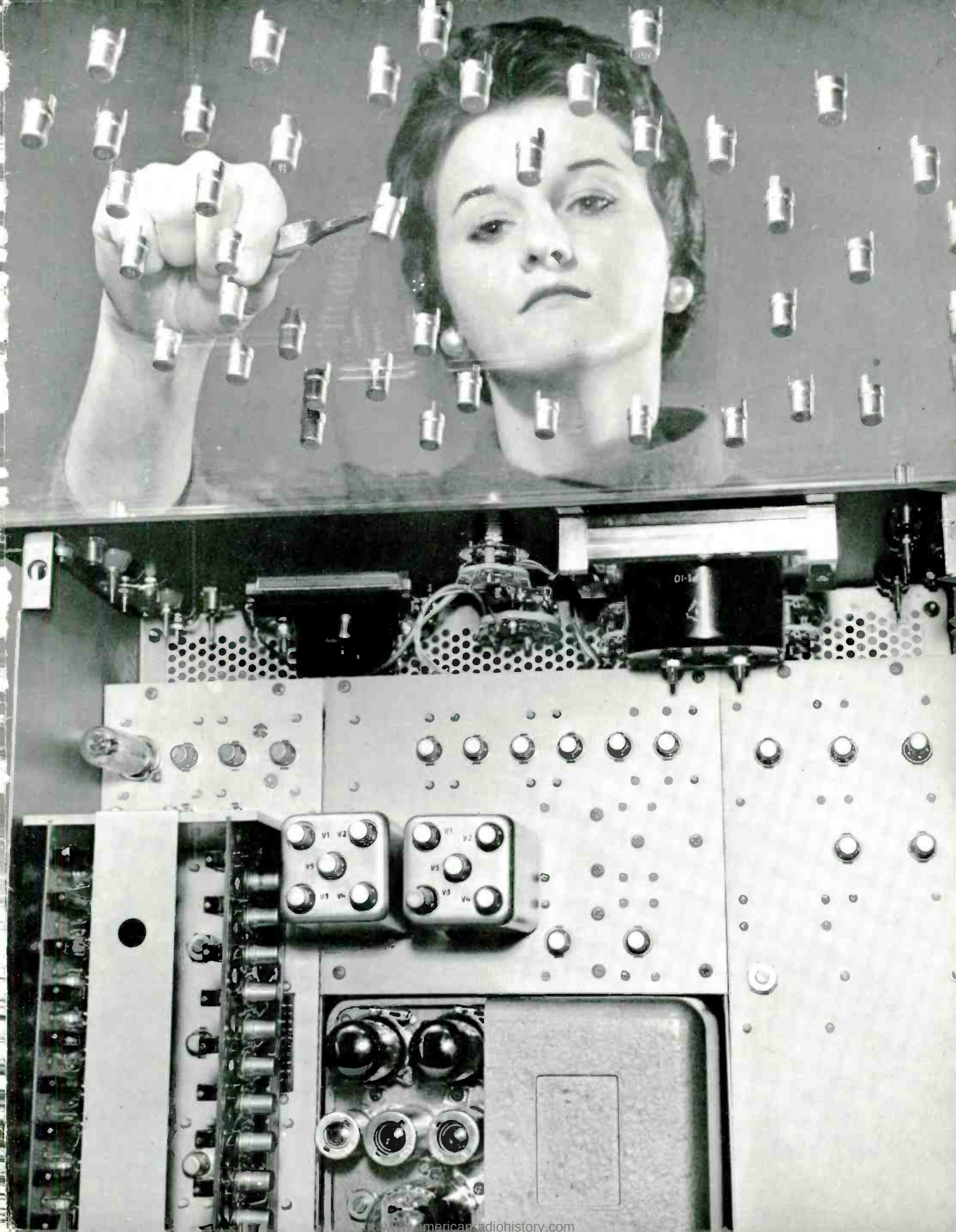
MILLION DOLLAR EXHIBIT

A majority of the 73,479 visitors who attended the Institute of Radio Engineers' show at the New York Coliseum saw RCA's collection of Space Age electron tubes and components valued at more than a million dollars.

Engineers viewed RCA tubes similar to those used in the radio aboard Astronaut John Glenn's earth-orbiting spacecraft, and RCA camera tubes which are slated to televise lunar landscape in future space exploration projects.

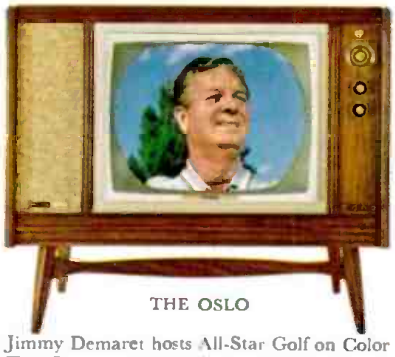
Among the ingenious electronic products on display were RCA thimble-size nuvistor electron tubes shown at right with a dynamic wave analyzer for measuring the vibration of jet engines. The device uses forty-two nuvistors in its compact circuits.

Picture Credits: Cover, Dennis Crow; p. 3, Dennis Crow, p. 6 7, American Cancer Society; p 8 (bottom), United Nations; p 9 (top), U.S. Fish and Wildlife Service; p. 9 (bottom), Standard Oil "Lamp"; p. 12, American Telephone and Telegraph Co.; p. 16-17, Joe Alper; p. 24-25, WTFM; p 30 (top), UPI, p. 30 (bottom), Magnum.



TIP FROM JIMMY DEMARET:

"You don't know what you're missing till you follow All-Star Golf on RCA VICTOR COLOR TV!"



THE OSLO

Jimmy Demaret hosts All-Star Golf on Color TV. See also Walt Disney's "Wonderful World of Color," Sundays, NBC-TV Network.

Nationally advertised list price shown, optional with dealer. Slightly higher West, South. UHF optional, extra. Price, specifications subject to change.

There's no TV like Color TV! Look what RCA Victor offers:

1. RCA Victor brings you Color TV performance-proved for seven years in homes from coast to coast. *Result:* reliability and quality you can count on!

2. The entire Color TV industry has adopted RCA's color tube as the standard. This tube brings you a picture so lifelike *you have to see it to believe it!*

3. TV's most dependable circuits are RCA Victor Security-Sealed Circuits, precision-crafted to give you the *most uniform, most dependable circuitry* ever built into TV. Security-Sealed Circuit Boards have no old-fashioned hand-wiring to come loose and short-circuit!

4. RCA Victor brings you the widest choice of models and prices in Color TV, starting from $495 (The Bromley, not shown). Most models are available with full-function "Wireless Wizard" remote control.

RCA The Most Trusted Name in Television

Tmk(s)®