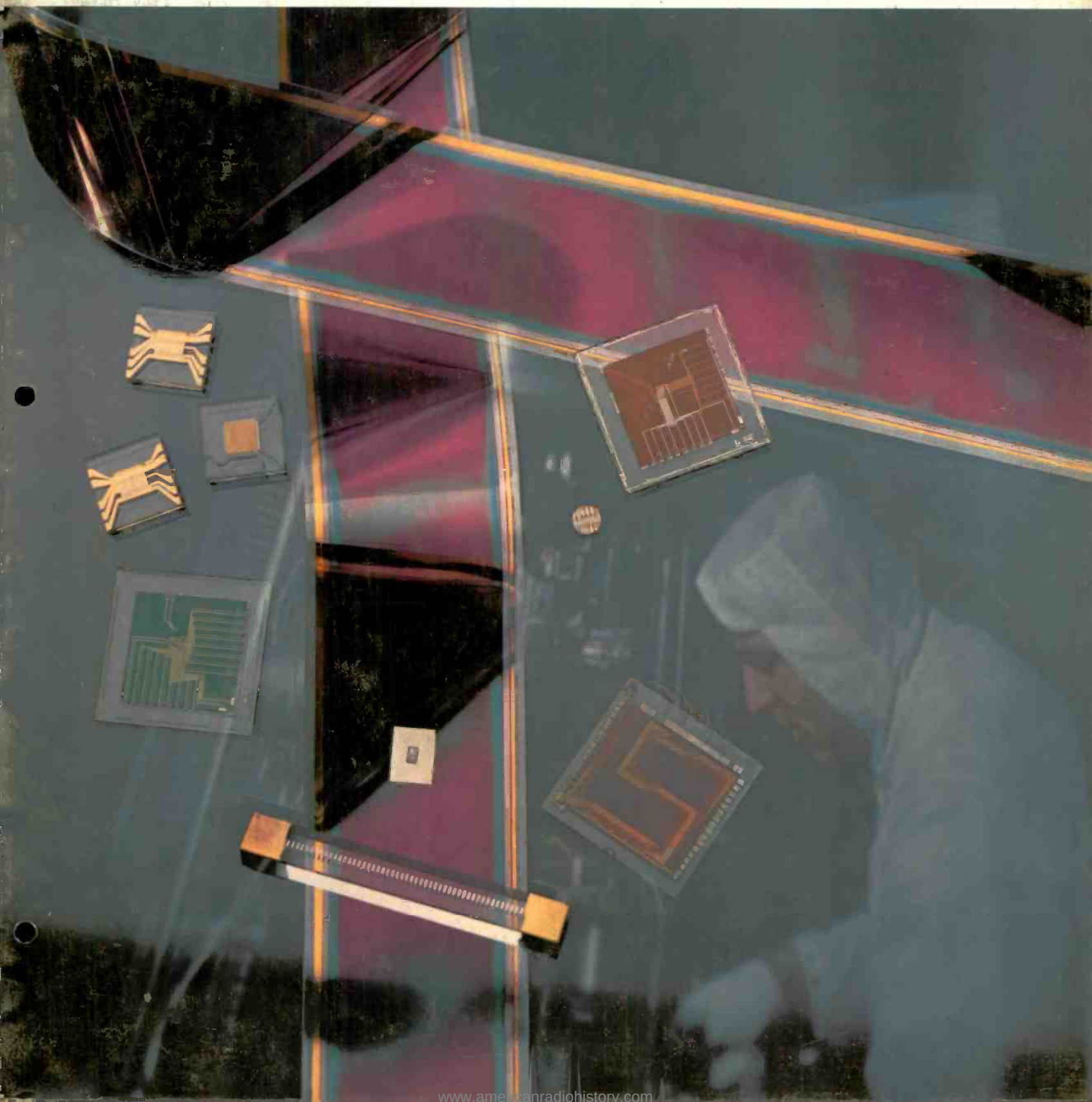
# ELECTRONIC AGE



Summer 1966

*Electronic Films: An Emerging Technology*



An engineer inspects a punched paper tape that has been used to generate the letter "a" on an oscilloscope in a demonstration of RCA's unique electronic type composition system. Called Videocomp, the system combines computer and television techniques to set type as fast as 100 manual linecasters. Each of the holes on the paper tape provides information on the position of dots needed to form a character. Displayed on the face of a high resolution cathode ray tube, the characters are exposed directly onto film or paper for subsequent printing by offset, letterpress, or gravure processes.

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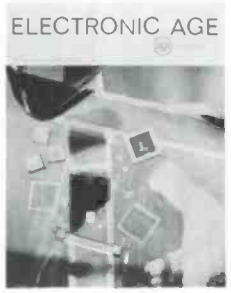


*Cover: Expanding technology of electronic films is represented in this photo montage. The violet ribbon is a new thin-film structure that records pictures electronically. The three large squares are superconductive computer memories. The three small squares are components for a proposed flat TV camera. The tiny circle is an array of silicon-on-sapphire transistors. The small square on the tape is a silicon-on-sapphire video amplifier circuit. The translucent oblong is a sonic-film computer memory. In the background, a research technician in a "clean room" uses an evaporation furnace to produce electronic films. An article on electronic films begins on page 12.*

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RCA Vol. 25/No. 3 Summer 1966

# Elections '66: Year of Analysis

NBC and RCA personnel rehearse for election night coverage. Frank Jordan, after consulting with Henry Phillips (extreme left), alerts studio that computers have begun to print out data.

by Robert E. Tolles

On the evening of November 8, political analysts, commentators, newsmen, engineers, executives, and computer specialists will assemble in Studio 8-H and adjoining rooms of the National Broadcasting Company to engage in what has become a biennial ritual. Aided by electronic data processing equipment, these highly trained experts will render a fast, accurate, and comprehensive picture of the results of the 1966 elections and prove once again that television has become the prime source of information on the election story for the American public.

"Elections 1966" will introduce a number of innovations by the networks in their continuing effort to improve their coverage. The bare statistics of total vote, percentage swing, and party composition of the House and Senate will be increasingly visualized for the convenience of the viewer. Electoral sentiment on critical public issues such as the war in Vietnam will figure prominently in the remarks of the election commentators. The method of projecting a winner on the basis of an infinitesimal portion of the total vote has been refined and made more accurate. Supplying the raw material for this mass of statistics, facts, and interpretation will be that indispensable tool of modern election coverage — the electronic computer.

In addition, vote-gathering will be faster and more efficient. Two years ago, the three television networks and the two major press associations formed News Election Service (NES) to coordinate and make possible more accurate and more complete vote collection. For the coming election, NES will assign some 100,000 part-time poll reporters to cover the nation's 172,000 precincts. These reporters will telephone results to county and state vote-collection centers which, in turn, will teletype the consolidated totals to the subscribing networks and press services.

In an effort to speed even further the collection of the vote, NES in cooperation with NBC this year will experiment with a computerized vote tally in 11 Western states. Raw vote totals will be fed to an election headquarters in Los Angeles, where they will be punched onto cards at the rate of 25,000 an hour and then fed into a computer. The computer will add the vote totals for the various senatorial, congressional, and state races and transmit the results via punched tape and data link to the network and press association computers as well as back to the state from which they came.

Both RCA and NBC have recognized the importance of election reporting and, apart from NES, have set up permanent units that operate year-round in planning and perfecting their coverage. A major function of RCA's newly organized Special Computer Systems Projects is to assist NBC in the analysis and compilation of election returns. NBC has a full-time professional staff of three whose principal task is to prepare for each succeeding November.

Frank J. Jordan, NBC's Manager of Election Planning and a man for whom elections are both vocation and avo-

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

*Television coverage of the November balloting will be faster, more accurate, and more comprehensive than in any previous election.*


Center, programmers and operators monitor computer operation. Right, RCA computer specialists Howell Land (left) and Dr. Richard Link examine data that have been processed by the computer.

cation, predicts that 1966 will be the year of analysis. "Up to 1960, the computer was used simply to tally the vote. Then, in 1962 and 1964, the emphasis on vote-counting diminished and was replaced by the fast projection. This year, we are not so much interested in projecting winners as we are in finding out why the voters voted as they did."

Correlations between the vote and specific issues, such as Vietnam, civil rights, antipoverty, and inflation, will be sought by the political analysts. In fact, Jordan believes this may be one of the most important off-year elections since it will be an unofficial referendum on the policies of the Johnson Administration. "Every race will be viewed in the light of to what extent it reflects approval or disapproval of Administration policies," he said.

The use of electronic vote processing to detect voter preference and attitude is a relatively new, if not precise, science. It is based on the assumption that people vote in definite patterns according to age, ethnic background, education, socioeconomic level, and other factors. The trick is to find voting precincts that correspond to these patterns and then use them to help make projections of entire election races.

The NBC/RCA system of vote analysis uses two types of precincts. One is the so-called "key" precinct, common to all vote analysis systems, that is barometric to the outcome of the election. Thus, to take a hypothetical case, a precinct in a suburb of Chicago has been found to be indicative of the vote in northern Illinois. The vote in this one particular precinct, taken in conjunction with a historic voting pattern that shows northern Illinois to be 5 per cent more Democratic than downstate Illinois, may well foretell the outcome of that state's election.

The other type of precinct is the so-called "tag" precinct, which is characterized by a particular demographic feature. This is a precinct with a large and identifiable portion of high- or low-income people, or of Catholics, Jews, or Negroes, of farmers or city dwellers, or of any one of a number of ethnic groups. Various special groups, such as milk farmers in New York State or tenement dwellers in Atlanta, may be selected if it is believed their attitudes may have a particular influence on an election. Given the past voting history of these groups and their proportion in the state as a whole, these precincts provide insight into where the vote is coming from and how attitudes have shifted.

The use of key and tag precincts has its limitations because Americans do not always vote in a precisely predictable fashion. The key precinct system, for example, has a built-in error of plus or minus 2 per cent. In a close election, this range of error can prevent the experts from calling a winner.

To counter this deficiency, the RCA Special Computer Systems Projects group with the aid of expert consultants has devised its unique Electronic Vote Analysis (EVA) system. In essence, this is a computerized approach to the analysis of election returns that uses specially constructed and highly sophisticated mathematical models.

Above, Arthur A. Katz, who heads up systems analysis for Special Computer Systems Projects, discusses a race with an associate.

Arthur A. Katz, Manager of Advanced Systems Analysis and Development for SCSP, describes EVA as a system for taking the various elements of election reporting — the key precinct sampling procedure, expert political judgment, and the vote itself — and welding them together to produce a projection.

"In the beginning of the evening, all we have to go on are the pre-election estimates that have been made by the political experts from their polls. At the end of the evening, the vote is in and the results are known. EVA operates in between and enables us to come up with a statistically accurate projection by combining in varying proportions the expert's educated guess, the sample precincts, and the vote itself."

The RCA experts use what they call a convergent model, which is a statistical construct that combines knowns and unknowns. The object is to raise the probabilities, as the vote pours in, to the point where doubt is virtually eliminated and a projection can be made. This may occur relatively early in the evening when there is a strong identifiable trend for a particular candidate. Or, in a close election, it may require many hours of waiting until a much greater percentage of the vote can be counted. In either case, adherents of EVA maintain their system is accurate within plus or minus half a per cent.

A further feature of EVA is its capacity for "statistical tuning." This is a system for structuring the voting districts in a state according to some 50 different geographic or demographic criteria. Again, the purpose is to combine the known with the unknown to reduce the probability of error. Suppose, for instance, the vote from one county indicates a certain association between the Republican vote and the proportion of high-income people in that county. It can be assumed, then, that same association will apply to a certain number of other similarly structured counties from which the vote is not yet in. The political analyst in charge of that particular race thus "tunes in" this assumption into the computer, which then comes up with a projection based on the new information.

"What we try to do is isolate every vote pocket in the state on the basis of past performance and then put the pockets together until we have our projection," Katz said.

To process the vast amount of vote information that will be funneled into NBC's election headquarters, RCA has assembled an integrated four-computer system with a memory capacity for storing 3 billion bits of information. Two large RCA 3301s are used for basic computation and processing of data output. Two smaller 301s have specialized purposes; one processes the demographic news analysis data coming from the tag precincts and the other will handle special tasks.

In some respects, the most valuable part of the NBC/RCA vote processing system is its Data Bank. Over the past five years, the computer specialists have placed on punch cards and machine tape vote totals down to the precinct level of all Presidential elections since 1920, of congres-

Computer personnel gather at control station prior to start of operations. Vote information is processed by a four-computer complex.

Election data are spewed out from computer's high-speed printer. Sheets are delivered to the political analysts for race projections.

sional elections since 1946, and senatorial elections since 1950. SCSP people maintain it is the largest and most comprehensive file of election returns available anywhere.

In addition, the Data Bank has been expanded in recent years to include a good portion of the information from the U.S. Census. Some 161 items of data for each of more than 3,000 counties — information such as age distribution, the amount of money in checking accounts, the number of vacant housing units, the number of food stores, the number of cattle — have been placed into the Data Bank.

The Data Bank, the huge computer center, and SCSP's talented staff are expected to provide an important source of new business for RCA in future years. According to Henry W. Phillips, Manager of SCSP, the department is organized to handle large systems projects, including an RCA-Data Source Utility business venture, and special projects for commercial and governmental customers having need of large specialized computer systems.

The prime and continuing function of RCA's computer system, however, is the compilation and analysis of election returns for television. Under its influence and that of the television networks, election coverage has undergone a metamorphosis. Reporting has been speeded up to the point where returns are known a few minutes after the polls close. Through the years, the system has evolved from its initial role as a mechanical vote counter to become a highly sophisticated analytical machine that pinpoints voting trends and offers insights on why people vote as they do.

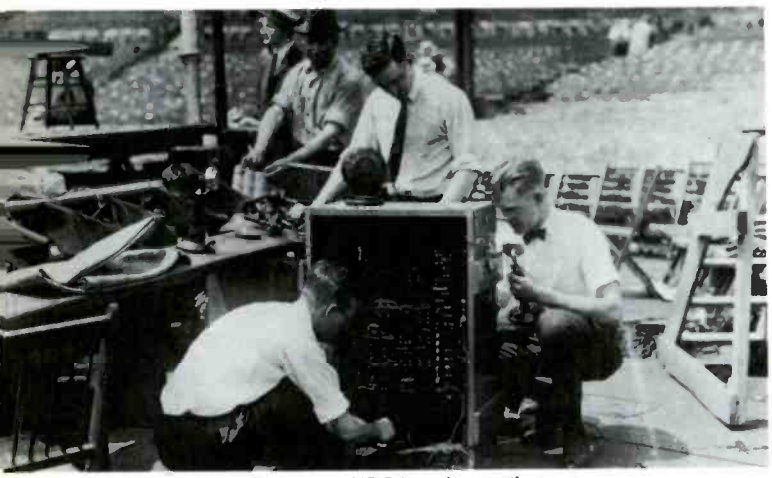
These changes have not always been welcomed. A number of critics have complained that this new apparatus of election coverage has taken the suspense out of poll-watching. Others are worried that a computer projection of a winner on the basis of fragmentary returns might lessen the incentive for people to vote in states where the polls have not yet closed. Still others see something sinister in what they think is the uncanny ability of the computer to foretell the voting preferences of 70 million American men and women.

But computers are not uncanny, nor are they smarter than the humans who program them. They are, however, infinitely faster, and they can perform complicated analyses. But they cannot substitute for the trained political analyst who must make an informed human judgment before he can instruct the computer to give him the answer.

"What the computer permits us to do," says Dr. Richard Link, SCSP Manager of Statistical Analysis, "is to generalize and quantify what the political experts have done for years. It has enabled us to look at 5,000 different things all at the same time and sort out for examination the most significant items."

Electronic vote processing has probably eliminated the drama, such as occurred in 1948, of a candidate going to bed on election night not knowing whether he would be President-elect or not the following morning. But it will not make obsolete the human sagacity that told him he had nothing to worry about. ■

# NBC's 40th Anniversary

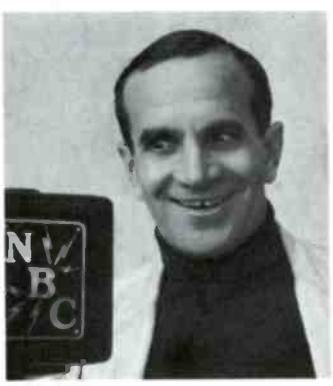


Dempsey-Carpentier fight — a pre-NBC broadcast milestone

"The Happiness Boys"


Milton Cross


Will Rogers




Al Jolson

Eddie Cantor

Weber and Fields

Al Smith


Herbert Hoover

*From its inaugural broadcasts in 1926 to today's full-color television schedule, the National Broadcasting Company has been a major force in entertainment and communications.*

by Samuel Kaufman

On an evening in the late autumn of 1926, a thousand guests in full evening dress gathered in the Grand Ballroom of the old Waldorf-Astoria Hotel at 34th Street and Fifth Avenue in New York City for a program of memorable entertainment. It was an unusual occasion — but to the guests in the ballroom, the feature that made it truly unique was not to be seen. It lay elsewhere — in more than two million homes scattered across the country as far west as Kansas City. In these homes, radio fans sat intently before their sets and twisted dials as they strained to hear the program of entertainment through countless decibels of interference.

The date was Monday, November 15, 1926, and this was the inaugural radio program of the National Broadcasting Company — America's first radio network. From the ballroom of the old Waldorf, the program went out to more than half the radio homes in the nation through 25 stations in 21 cities.

Merlin Hall Aylesworth, President of NBC, opened the ceremonies with a five-minute speech. Then Mary Garden, from Chicago, introduced by Milton Cross, sang "Annie Laurie" and "My Little Gray Home in the West." The program lasted four hours and 25 minutes and included the finest talent available in the mid-twenties: the New York Philharmonic Orchestra conducted by Walter Damrosch, the New York Oratorio Society conducted by Albert Stoessel, Edwin Franko Goldman and his Band, the comedy team of Weber and Fields, Will Rogers (by remote broadcast from Independence, Kan.), and the dance orchestras of Vincent Lopez, Paul Whiteman, George Olsen, and Ben Bernie.

The creation of NBC may have saved radio from infant mortality. Between 1922 and 1924, the number of radio stations increased from 600 to 1,400. But most of these stations were operated as promotional sidelines of other businesses or hobbies: programs were amateurish and schedules inconsistent. As their novelty wore off, the mortality rate of these stations was rapid: from 1,400 in 1924 down to 620 in 1926.

Programming was dependent on whatever local talent the stations could muster. Even the important stations had no economic basis for expanding, improving, or maintaining their broadcast operations. Leaders in the infant industry recognized there was an urgent need for a regular, professional, program service on a national basis that would reverse the process of radio's decline.

SAMUEL KAUFMAN is News and Feature Editor at NBC.

The National Broadcasting Company was established to meet this need, and its purposes were announced in a newspaper advertisement published by the Radio Corporation of America on September 13, 1926. The ad stated that RCA had purchased Radio Station WEAF in New York from the American Telephone & Telegraph Company and that RCA was forming NBC "to provide the best programs available for broadcasting in the United States." The ad went on to say that NBC "will not only broadcast these programs through station WEAF, but it will make them available to other broadcasting stations throughout the country so far as it may be practicable to do so, and they may desire to take them. It is hoped that arrangements may be made so that every event of national importance may be broadcast widely throughout the United States."

The man responsible for the creation of NBC in 1926 was David Sarnoff, now Chairman of the Board of Radio Corporation of America, then Vice President and General Manager. In 1916, as an employee of the Marconi Wireless Telegraph Company of America, he foresaw "a radio music box . . . which would make radio a household utility in the same sense as a piano or phonograph." And, in 1922, he suggested a nationwide program service via networking. The goal was realized four years later with NBC's inaugural. Throughout NBC's 40 years, General Sarnoff was the guiding figure in the radio network's growth, the inception and expansion of television, and the introduction of compatible color to the industry.

Although only a single program service was contemplated when NBC was formed, the widespread demand for network service led almost immediately to the establishment of a second network. NBC engineers named the two networks Red and Blue for the sake of convenience when drafting maps of network coverage.

Initially, 25 stations constituted the Red network and six the Blue. A Pacific Coast network of seven stations was also created in early 1927. Although the first coast-to-coast network program transmission by wire was achieved on New Year's Day, 1927 (Graham McNamee describing the Rose Bowl game from Pasadena), transcontinental network operations did not become economically feasible for another two years.

In NBC's four-hour inaugural program, all the numbers were musical except for Will Rogers' monologue and the comedy act of Weber and Fields. As time went on, the variety of program fare was enormously broadened. Pro-

Amos 'n' Andy

Rudy Vallee

Fred Allen

Ed Wynn

Bob Hope and Jerry Colonna

Arturo Toscanini

Jack Benny and Mary Livingston

Jimmy Durante

Babe Ruth and Graham McNamee

Fanny Brice

Red Skelton

Bing Crosby

An early NBC mobile unit

grams in every category — drama, music, religion, education, sports, science, news, interviews, and discussions — attracted wide audiences. Performers from all the entertainment media — stage, screen, recording, music, opera, vaudeville, and nightclubs — were recruited for the new business of broadcasting. But it was soon apparent that broadcasting did not need to borrow talent from other fields; it began nurturing outstanding performers of its own. At the same time, both set sales and audiences soared.

Musical programs became a staple in NBC programming, beginning in 1928 with the NBC "Music Appreciation Hour" narrated by Dr. Damrosch. In 1931, NBC broadcast the first complete opera from the stage of the Metropolitan Opera House, and in 1937 it organized the first full-sized symphony orchestra formed exclusively for the benefit of radio listeners. Arturo Toscanini, the world's most eminent conductor, was induced out of retirement to lead the orchestra.

The largest audiences, however, were attracted by comedy and light entertainment programs. The full flowering of this type of programming came during the thirties with the appearance of such comedy stars as Cantor, Jolson, Vallee, Allen, Benny, Hope, Durante, Crosby, and Bergen. Earlier devotees of radio will recall, however, that they were preceded by such broadcast pioneers as the Happiness Boys, May Singhi Breen and Peter DeRose ("Sweethearts of the Air"), Jolly Bill Steinke, and Roxy and His Gang.

In drama, NBC originated the technique of adapting for radio the stage play, the novel, and the short story. Almost every major figure of the American theater has been presented during NBC's four decades of radio broadcasting. At the same time, a new form of entertainment, the serial drama, was developed. In 1928, Station WMAQ, Chicago, put two unique characters on the air: Amos (Freeman Gosden) and Andy (Charles Correll). The "Amos 'n' Andy" daily dialogues were soon transferred to the NBC network where they became a national institution. The 15-minute daytime serial, beginning with "The Rise of the Goldbergs," instituted a new ritual for the American housewife.

News reporting, analysis, commentary, and eyewitness descriptions of important events soon grew into one of the most vital of program categories. Prior to World War II, radio was for the most part a vehicle for brief news bulletins rather than the comprehensive, continuous journal of world events it was to become — a role that has been enhanced with the advent of television.

The broadcasting of special events in the early days called for special ingenuity on the part of NBC engineers to arrange for remote pickups, shortwave transmissions, and switching controls. To cite a single example: a 1927 *tour de force* of radio coverage was NBC's handling of the reception of Charles A. Lindbergh upon his arrival in Washington after his historic flight to Paris. Graham McNamee at the Navy Yard reported in staccato fashion Lindbergh's landing from a cruiser, Milton Cross up in the Capitol dome gave an eyewitness account of the official reception, John Daniel from the Treasury building described the parade down Pennsylvania Avenue, and Phillips Carlin "wrapped it up" from the top of the Washington Monument.

By the time of NBC's 10th anniversary, its correspondents were on the front lines in Ethiopia and Spain. During the Munich crisis in 1938, when atmospheric conditions cut off other American broadcasters from immediate access to events in Europe, the NBC News Department set up a roundabout radio circuit from Europe to Africa to South America and finally to New York. Through this circuit, Americans heard Prime Minister Chamberlain say that Hitler would "come halfway to meet me" in Munich.

As war clouds gathered and broke, NBC rapidly expanded its news coverage. NBC newsmen accompanied the American armed forces on every front, and the radio audience heard them describe at firsthand the landings in Africa and Italy, night bombing missions over Germany, defeat in the Philippines, and the island-hopping advance toward Japan. On D-Day, NBC reporters rode with the first wave of invasion troops in the Normandy landings. At home, nothing was heard on the network for 24 hours except bulletins from the fighting front, news analyses by NBC correspondents, and the prayers and inspirational words of Allied leaders on both sides of the Atlantic.

At war's end, NBC's worldwide roster of reporters and commentators numbered 65 persons. The war had built the network's News Department into a truly international service, and it was continued on a permanent basis.

Within five years after its inaugural radio program, NBC began transmitting television pictures from an antenna atop the Empire State Building. However, a number of years elapsed before television was introduced as a regular program service by RCA's David Sarnoff at the New York World's Fair in 1939. And it was not until the postwar years that television reached its maturity as perhaps the most important single innovation in communications of the century.

Early television publicity frequently referred to the new medium as "sight added to sound." The orchestra and singer were now to be seen as well as heard, as was the newscaster reading his script or the comedian telling his jokes. But this concept was quickly outgrown as television brought new program subjects to the screen and gave new dimensions to established program types.

In 1945, President Truman was heard over an Eastern television network at the 1945 Navy Day exercises in New York's Central Park. Later that year, the Army-Navy football game in Philadelphia was brought to New York by coaxial cable and broadcast over WNBT. These were TV network "firsts," but at this stage of television broadcasting almost every major program was a "first" of some kind.

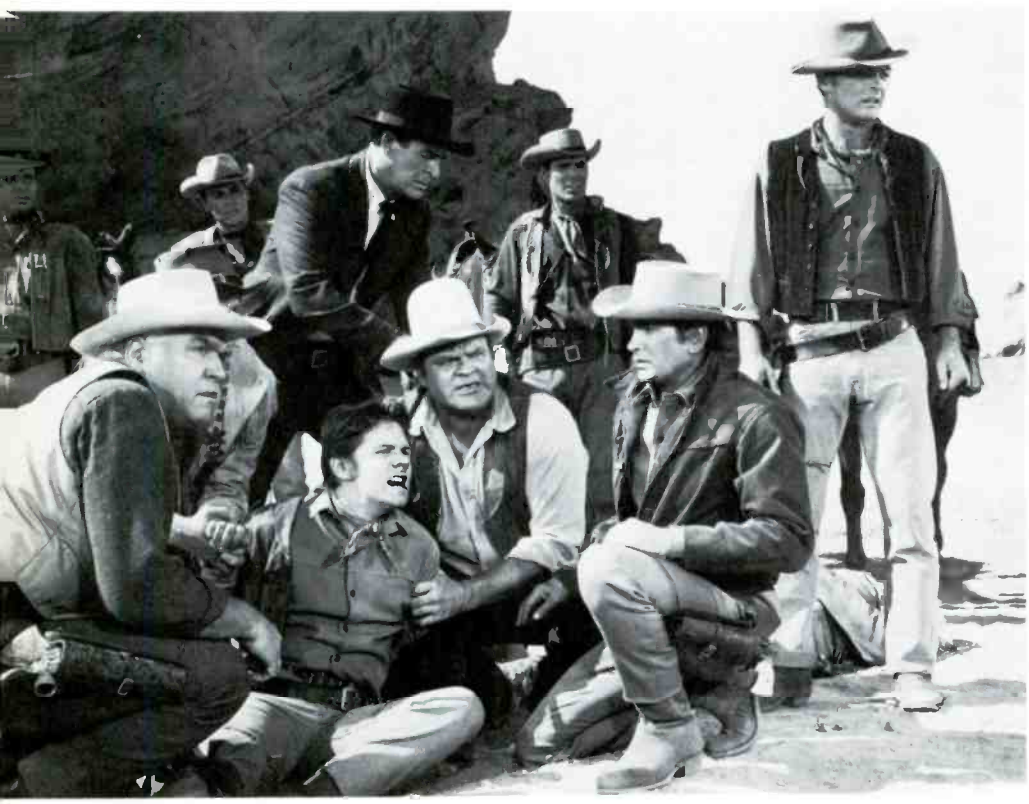
By 1947, with only six stations in operation and only 14,000 TV homes in the country, the NBC-TV network was telecasting "Kraft Television Theater," the World Series, "Howdy Doody," the Theater Guild dramatic series, and the Louis-Walcott fight.

The year 1951 marked NBC's first quarter-century of service. To celebrate, the network inaugurated regular coast-to-coast TV operations; the first program to be carried was NBC's coverage of the signing of the Japanese Peace Treaty on September 8 in San Francisco.

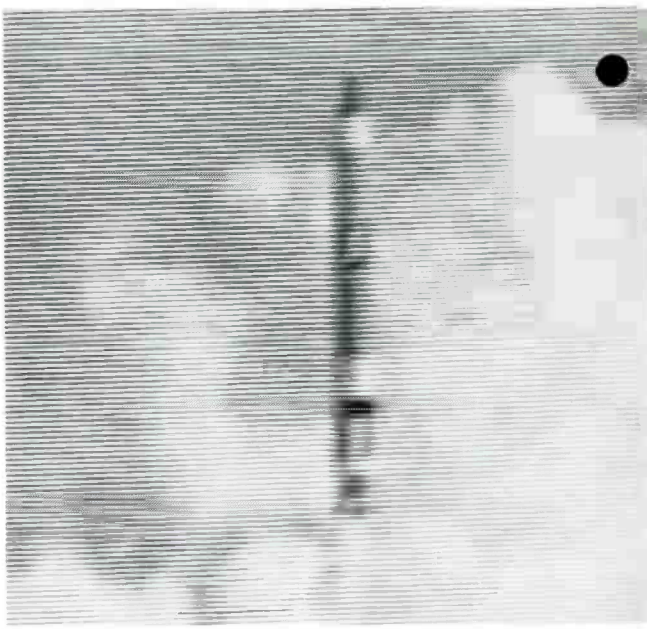
The documentary form of story presentation was ideally suited to television, and perhaps the most eminent example

"Galileo" on "Hallmark Hall of Fame"

The funeral of John F. Kennedy



"Bonanza"



Gemini

Chet Huntley, Richard M. Nixon, and David Brinkley


Henry Morgan

of this type of programming was the 26-part series, "Victory at Sea." Depicting Naval operations during World War II, the pioneer programs first went on the air in 1952 to great critical and public acclaim. They have since been shown many times, both here and abroad.

Television's outstanding regular daytime show also had its first showing in 1952. "Today" was a totally new idea in programming — an early morning two-hour format of news, news features, interviews, and entertainment. Dave Garroway presided over "Today" for the first nine years, followed by John Chancellor, and now Hugh Downs.

By 1953, another technical innovation of major significance was ready to be offered to the public: color television. On December 17 of that year, the Federal Communications Commission gave its long-awaited approval of the standards for compatible color television based on the system that had been developed by RCA. The feature of compatibility was critical to the success of color TV since it made possible the introduction of the system without causing the obsolescence of existing black-and-white receivers.

In August, 1953, NBC's "Kukla, Fran, and Ollie" program was seen in the first publicly announced experimental broadcast of a network program in compatible color. Added impetus was given to color programming with the production of "Carmen" by the NBC Opera Company that same year, followed in 1954 by the first color broadcast of the Tournament of Roses parade in Pasadena, and in 1955 by the full Broadway production of "Peter Pan" with Mary Martin and Cyril Ritchard, which attracted a then-record audience estimated at 65 million.

The growth of color television was slowed down, however, by the reluctance of the other networks to enter this new field. But by 1965 the color boom was on. NBC was presenting almost 100 per cent of its entire evening schedule in color, and the sale of color receivers was outstripping demand.

No branch of NBC programming underwent a more remarkable growth in the postwar years than did the coverage of news and public affairs. The News Department steadily expanded its staff, facilities, and coverage until its programs now represent about one-fourth of the TV network schedule. More than 800 correspondents, cameramen, and other personnel are stationed in every news-gathering center of the world.

Programs of unusual significance have been presented by NBC News, frequently with little or no advance notice. During the Cuban crisis in 1962, for example, NBC interrupted its regular television programming with more than 100 special programs, reports, and bulletins. The assassination and funeral of President Kennedy in 1963 occasioned more than 71 hours of television coverage. Special three-hour programs on subjects such as civil rights and American foreign policy have been presented during prime evening hours.

The now-famous team of commentators — Chet Huntley and David Brinkley — established new standards of reportorial skill for television, beginning with NBC's coverage of the 1956 Democratic convention in Chicago. "The Huntley-Brinkley Report," a daily summary of national and international news, soon became television's most popular news program and has regularly won the highest awards for excellence.

At first, the emergence of television had a depressing effect upon radio. As television gained a firm foothold in the 1948–51 period, it drained off audience and advertising from network radio and converted what had once been a national entertainment medium into a personalized service. For several years, all radio networks were operating at a loss, and their future was uncertain.

As television took over the living room, however, radio sets started moving into other rooms and virtually became standard equipment in automobiles. Portable receivers, clock radios, and pocket-sized transistor sets became popular. But major advertisers continued to reduce or withdraw their radio budgets in favor of the huge audiences of TV. NBC decided to do something about it. Its principal step was the conception of "Monitor" — the week-end program service utilizing radio's great flexibility "to go places and do things" and to give listeners the feeling of participation. Coupled with other innovations, the "Monitor" format of programming was able to reverse radio's decline.

The current estimate of the number of radio receivers in the U.S. reflects the change that has overtaken this medium. The total is 242 million — an average of four sets per home, including clock, transistor, console, portable, and automobile sets.

Through the years, there have been vast changes in NBC's studio facilities — for both television and radio. After the 1926 inaugural, most regular programs originated from the WEAF studios on lower Broadway in New York. Centralized network studios were soon constructed at 711 Fifth Avenue, known as the National Broadcasting Company Building. When these facilities became obsolete, NBC — along with RCA — in 1933 became tenants of the new realty development of Rockefeller Center. In recognition of the new industry, the Rockefeller interests named their complex Radio City.

The past several years of NBC's history have been marked by the network's entrance into the era of satellite transmissions. Extensive use has been made of the Relay, Telstar, Syncom, and Early Bird communications satellites to bring events and programs of foreign origin to U.S. television screens as they were happening. Future communications satellites will be larger, will cover nearly all areas of the world, and will be capable of broadcasting directly into the home.

Broadcasting is destined to remain earthbound no longer than man himself. Within a few years, American astronauts will be landing on the moon, and the television audience can expect to hear the announcer say: "This program comes to you live — from the moon."

In the exciting world of electronic communications, truth has nearly always been stranger than fiction, and performance has habitually outrun prophecy. This truth has been verified by the four decades of NBC history. Each year the organization reaches a new goal, and the place of arrival becomes a fresh starting point. Four decades of broadcast pioneering are but a preparation for a future that promises to be more challenging and exciting than all that has gone before. ■

# Electronic Films

by Bruce Shore

Though they are not produced in wide-screen Cinemascope, have never won an Oscar, and cannot be viewed on "Saturday Night at the Movies," electronic films are already smash hits in many important sectors of modern electronics technology. Increasingly, they are being "booked" into television equipment, computer logic and memory circuits, two-way communications systems, missile and spacecraft controls, and, of course, pocket radios. In fact, if present trends continue, they may yet make the electronics industry the new "film capital" of the world.

As distinguished from photographic film, electronic films are delicate tattoos of electronically active material condensed, for the most part, from hot vapors onto cold, hard, insulating surfaces such as glass. Depending on the materials used and the manner in which they are deposited, such films — many of them 10 times thinner than the shimmering coat of an ordinary soap bubble — may act singly or in combination as whole electronic circuits or simply as components thereof from transistors, diodes, and oscillators to resistors, capacitors, and interconnection paths.

At RCA Laboratories in Princeton, N.J., such films have been under investigation for many years and are presently being explored in programs that may eventually lead to a TV camera only half an inch square; a hand-held, battery-operated computer; an exotic form of computer memory that would use the phenomenon of superconductivity to store a quarter-million bits of information on a glass slide five inches square; a new type of video tape that can store pictures optically for later read-out by an electron beam; and a revolutionary kind of integrated circuitry for application in all forms of electronic equipment.

Interest in electronic films arose in the early 1920s following the landmark investigations of Irving Langmuir and Kenneth Kingdon into the nature and dynamics of atomic monolayers — thin layers of various materials only one atom thick. The development about the same time of X-ray diffraction and similar investigative techniques led other researchers to extend these studies to include thin metal and metal oxide films that evinced valuable optical and electronic properties.

Electronic scientists were especially intrigued because of the problems they were experiencing in improving the operation of electron tube cathodes — the tiny metal founts out of which pour the electron beams used to amplify radio waves. They had already found, as early as 1905, that metal cathodes worked much better and produced far more electrons if they were painted with a film of barium strontium oxide. Just how the oxide helped, however, was a puzzle that, it was hoped, the new findings concerning thin films might explain.

Thin-film research began in earnest thereafter both here and in Europe. One of its early dividends was the thoriated tungsten cathode — a tungsten filament whose surface is impregnated with the element thorium. Capable of withstanding very high temperatures while putting out torrents of electrons, this cathode is still one of the best available for fashioning the powerful signals that make worldwide radio communications possible.

Far more spectacular in its way, however, was the development during this same period of the photocathode — a thin film that would release electrons when bombarded with light. It was this achievement that was the first truly dramatic application of thin-film technology to electronics. For it became the heart of the television camera tube as well as of other conversion and imaging tubes such as the photomultiplier, and ultraviolet and infrared detectors.

Such films, many of them the creations of Dr. Alfred Sommer, of RCA Laboratories, are exotic mixtures of metals and oxides (such as sodium-potassium-cesium-antimony) evaporated onto glass windows under high vacuum in diaphanous layers from 200 to 800 angstroms thick. (If dollar bills were one angstrom thick, a million could be stacked in the same space taken up by a single conventional bill.)

When light from a scene to be televised strikes this film on the inside face of a TV camera tube, electrons in numbers directly proportional to the intensity of the light spring inward towards a glass target on which they collect in a pattern that is the electrical equivalent of the visible scene. An electron beam on the other side of the target then scans the pattern and is reflected by it to a greater or lesser extent depending on the strength of the charge at any one point in the pattern. Thus, the electron beam as reflected from the pattern becomes a pulsating current that varies in intensity as did the light that struck the photocathode originally. This current is then amplified, sent to a TV trans-

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*Delicate layers of electronically active material are making possible a new generation of solid-state devices.*

mitter for conversion to a microwave signal, and broadcast.

At about this same time, RCA scientists helped to perfect still another material — silver-oxide-cesium — which used a like principle to detect infrared radiation and became the basis for the Sniperscope and Snooperscope used by American soldiers during World War II to spot enemy infiltrators in the dark.

Although research on thin films continued to be done through the 1940s, it was temporarily eclipsed by development of the transistor in 1948. Physicists, chemists, and metallurgists focused instead on studies of the bulk properties of semiconductive materials such as germanium and silicon.

For a time, transistors, semiconductor diodes, and other solid-state components born of this effort seemed to sweep all else before them. In small signal applications such as in hearing aids and pocket radios, and in high-speed switching applications such as in computers, these devices seemed to have all the advantages and none of the disadvantages of electron tubes. They were small, operated at room temperature, were highly reliable, and were potentially very inexpensive to manufacture. This was in the early 1950s. By the late 1950s, however, as such devices attempted to compete with tubes in high-frequency applications, as they sought to attain really high-speed switching, as they ran up against industrial and military circuits that employed high voltages and operated in punishing environments, their inherent electrical limitations and their sensitivity to surface deterioration began to become manifest.

At this juncture, two major developments of a pseudo-thin-film nature were reported by Bell Telephone Laboratories in Murray Hill, N.J. The first was a technique for insulating the active areas of silicon devices by "growing" a silicon oxide film over them. This led eventually to the famous planar process whereby such films are used like masking tape — both to define and to isolate the areas in the 25-cent-piece-sized silicon wafers in which today's transistors are fabricated. These insulating layers are now grown on virtually all silicon devices as a matter of course and are usually no more than 5,000 angstroms thick — the wave length of green light. They sharply reduce the problems of surface contamination in transistors.

The second development, announced by Bell Laboratories in 1960, was epitaxy — the growth on these same

An experimental superconductive computer memory, which in its final form will be capable of storing 250,000 bits of information, is held by Robert Gange. Memory is kept at liquid helium temperature.

wafers of single-crystal skins which are exactly like the wafers structurally but which differ significantly in their electrical properties.

Taken together, these two techniques not only overcame the limitations impeding further advances in semiconductor technology at the time, but equally important, they set the stage for the evolution of integrated circuitry. Today, integrated circuits are built into silicon wafers by chemically etching holes in the planar oxide down to the epitaxial layer. Chemical impurities are then driven into this layer to form devices. After that, the holes are resealed by growing more oxide over them or evaporating metal contacts into them. Metal pathways connecting these contacts plus resistors and capacitors are then evaporated down on the oxide, where needed to complete the circuits.

Thus, by 1960, transistors and complete integrated circuits were, and still are, being made in layers of single-crystal, epitaxial silicon coated with silicon oxide. Such layers, incidentally, are only 10,000 to 20,000 angstroms thick — thinner than frost on a windowpane.

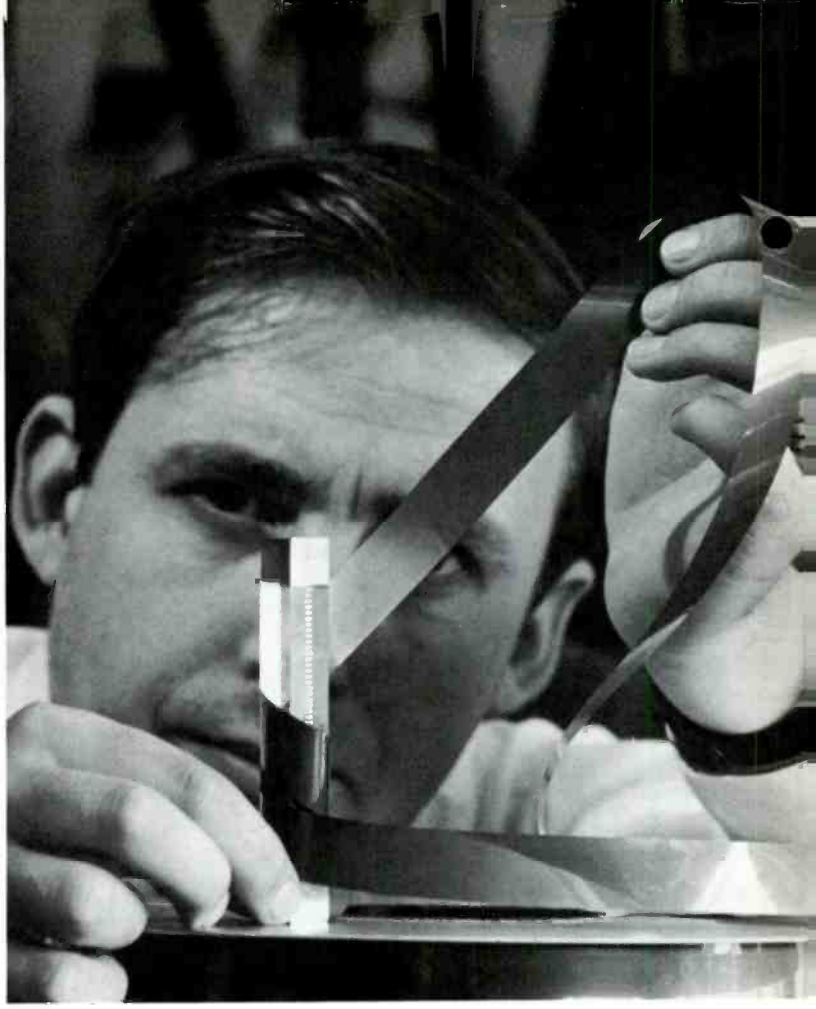
Thin as these layers are, however, they are not considered to be thin films in the usual sense because they are inextricably anchored to a supporting silicon base that is many thousandths of an inch thick and is cheek-by-jowl a part of them. So much so, in fact, that this base produces a parasitic electrical effect — a kind of electromagnetic drag — that inhibits the operation of the devices as a whole and degrades their performance.

It was the quest for a way to obviate this parasitic effect as well as to give new dimension to the concept of integrated circuitry that led Dr. Paul Weimer, of RCA Laboratories, to a line of research that, in 1961, produced the first thin-film transistor (TFT) — a new type of transistor consisting of layers of polycrystalline cadmium sulfide, silicon oxide, and gold evaporated on a glass slide in a sandwich 2,000 to 10,000 angstroms thick.

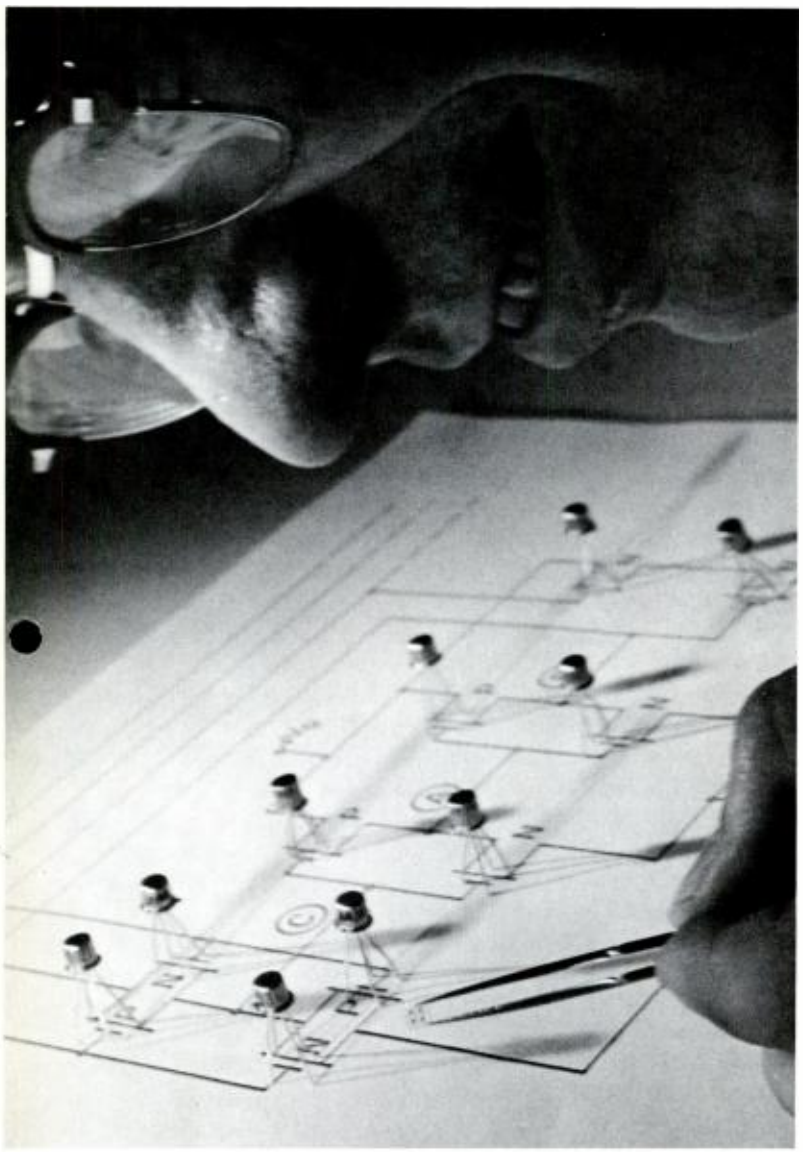
Though it is not yet so fast nor so reliable as its planar, epitaxial, single-crystal silicon cousin, the TFT has many advantages in its own right and is currently being tested together with other thin-film components in compact experimental arrays that may one day lead to a flat, TV camera "eye" only half an inch square, and a hand-held digital computer capable of operating from a flashlight battery.

Taking a different approach to the parasitic problem stemming from the supporting silicon wafer of conventional integrated circuits, scientists at the Autonetics Division of North American Aviation, in California, and at RCA Laboratories, about 1963, began wondering if they could not separate the planar and epitaxial layers from their supporting silicon by growing them on a single-crystal insulating material so close to silicon in structure that the layers would not know the difference. The insulating material chosen was sapphire (aluminum oxide). Though not perfect, the match between the silicon layers and the sapphire proved to be so good it was immediately possible to grow certain types of diodes and transistors this way and to show that they did not suffer any parasitic limitations.

So promising is this new silicon-on-sapphire technology, in fact, that scientists are hopeful of using it to achieve transistors and integrated circuits capable of handling radio



Lubomyr Onyshkevych displays a computer memory that combines sonic and electronic principles to store information. Memory may one day replace computer magnetic tape, shown coiled around the new unit.



A conventional transistorized circuit is compared by Dr. Charles Mueller with four silicon-on-sapphire thin-film circuits, each of which is the electronic equivalent of the conventional circuit.

Dr. Paul Weimer holds three thin-film transistor circuits that are currently being tested in arrays that may one day lead to a TV camera "eye" only half an inch square. Pattern in the background is a magnified version of one of these circuits. In his left hand is a TV vidicon tube.

frequencies up to a billion cycles per second for application in new forms of radar that scan the sky electronically and in new "scratch-pad" computer memories that can retrieve a bit of information in the time it takes a light beam to travel 10 feet.

Not to be outdone by researchers foraging in the virgin territory of thin-film semiconductor physics, other scientists and engineers have recently been equally enterprising in their application of thin-film technology.

Under Dr. Rabah Shahbender, of RCA Laboratories' computer research program, for example, a computer memory is being developed that uses the interaction of sound waves and electrical pulses to change the magnetic character of tiny areas in a thin permalloy film into either of two possible states. These states correspond to the "one" and "zero" of binary code — the language of computers. Which state they are in can be sensed later by the mere expedient of sending a sonic pulse through the film to "read" them. Such a memory may one day store 100,000 bits of information on a glass slide only 10 inches long and one inch wide.

Also under development by a team of scientists and engineers led by John Carrona, of RCA's Electronic Components and Devices activity, is a superconductive memory that is a sandwich of tin, lead, and silicon oxide films that store computer "ones" and "zeros" in the form of electrical currents that can persist forever so long as the memory is kept in liquid helium at a temperature only a few degrees above absolute zero. Such a memory, in final form, will consist of a flat glass plate on which the thin-film sandwich is deposited. It is estimated that one such "plane" should be capable of storing 250,000 bits of information in an area only five inches on a side and only 47,000 angstroms or two-thousandths of an inch thick.

An equally novel thin-film structure presently under development at RCA's Astro-Electronics Applied Research Laboratory, headed by Dr. E. C. Hutter, is a dielectric tape for use in a special camera that will take close-up pictures of the planets and relay them back to earth electronically at five times the speed possible with present space cameras. It consists of thin films of copper-gold, a photoconductive material, and a polystyrene coating all laid down on a plastic ribbon.

When light falls on it, an electrical charge pattern varying in strength in proportion to the intensity variations in the light itself builds up on the polystyrene. When an electron beam scans across this charge pattern, it causes tiny electrical currents to flow in the tape in direct proportion to the voltage variations in the charge pattern. These, in turn, produce a TV signal. In effect, this novel device is like a standard vidicon TV camera, but it has several superior features including the ability to store an image until it is wanted.

"Electronics all in rime" one wit has called this remarkable technology for building electronic devices in films whose thickness is measured in wave lengths of light. Whether, in fact, all types of electronic components can or will be produced this way eventually is problematical. One thing is certain, however. There is a new generation of "film stars" coming along in the electronics field that has never heard of Hollywood. ■


# Teaching Music with Records

by Emily Coleman

The now-famous "classroom revolution" with its arsenal of teaching machines, talking typewriters, language laboratories, tape recorders, and television receivers is neither as new nor as revolutionary as it seems. At least not so far as the teaching of music is concerned. Since there is no substitute for music itself, and since there is an obvious limitation to the number of live vocalists and instrumentalists available to the classroom, music educators have always relied heavily upon any scientific innovations that could bring the sound of music into the school. The mechanical piano, the phonograph, radio, and now television and stereophonic sound have all been enlisted in the continuing effort to make music an accepted way of life in the United States. Although advancement has seemed agonizingly slow at times, signs of real progress are everywhere at hand — in record and phonograph sales, in the increasing numbers of FM stations oriented to classical music, in growing concert and opera audiences, and in the burgeoning culture boom itself.

Credit for all this must go to a long line of crusading pioneers who were both dedicated and determined. Reading about music, as educators in earlier days discovered, was not the same as listening to it. Will Earhart of Richmond, Ind., who, around 1900, started one of the first "music appreciation" classes in the country, had previously lamented: "Finally I discovered that I was not teaching my pupils what I really wanted them to know, *music*." To remedy this, Earhart made use of choral arrangements from selected compositions of the great masters as well as piano reductions of symphonic works. In 1904, the Richmond schools bought a mechanical piano, which Earhart called a "boon," even though he was something less than satisfied with its musicality.

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At about the same time, the Aeolian Company, one of the largest makers of mechanical pianos and piano rolls, brought out a series entitled "The New Musical Education Courses," which included not only Beethoven symphonies, trios, and quartets but also the complete operas of Richard Wagner (in severely truncated form, to be sure). One Wagnerian course offered all of the leitmotifs of the *Ring*, with the name of each theme unfolding as the music played on.

But mechanical pianos were less than ideal. Too heavy to move easily from classroom to classroom, they were also maddeningly monochromatic, insensitive to any nuance, and given to a certain rigidity of tempi. Technology was ready to meet the growing need, however, and by around 1910 a new marvel called the "talking machine" had all but supplanted the mechanical piano. (Because of complications of licensing and nomenclature, the term "phonograph" was not used generically until many years later.)

The Victor talking machine was simple to operate, easy to transport, and if the musical quality of the disks, or records, still left something to be desired, they were definitely superior to the mechanical piano rolls. Aware of the educational value of its product, Victor officials lost little time in setting up an educational department, and in 1911 engaged as its head Frances Elliott Clark, a prominent music educator who had already caused a stir in professional circles by her effective use of recordings in the classroom. Mrs. Clark approached her duties with a missionary's zeal, and it was not long before the talking machine and the trademark of the horn and the dog were familiar sights in classrooms all over the nation.

The success of the phonograph in a rural school in the days before radio and television, for example, was immediate. "We have only had our Victor a week," wrote one Idaho teacher in 1914, "but have already used it to march by, to play games by, and to sing by. We are learning new

*Educational records are helping teachers instill in their students a lifelong appreciation for fine music.*

songs from the records, and the boys are trying to become excellent whistlers. If ever a Victor was needed anywhere, it is in the tiny, crowded, starved, ugly rural school."

City school systems were also enthusiastic; by March of 1913, Victor equipment had been placed in 500 cities, and by September of the same year the number had risen to 2,700. In servicing this growing demand, Mrs. Clark was faced with twin dilemmas that have changed hardly at all with the passage of the years: How best to serve education — and how best to sell Victor records. Her solution was to develop as much specially recorded material as the budget would allow, while trying, at the same time, to relate the commercial catalogue to educational purposes — an approach that, with certain refinements, is still followed today, and which has consistently kept the name "Victor" in the forefront of the educational market.

Victor's first records designed especially for children included vocal renditions of nursery rhymes, folk songs, singing games and dances, the latter supervised by two noted authorities, Elizabeth Burchenal and Cecil J. Sharp. For the teacher, Mrs. Clark and Victor had ready "A New Graded List of Victor Records for Children in Home and School," which contained both general and specific guidance. "Music for children should conform to the same high standard as literature" was one admonition, while advice on Chopin's "Minute Waltz" stated: "A perfect little waltz, 'only a minute,' for little feet. May be used for flying and floating rhythms. There is a story that Chopin wrote this waltz after having watched a small dog whirl around as he played with his tail."

Today's approach is much more sophisticated, to be sure, and more original, but — considering a time lapse of approximately half a century — one must still salute the soundness of Mrs. Clark's basic philosophy. "Little Duck," for example, is one of RCA Victor's current "Dance-A-Story" series, and in the teacher and parent guidelines, note the following: "Stay within the dramatic context of the story. Instead of saying, 'Bend down close to the floor' or 'Straighten your back when you jump,' say 'The duck goes down deep into the water' or 'Try to reach the sea gull high in the air.' If you follow this pattern, children will show excellent dance techniques."

The "Dance-A-Story" series is made up of both records and charmingly illustrated little books. One side of each record contains specially composed music only and the other side has both the music and narration by Anne Barlin, co-author of the story. Depending on the teacher's knowledge of her own students, she can use either side, one for free expression, the other for imitation.

At the opposite end of current developments in music education is a series such as RCA Victor's "A Treasury of Music," edited by William C. Hartshorn, Supervisor of Music for the Los Angeles Schools. Designed for the study of major musical forms, this collection, projected for 10 albums (two — "Program Music" and "The Concerto" are already released — and two on "The Symphony" are due this fall), is highly technical and presupposes a considerable musical background not only on the part of the student but, most important, on the part of the teacher also.

Such is not the case with RCA Victor's "Adventures in


Music," one of the most highly praised of any recent project in the use of records in music education. Edited by Gladys Tipton, Professor of Music Education at Teachers College, Columbia University, "Adventures in Music" departs from the old philosophy of "let the record do it for you" but at the same time recognizes that today's overburdened teacher must have help. This is provided, in depth, in the Teacher's Guide, which is an integral part of each album.

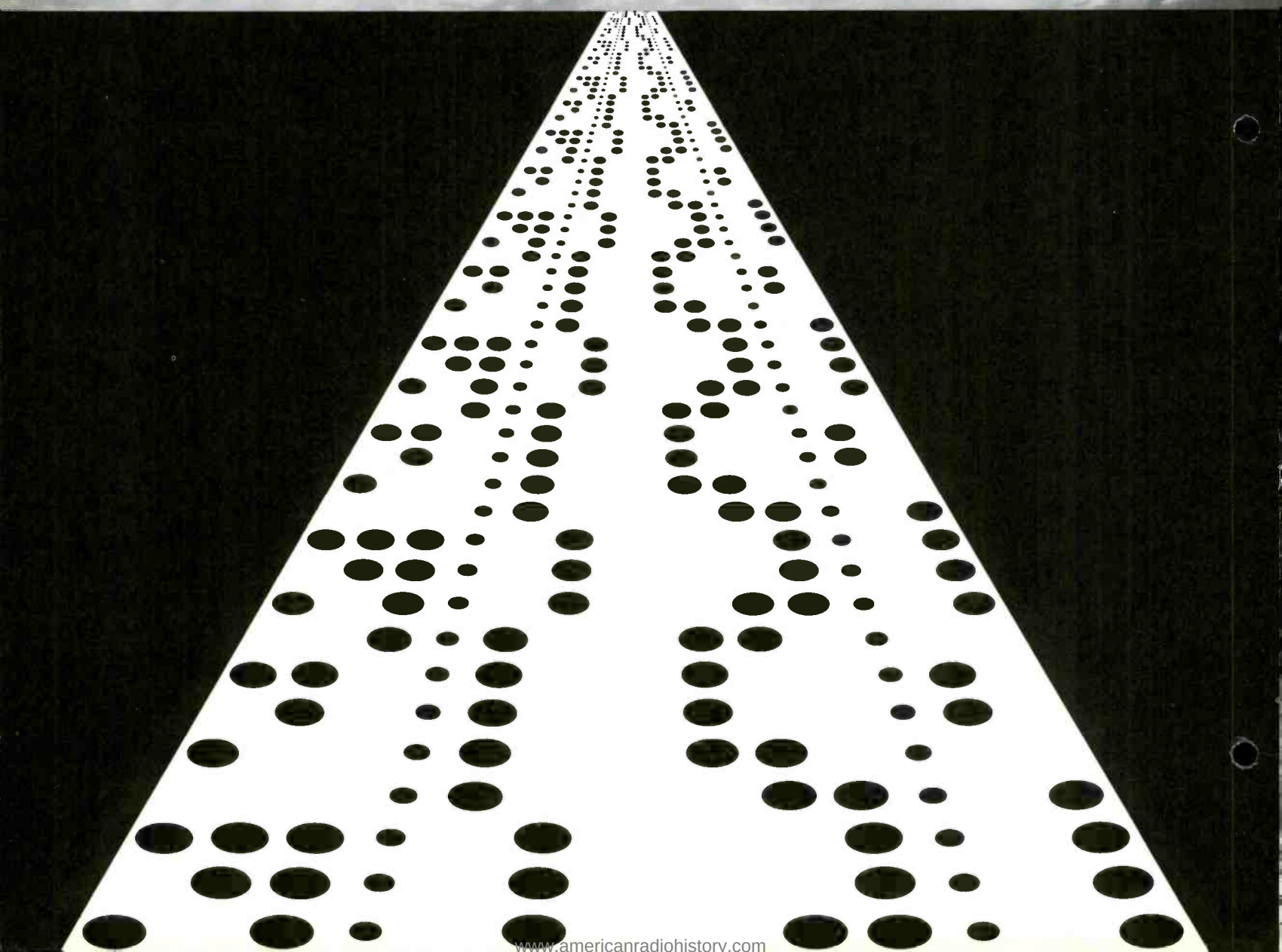
Deliberately, there is no spoken narrative on the records. "Adventures in Music" is produced for elementary schools. Hence, it was felt that a spoken narrative might limit the teacher and the tempo of progression. Some might want to go faster in one direction; others, slower in another. The Teacher's Guide, therefore, furnishes a wealth of material that leaves the teacher free to pick and choose. "There is *no one, correct way* in which a musical selection should be introduced," states each Guide, "but, rather, there are many effective avenues of approach." Suggestions include the use of the title (is it descriptive?), anticipation (how will it sound?), background information about the music and the composer, related art or literature, and identification of a theme or themes.

There are 10 albums in the "Adventures" series and they cover grades one through six. The musical selections are astonishingly varied and unhackneyed, and are played with admirable style by the National Symphony under Howard Mitchell. Bach is present, of course, but so, unexpectedly, is Gluck. There are Tchaikovsky and Dvorák, but also Stravinsky and Bartók. Victor Herbert is included, but so are Virgil Thomson and Aaron Copland and Gian Carlo Menotti. Each album contains from nine to 18 selections (shorter ones for the younger children), and each selection is covered by background information that includes material on the music and how it may be reflected in children's responses in regard to rhythm, melody, mood, form, and instrumentation. There are additional suggestions that might involve the related use of fingerpainting or the invention of dance patterns. There is information on the composer, how the music came to be written, related arts, and related listening.

A first-grader, for example, after hearing Shostakovich's "Pizzicato Polka," might be invited to dramatize what the music sounded like, and would be encouraged to make his own puppets and produce a puppet show, using the music as an accompaniment. A sixth-grader, on the other hand, might be introduced to Walton's "Valse" from *Facade* by the reading of one of the Edith Sitwell poems that inspired it, thus setting the scene for satire in music. And still another sixth-grader might supplement Debussy's "Play of the Waves" from *La Mer* by reading sections of Rachel Carson's "The Sea Around Us," thus contrasting musical impressionism with vivid, realistic writing.

In the four years since all 10 albums of "Adventures in Music" have been available, the series has been warmly received all over the country. Teachers of teachers-to-be have been especially enthusiastic. A well-known music educator from the State University of New York at Potsdam recently remarked: "I have decided that the greatest thing that ever happened to music education was the song 'Do, Re, Mi'; the second greatest was 'Adventures in Music.'" ■

# The Computer: Expanding Horizons



*Computerized techniques applied to the fields of medicine, the library, education, and retailing are hastening the information-processing revolution.*

by Charles M. Sievert

What is the future of the computer?

One prominent authority on the subject, Jerome B. Wiesner, dean of science at the Massachusetts Institute of Technology who also served as science adviser to President Kennedy, makes this evaluation:

"The computer, with its promise of a million-fold increase in man's capacity to handle information, will undoubtedly have the most far-reaching consequence of any contemporary technical development. The potential for good in the computer, and the danger inherent in its misuse, exceed our ability to imagine."

Another expert, Theodore A. Smith, RCA Executive Vice President, Corporate Planning, says that computer technology has advanced so fast and has been proven so completely that it can be applied to countless fields and directions to reap greater productivity from our national resources of capital and labor.

Computers have been used to solve many business problems and will continue to open up new applications in helping industry become more efficient in its operations. In addition, it is clear that computers will find entirely new applications in areas where they have not previously received great consideration.

An early breakthrough of new roles for the computer is already evident in four spheres — in medicine, the library, education, and credit and finance. In all of them, it is being welcomed because our postwar population explosion has been accompanied by a vast expansion of paperwork and a need for faster availability of information.

The first inroads of the computer into medicine naturally have been explored with caution. This summer, the Iowa Methodist Hospital, in Des Moines, will probably be the first to apply a computer to day-to-day medical procedures. It will administer a two-lead electrocardiogram to all nonemergency, noncardiac adult patients as part of its routine admitting procedures.

Donald W. Cordes, the Hospital's administrator, says, "This is now practical, both in terms of time and cost, because the cardiograms will be tape-recorded and interpreted on a computer."

Mr. Cordes foresees great promise in this program because "it should uncover much latent and incipient heart disease and, consequently, enable physicians to help counteract predisposing conditions in patients and reduce future cardiac attacks."

The computer, it must be remembered, is considered a tool in the medical world, not a replacement for a doctor, but the saving in time and labor cannot be ignored. Time saved by a computerized diagnosis can be vital to the patient.

Many small communities lack a physician who is also a trained cardiologist. The procedure is to mail the electrocardiogram to a big city hospital where it is read and interpreted and then returned by mail to the community, which involves a lag of two to four days. This is a time gap that the computer will be able to eliminate via telephone-line transmission of computer-readable information that can be put on tape, processed, an interpretation printed, and, after checking by a cardiologist, returned immediately to the small-community doctor.

Speed is a principal virtue of the computer for the hospital and doctor. It is now estimated that it can prescribe allergy treatments in a few seconds instead of the hour's time it takes an allergist. In the case of scoring the Minnesota Multiphasic Personality Inventory test, a program developed at the Mayo Clinic can produce a worded personality evaluation in less than a minute as opposed to the 45 minutes it would take a psychologist or psychiatrist.

Hard to believe are some of the extraordinary results medical researchers are now extracting from the computer. For instance, in one hour a computerized process produced the results of 1,000 blood tests compared to an average of 60 that were written by a technician.

In Brooklyn, Kings County Research Laboratories has developed a fully automated process for performing 10 simultaneous tests on one sample of blood, providing a biochemical profile of a patient at a cost equal to that of doing two or three examinations in the routine manner.

Says Murray A. Blaivas, co-director of the Laboratories, "Hospitals utilizing the new system of automated blood testing under computerized control could, by taking a blood specimen at the time a patient is admitted, have the results of a general series of tests teleprocessed or delivered to the nurses' station within the hour, probably before the patient could be settled into his bed."

Another interesting pilot project has been undertaken at the University of Arkansas Medical Center. It is a new medication system aimed to reduce errors, cut nurses' bookkeeping duties, and provide a drug therapy audit.

Meanwhile, the medical schools of three universities — Columbia, Harvard, and Yale — have launched into the first stage of placing medical information on punched cards as an exchangeable source of bibliographic material.

Thomas F. Fleming, librarian of the Columbia College

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of Physicians and Surgeons, admits it is a long process to evaluate what information should be machined, put on tape, fed into the computer and made instantly retrievable, but he emphasizes the value of the three-way exchange of each school's information resources.

Columbia, he points out, concentrates particularly on plastic surgery, but its progress in this field will be instantly available to Harvard and Yale. Similarly, he adds, "we will have the benefit of their surgical findings."

These three universities will be linked by a direct telephone line with a terminal at each university's computer, thus overcoming the time factor of transmission of written information because of the distance separating them.

Excited as medical men become when they envision the newly found advantages that computers will put at their disposal, they also realize there is no promise of overnight miracles to build up the needed storage of information. This will take time, counted more by years than months, and competent help for the programming.

Also on the medical front is an enormous computerized project being considered by the National Institutes of Health in Bethesda, Md., which embraces about 10 information centers across the nation on all major diseases.

This also will span years in planning and building, but some seeds already are being sown. The National Institute of Neurological Diseases and Blindness has started an information bank on "neuromuscular" diseases, including Parkinson's, and Harvard is just beginning to machine information on eye disorders. Other centers with similar objectives include the Mayo Clinic and the University of California. From these banks, doctors will have virtually push-button access to up-to-the-minute information.

The nation's colleges also are acutely computer-conscious. For instance, the National Aeronautics and Space Administration (NASA) will distribute its wealth of declassified technological information to universities in computerized form, thus fortifying the bibliography of a fast-growing subject in our universities.

A recent survey reveals that colleges are not only teaching computer technology, but are using computers in their research programs. Out of 466 colleges and universities with computer curriculum, 322 already have machines.

In retailing, the computer already has contributed vast benefits — stabilized inventories, faster billings, reduced paperwork, sharper control over collections, keeping accounts receivable on a more current basis, and more precise control of distribution from warehouse to store shelf.

But as Mr. Smith sees it, the ultimate change in retailing will be in the automation of the process of financial interchange by which goods are bought and sold. It will entail an integrated data processing system that links customer with store and bank in such a way as to obviate the need for cash or check-writing.

It is a system that already has captured the attention of such an outstanding organization as the American Bankers Association, many of whose members are establishing or have purchased credit card groups as a stepping stone to its crystallization.

How it may work has been described simply by Mr. Smith. He points out that the system begins with the housewife and two credit cards, one for cash purposes and the other for credit. The cash card will be used by the housewife at the supermarket, for instance, where she will insert it into a telephone device at the checkout counter and depress a series of numbered buttons to record a purchase of, say, $35.65. The telephone line will carry this input to the housewife's bank where a computer will deduct the amount from her account and credit it to the supermarket.

The second card, according to Mr. Smith, will be for credit reference purposes, and the housewife will use it whenever she makes a purchase on credit. The process will be similar to the cash transfer in that the card will be inserted into a telephone terminal at the store and the retailer will receive an instantaneous credit rating on the customer. The signal could also indicate the degree of desirability of extending credit through the store's credit plan versus that of the local bank.

So, on a typical day's shopping, a housewife may make a cash transfer at the First National, a charge at Brentano's, a cash transfer at the drug store, a charge at Lord & Taylor, and a cash transfer at the toll booth on the ride home. Once at home, she can pay the utility and telephone bills by using the terminal connected to her home phone.

"It is not difficult to see that with such a system the need for money or checks will practically disappear," says Mr. Smith.

Of course, there is some fear that the computer ultimately will standardize the human race, so to speak, in its ways of living. We will all be numbers, and we will all have virtually the same things, dictated by the computer.

But these fears can be quickly dissipated, for instance, by appreciating that a computer guided the design of a 13-story apartment building in Washington, D.C. — and no two floors are alike. There are 167 different floor plans for the 240 apartments. Unusual in the building's design is that there are no continuous straight lines anywhere.

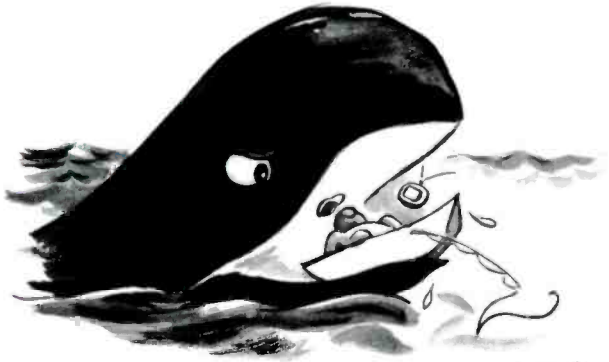
The ultimate impact on the consumer, however, will be that day when the home computer arrives. With integrated circuitry reducing so astoundingly the size of a computer — not too long ago called a "monster" because of its dimensions — the home computer would be about the size of a shoebox.

What are some of its possibilities? A taxpayer, for example, will be able to store all the figures about his income, expenses, and deductibles until he needs them for that blue Monday in April.

A housewife, out for bridge or golf, could phone directly to her tied-in computer to light the oven in which the evening's dinner has been readied for cooking — and, with the help of built-in solid-state sensing devices, have it timed to turn off automatically.

Or, again with sensing devices, computers could determine when clothes dryers are free of moisture and turn them off; they could control humidity and temperature in the home; in fact, all electrical appliances could be adapted for computer control.

But these are all far in the world of tomorrow. Today's housewife will have to be patient — and live for the day when the cost of electronic brains comes down to the supermarket level. ■

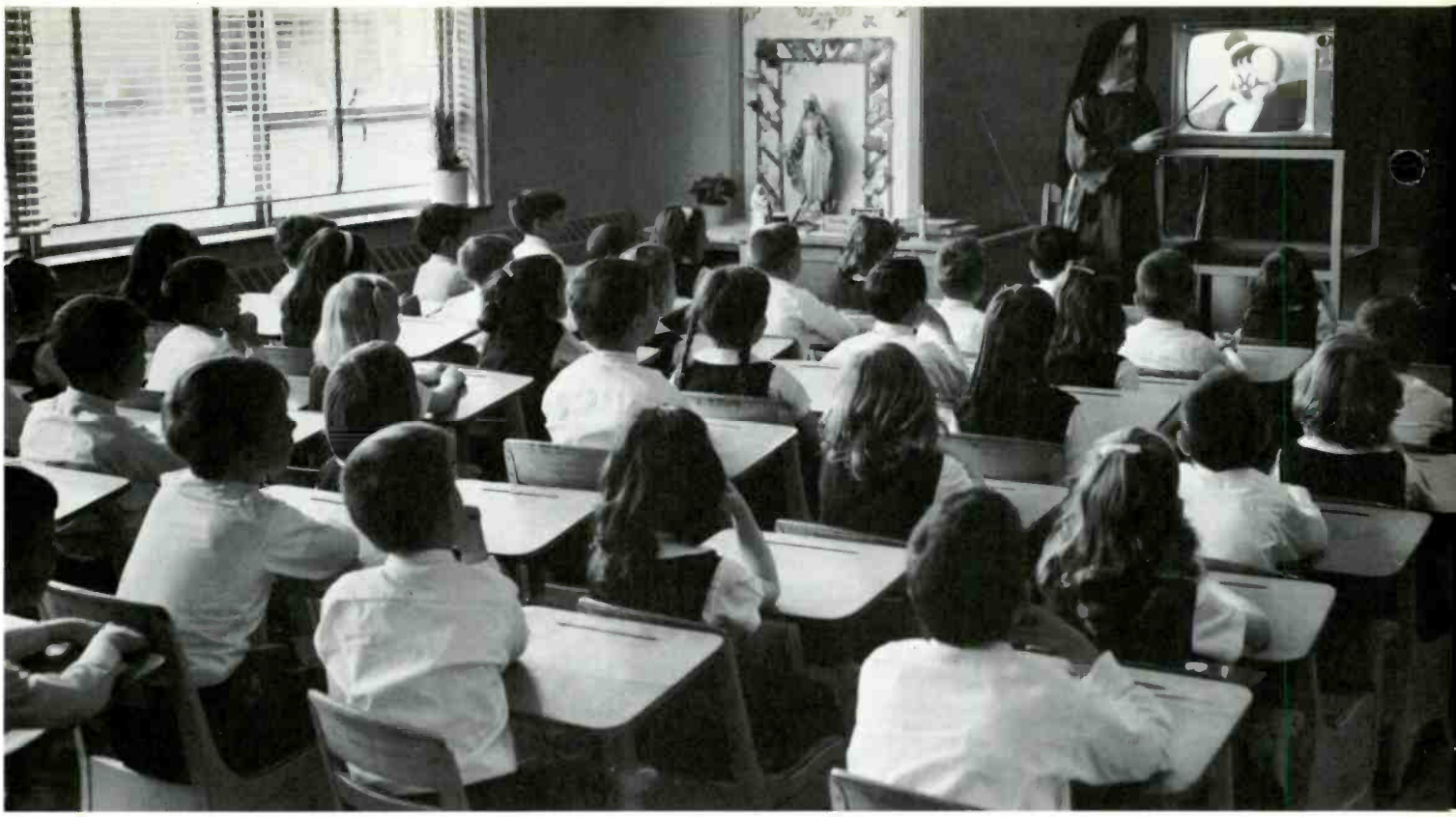


# THIS ELECTRONIC AGE...


*"Can you hold it a minute?
I seem to have put in the wrong tape!"*

*"A funny thing happened today.
I had an almost overpowering urge
to mutilate, bend, staple, and fold."*

*"Isn't it Sirius that is known as the Dog Star?"*



A teacher uses television for a classroom demonstration at a parochial school in Yonkers.

# "On-the-Air" Classroom Television

by Robert Shortal

This fall, almost a million parochial school students in five Roman Catholic dioceses will be receiving instruction in various subjects by means of a unique "on-the-air closed-circuit" educational television service that may make the TV set as important in classroom teaching as textbooks and blackboards.

The ETV systems in the dioceses of Brooklyn, Detroit, Los Angeles, Miami, and New York represent the first major step toward fulfillment of a long-time educational dream: a national network of public and private ETV systems sharing a vast library of filmed and taped program material featuring the best teaching talent in the country.

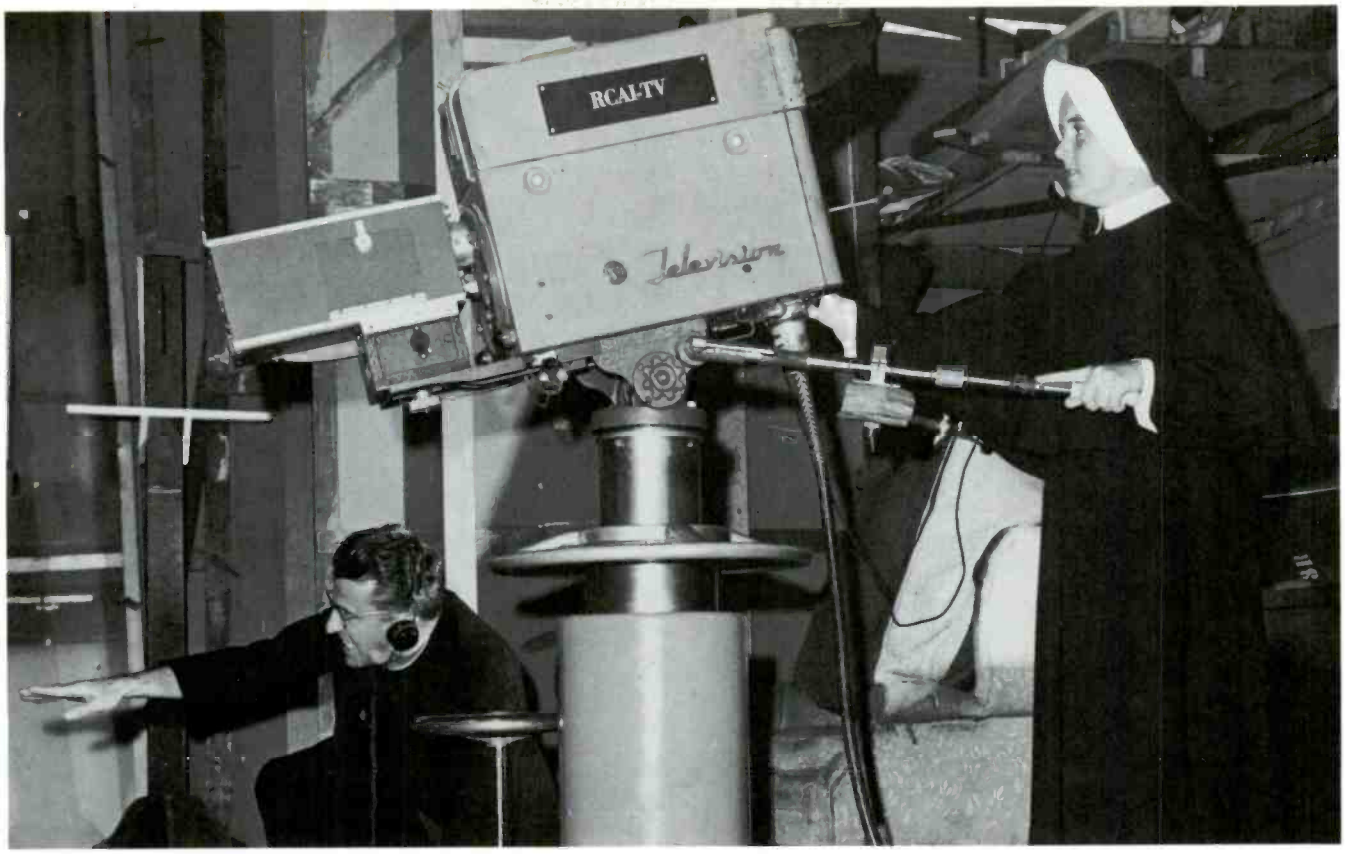
The relentless pressure of an expanding school population, combined with an inadequate supply of teachers and continuing demands for higher educational standards, has compelled educators to look for help in new and improved teaching methods, tools, and systems. Television appears to be one of the most promising areas under exploration.

Over the past decade, the process of trial and error, of work and experimentation, of success and failure, has served to demonstrate that television can be a major resource in solving many of the nation's educational problems. The difficulty has been in coordinating the educational television efforts of various school systems into a unified program.

The five diocesan ETV systems represent the most ambitious use until now of the Federal Communications Commission's so-called 2,500-megacycle service set aside exclusively for educational use. On July 30, 1963, the FCC reserved 31 channels in the 2,500–2,690-megacycle band for instructional television. This Instructional Television Fixed Stations Service permits a user to obtain the necessary channels to broadcast up to four different programs — or courses — simultaneously, compared with conventional TV broadcasting that is limited to one program per station.

This service sometimes is called "on-the-air closed-circuit" because the programs being broadcast through the airwaves can be picked up only by TV sets connected to a special antenna-converter apparatus. A few public school systems already are on the air with 2,500-megacycle service, but diocesan-wide parochial school systems appear to have taken the lead in developing this service. In addition to the five that will be broadcasting by autumn, 1966, at least a dozen other dioceses have filed, or indicated they will file, for construction permits with the FCC.

ROBERT SHORTAL is on the RCA Public Affairs staff.




Techniques of TV broadcasting are taught at RCA Institutes' Studio School.

*This fall, five Roman Catholic dioceses will spearhead the use of the FCC's new 2,500-megacycle service for educational television.*

The Rev. John M. Culkin, S.J., Consultant on Television to the National Catholic Educational Association, said the 2,500-megacycle service "opens up for the first time new areas for cooperative planning and programming to meet common needs with national resources. It now becomes possible to think in concrete terms of courses and series of programs on film and television tape using the best teaching talent in the country."

As a prelude to such a development, the five dioceses have agreed to form a nonprofit organization, called Instructional Television Cooperative, to provide a national program source for ETV stations. The ITC will produce, on a cooperative basis, programs dealing with many subjects and utilizing top teaching talent, making them available to public and private ETV systems operating in the 2,500-megacycle band.

"This project offers the exciting possibility of a national exchange of really high-quality programs, bringing to all communities and school systems, regardless of size, the finest teachers in every subject field," according to Father Culkin, who also is Director of the Center for Communications at Fordham University. "Working on the principle of the book-lending library, these exchanges hold real promise of success toward fulfilling the high goals set for education."

Of the five diocesan ETV systems scheduled to operate in the 2,500-megacycle service, the Miami and New York systems were designed and built by the Radio Corporation of America. The Miami system went into operation several months ago, and the New York system was dedicated May 17, 1966, by Francis Cardinal Spellman on the occasion of his Golden Jubilee as a priest.

The most challenging of the five systems, from an engineering standpoint, was the one built for the Archdiocese of New York, which covers 4,717 square miles. This area comprises Manhattan, the Bronx, and Staten Island in New York City, and the counties of Westchester, Putnam, Dutchess, Orange, Ulster, Rockland, and Sullivan — a region of contrasting topography, both natural and man-made.

The New York Archdiocese's educational TV system is the largest yet built to operate in the 2,500-megacycle service and the first equipped for color programming. All programs — black-and-white and color — will originate from a modern communications center at St. Joseph's Seminary, Yonkers, N.Y., and will be broadcast on three channels to more than 400 elementary and secondary schools over a combined microwave relay and transmitting system. These schools have a total enrollment of approximately 225,000 students.

A nun receives a "well-done" from studio instructor.

Operation of TV control console is an important part of ETV training.

Because of the large area covered, there are six broadcasting locations that pick up the programs relayed by microwave from the Yonkers studio and, in turn, radiate the programs to the individual schools in the general area. Each school is equipped with a dishlike antenna and a converter that steps down the microwave signal to a standard TV signal. A distribution system in the school, similar to that used in hotels, hospitals, and apartment houses, then carries the signal by wire to the individual classrooms. The TV sets in the classrooms receive the educational programs on three channels. However, a simple movement of the wall jack permits the TV sets to receive broadcasts from regular UHF and VHF stations.

The Yonkers studio is equipped with the latest broadcast equipment, including a complete color TV film system acquired from the RCA Pavilion at the New York World's Fair. This system enables the Archdiocese to originate color programs from film or slides. The addition of color studio cameras and color tape recorders at a future time would enable the Archdiocese to produce live color programs or tape them for later replay. At present, the studio is equipped with black-and-white studio cameras and tape recorders.

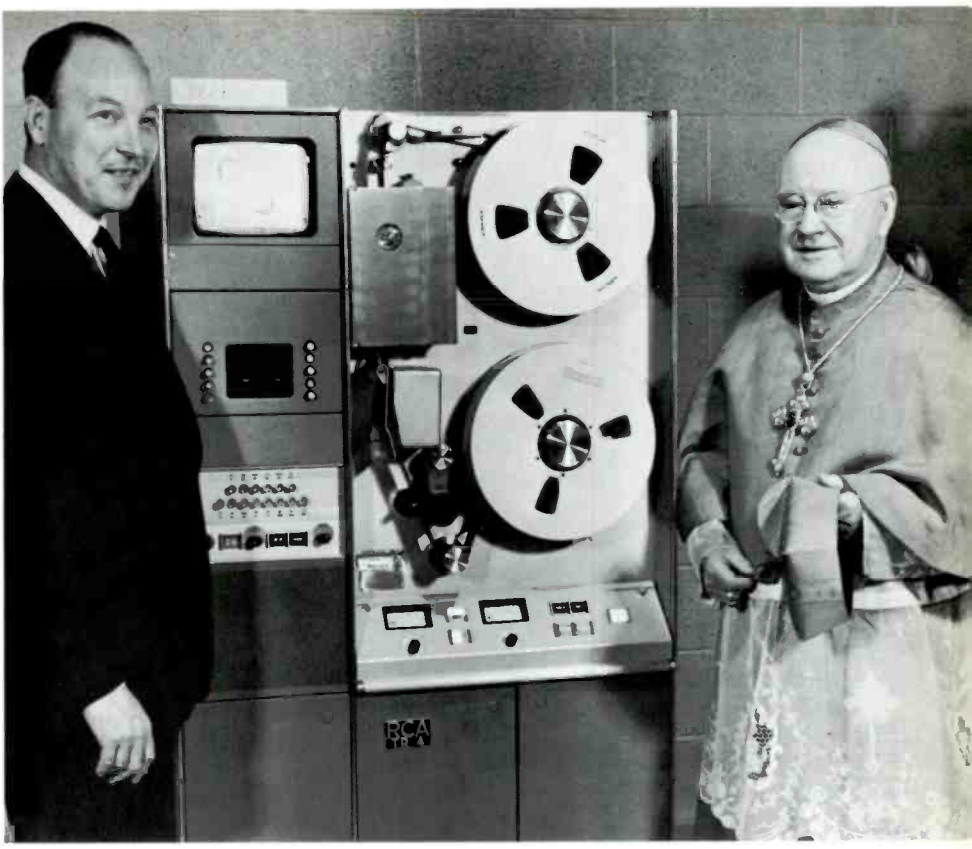
The Rt. Rev. Msgr. Joseph T. O'Keefe, Associate Superintendent of Schools and Coordinator of Educational Television for the Archdiocese of New York, said the color capability opens new and brighter windows on the world of knowledge. "Color enables students sitting in widely separated classrooms to see demonstrations in chemistry, biology, medical technology, and other subjects where the actual color of objects and processes is essential to a complete understanding."

Msgr. O'Keefe said the ETV system also will play a key role in the Archdiocese's in-service training of teachers and in its adult education program. Plans also are being developed to use the system for a number of parish functions during nonschool hours.

Beginning this fall, he added, television will be used at the elementary level for such subjects as mathematics, science, art, music, geography, and Spanish. "We are convinced that a second language should be taught at the elementary level, and Spanish can be a subtle way of teaching better English to students who come from Spanish-speaking homes." At the secondary level, television will be used initially for instruction in calculus, American history, economics, and English literature.

"We look upon television as an audio-visual aid that will supplement, not replace, the teacher in the classroom. It will enable the teacher to bring into the classroom experiences she could not otherwise provide, and at the same time free her from certain time-consuming preparations.

Televised program absorbs the attention of young pupils.



RCA's Robert W. Sarnoff and Francis Cardinal Spellman at Archdiocese ETV dedication.

This means she will have more time to devote to the specific needs of her students. At the same time, television will accelerate the teacher's professional growth by enabling her to learn by observing the teaching of others," Msgr. O'Keefe said.

He pointed out that teachers will receive a plan for each lesson, suggesting preparation and follow-up drills and homework. "We don't intend to have the teacher merely shut off the TV set and go on to something else. She will work in concert with the studio teacher, developing a team spirit that we hope will enable us to upgrade the curriculum and enrich the educational program more easily and economically than before."

Msgr. O'Keefe said television will bring about greater equality of opportunity for all pupils, since those in smaller schools now will be able to enjoy the same variety of courses as children in larger schools. "We now can bring into every classroom experiments, processes, and activities that would be impossible or too costly to do otherwise. And each student will have a front-row seat," he added.

Television is particularly useful as an instructional aid to add new learning experiences to the school program. It makes possible basic instruction in courses such as foreign languages and also serves as a supplementary resource in offering additional teaching or explanation of a subject. In some instances, it is used simply as an "enriching" or cultural experience by bringing some unusual event to the classroom, such as an inauguration, a space launch, or a Shakespearean play.

Catholic dioceses have been preparing for the day when they will be on the air. For the past few years, Fordham University has sponsored a summer program in the uses, techniques, and implications of educational television — including an abbreviated course in basic TV studio operations at the RCA Institutes' Studio School in New York City.

Priests, brothers, nuns, and lay teachers from all over the country have been taught how to operate cameras, sound booms, audio equipment, lights, the master control, and the many other off-camera jobs in television. They received the theory of educational TV at Fordham and some practical experience in TV operations at the Studio School.

It has been estimated that upward of 50 Roman Catholic dioceses and some 5,000 public school districts are especially suited for 2,500-megacycle educational television systems, which could make this service one of the fastest-growing segments of the over-all ETV market in the next few years. The advent of the 2,500-megacycle service becomes an occasion of great significance in further broadening the educational experiences of students at all levels. ■

# Satellite Television Moves Ahead

*Know-how of the common carriers promises to increase the frequency and improve the technical quality of intercontinental broadcasting.*

by Desmond Smith

The Federal Communications Commission in July, 1965, authorized four of the nation's common carriers — RCA Communications, Inc., AT&T, IT&T World Communications, Inc., and Western Union International, Inc., — to provide facilities for a satellite television transmission service. This action calling for a joint offering by these carriers appears to be the most feasible and practical temporary solution to an unusually complex situation — the extent to which persons or entities other than common carriers can be authorized to obtain services directly from the Communications Satellite Corporation. The new ruling enables each of these carriers to obtain operational experience while at the same time preserving the concept of Comsat as a "carriers' carrier." The hope is that the common carriers' know-how will put an end to some of the problems that have been associated with satellite television transmissions.

As one TV executive put it recently: "We've gotten telephone cross-talk, mariachi music from Mexico — you really sweat it out. And when you call your engineer to find out what is going wrong, you often get the same reply: 'Well, it's leaving *here* all right.' "

Satellite television involves an intricate technical process, and, in moving into intercontinental television, American broadcasters are taking on both a technology and an industry removed from their own world. A typical Europe–U.S. television program — say, NBC's "Meet the Press" — will include guests in several European capitals. To get the picture and sound of each of them onto the TV set in the United States is, above everything else, a prodigious traffic problem.

Intercontinental TV transmission begins with the picture and sound from the various European studios. This, in turn, is fed into an intricate network of coaxial cables that carry the electronic signal to the nearest ground station. In essence, these European ground stations — Plumeur-Bodou in France, Raisting in Germany, Goonhilly in England, and Fucino in Italy — are high-powered transmitters and receivers whose purpose is to rebroadcast to and from the Early Bird satellite — a 50,000-mile electronic bounce from earth to space to earth again. In the United States, this signal is picked up by the Andover, Me., ground station. From there, it is carried via the AT&T coaxial cable to the operations center of one of the four authorized common carriers in New York.

Although much has been written about the idea of satellite television, how it is actually working out in practice is one of the most interesting stories of the 1960s. In theory, Europe–U.S. television programs via Early Bird are available now. In practice, such programs have been relatively infrequent. To understand why, it would be helpful to take a closer look at Early Bird.

In the jargon of space scientists, Early Bird is part of an "early capability satellite system," the forerunner of a future worldwide commercial communications satellite system. At the present time, Early Bird, parked over the Atlantic, is capable of handling 240 telephone conversations simultaneously between the United States and Europe. This traffic is as nothing, however, compared to what it will become when a satellite weighing several tons can be orbited. Until this happens, the 85-pound Early Bird is functioning chiefly as an experimental switchboard-in-the-sky. Thus, when a television network wants to beam a program to Europe, or vice versa, the telephone circuits have to be shut down. The reason is that television requires a channel six megacycles wide to transmit pictures. As a result, clearing television time on Early Bird — or "the Bird" as it is known around RCA Communications' television service office — is a little like trying to get tickets for "Hello, Dolly!" If an American television network, for example, wants to broadcast a Christmas show from Rome, the Communications Satellite Corporation (the manager of Early Bird), the U.S. international carriers, or any of the European users of satellite channels could turn down the request. The 240 two-way voice channels are needed for transatlantic telephone calls that reach peak usage during holiday seasons.

But clearing time on "the Bird" is only the beginning. Getting the program to and from the satellite is a formidable exercise in traffic management. A program such as NBC's "Meet the Press" with Secretary of State Dean Rusk consumed weeks of work. Circuits had to be arranged between London, Paris, Bonn, Rome, Brussels, Fucino, Andover, and New York. Moreover, the limited number of ground stations presently in operation calls for an extraordinary knowledge of alternate cable routes.

One of the major and persistent problems that con-

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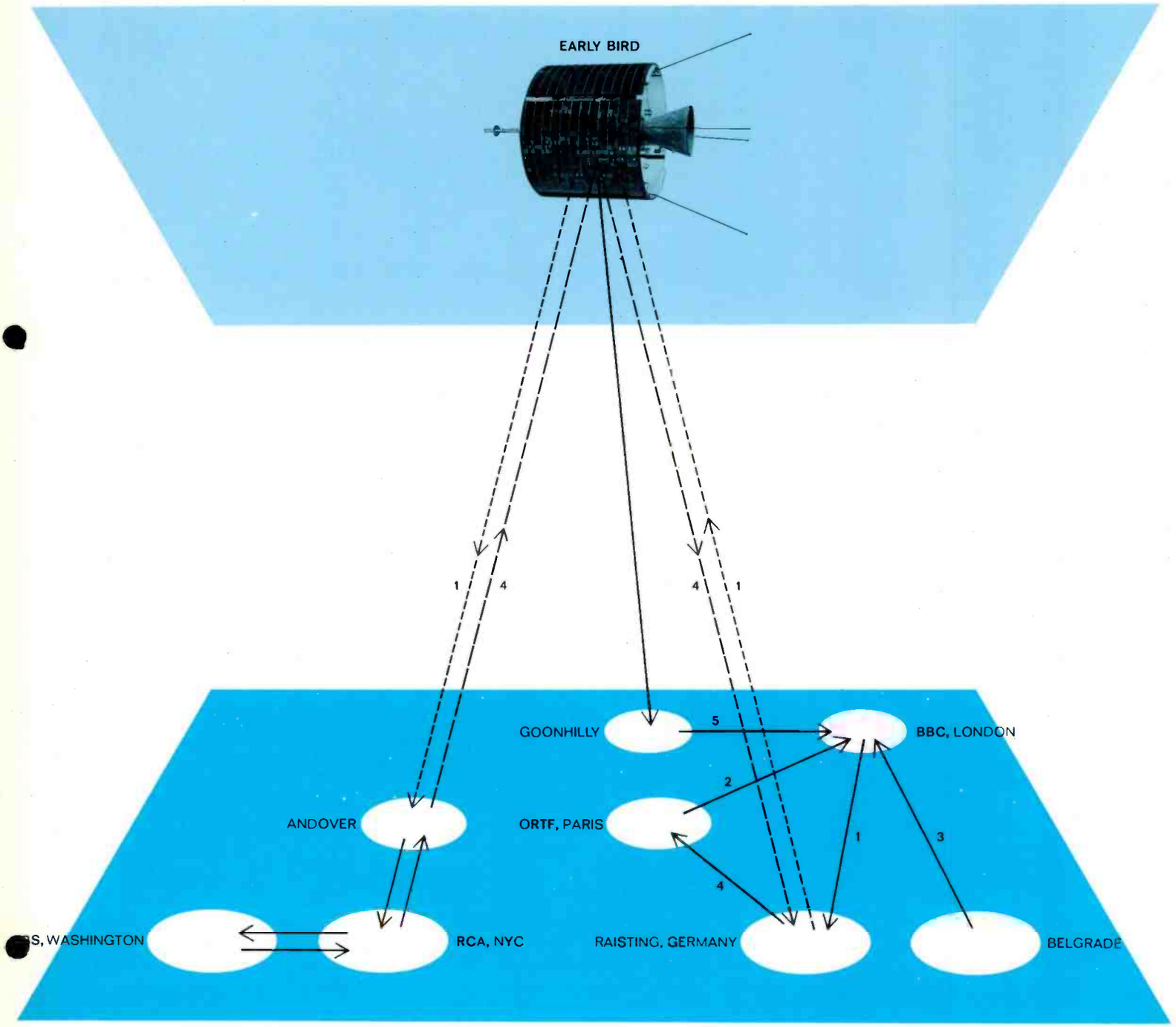
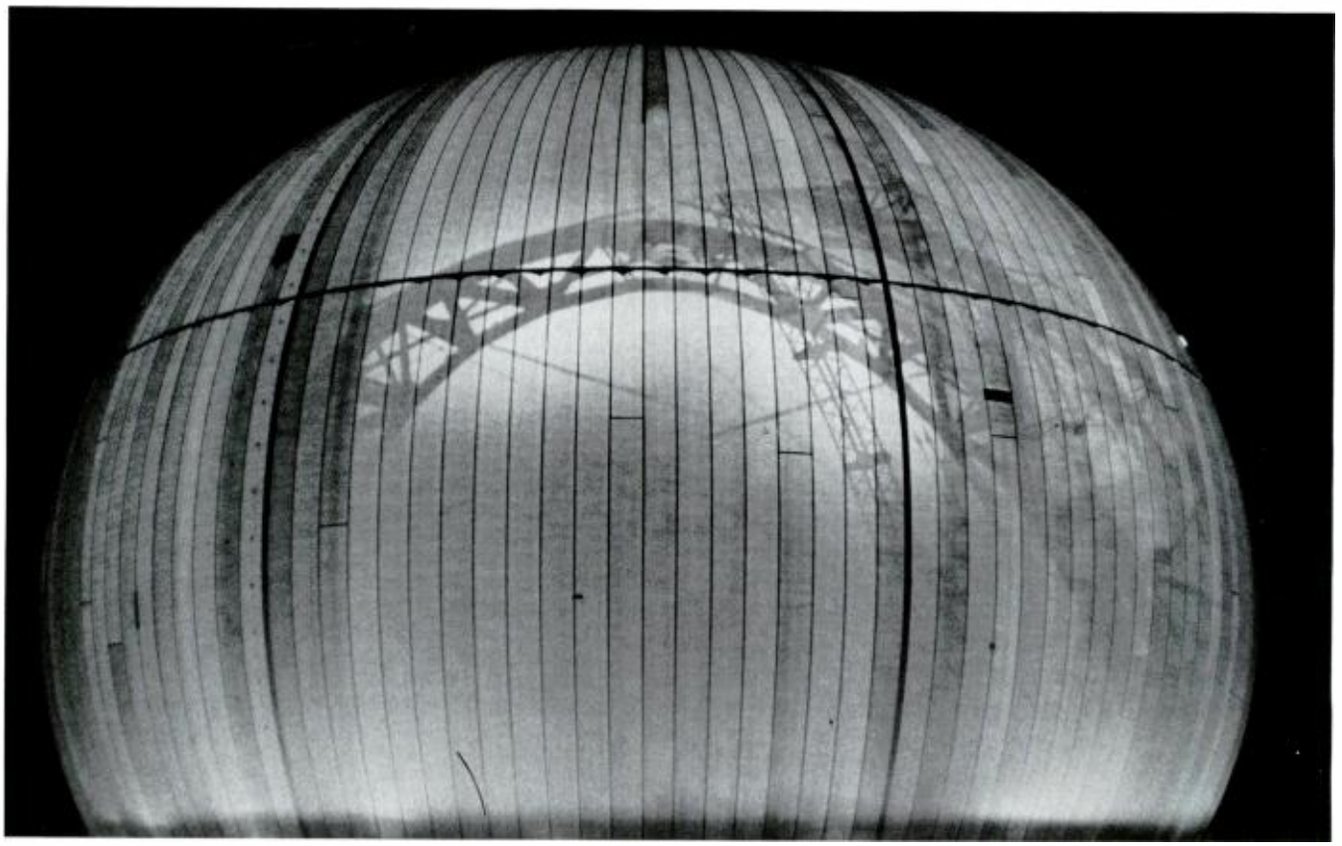
Complexity of routing for a satellite television program is seen in this diagram. CBS's "Town Meeting of the World" originated simultaneously from Washington, London, Paris, and Belgrade. European signals were carried via the Raisting, Germany, ground station to Early Bird and then to the U.S. via the Andover, Me., ground station. U.S. signals followed a reverse route with the Goonhilly, England, ground station added to the circuit for simultaneous viewing in England.





Dome at the Andover, Me., ground station contains antenna from which television signals are broadcast and received.

fronted broadcasters in the past was the sheer diversity of European communications facilities. This problem is something the common carriers have lived with over the years. Simply put, there is no European equivalent of the situation in the United States where AT&T owns and operates a nationwide coaxial cable network with a readily available tariff of prices and conditions.

What may be regarded as the first major assignment for RCA Communications' television service took place in October, 1965. As it happened, it was CBS's "Town Meeting of the World" with former President Dwight D. Eisenhower. The program also featured Arthur J. Goldberg, U.S. Ambassador to the United Nations, Thurgood Marshall, U.S. Solicitor General, and European students in London, Paris, and Belgrade. As the chart on the previous page shows, it was an extraordinarily complex technical assignment. The program was to be seen simultaneously in both Europe and the United States — a technical maneuver that called for two-way picture and sound facilities. BBC, London, was to be operational headquarters for the broadcast, but almost immediately a routing problem cropped up.

Routing may seem like a trifling traffic problem. But in a very real sense the most important and difficult problem in planning an intercontinental TV broadcast is not lining up the guests but taking care of the electronic pathways over which the television signal must travel. In this instance, Lou Donato, Manager, Data Voice and Television Services of RCA Communications, was informed that there was no way for the British to receive simultaneously the TV signals from Paris and from the United States. Says Donato, "The dilemma was brought about by the fact that there was only one video circuit available from Paris to London. As a consequence, the British audience could view only the portion originating in Paris but not the U.S. segment of the program." Donato persuaded the British to operate Goonhilly as a secondary ground station. The result can be seen from another glance at the chart. By adding Goonhilly to the ground station line-up, Donato had cleared a pathway from New York via Early Bird to BBC, London.

RCA's determination to improve the technical quality of satellite television was tested again late last year, when NBC decided to originate "Meet the Press" in Europe. For many years, television programs broadcast across great distances have suffered from streaking; the effect is evident as a carry-over image from a commentator's white shirt onto his suit lapel on the right side of a TV picture. The explanation is to be found in something engineers call "low-frequency distortion." Donato and his colleagues did some strenuous thinking about the problem. Under the old system, this problem might well have been ignored. RCA's television service, however, insisted that the picture quality could be improved. It was. Other picture impairments, such as poor resolution, improper contrast, picture ripple or hum, and picture instability, have also been eliminated or improved.

For the broadcasters — who, after all, are going to be

the biggest users of satellite TV — there is an important lesson in all of this, for technical issues now loom as the biggest obstacle to the worldwide satellite communications system on which the United States has pinned such high hopes. Any attempt to widen the range of intercontinental television will depend not only on bigger and better satellites but will also depend in good measure on many more ground stations, microwave, and coaxial cable facilities. Meanwhile, the common carriers will almost certainly help increase television usage of satellites.

RCA Communications' President Howard R. Hawkins states the case succinctly: "Early Bird, you see, is just a beginning. By 1968, we should see the start of a truly global system. I can foresee prospects, for example, for closed-circuit TV on a worldwide basis. And the prospects for television service to the developing nations are obvious."

Indeed, the combination of the common carriers' international know-how and the broadcasters' creative abilities has already had a result that might have been predicted by anyone familiar with the American experience: bigger and more ambitious intercontinental broadcasts. In the last two years, thanks to satellite TV, German viewers have seen and heard President Johnson; Italian viewers have followed the triumphant visit of Pope Paul to the United States; British viewers have watched the Clay-Patterson fight direct from Las Vegas; and American viewers have had an armchair view of the Olympic Games direct from Tokyo.

Obviously, the ranch hand in Montana and the professor at the Sorbonne live in worlds that are not similar. There is a vast difference between a *wayang* shadow play in Indonesia and a baseball game played on a sandlot in Iowa. So is there a difference — to pick just another example — between a political campaign in France and a Presidential campaign in the United States. But the very distance between such extremes represents satellite television's immense and formidable potential.

It is fair to predict that by 1970 we will be well on our way to having worldwide television. Even now, we are chipping away the old sectional and geographic differences. In Europe, 18 nations have already joined forces to wipe out communications barriers. Through Eurovision, more than 30 million families — from Stockholm to Madrid — can watch major events and sports as they happen. The broadcasters have shattered language barriers, political differences, and standards conversion. And this is really the most exciting vision of the future.

Arnold Toynbee, one of the world's great historians, has written: "A worldwide network of television broadcasting is going to expand the circle of everyone's personal acquaintances to a worldwide range: and this is the very thing that we most need in the dangerous chapter of history through which we are now passing." By increasing the broadcaster's ability to program on a global basis, satellite television will almost certainly increase broadcasting's ability to inform, enlighten, and entertain. ■

First color program from England via Early Bird was NBC's "A New Look at Olde England" with Sander Vanocur interviewing university students.

# Television and the Movies

*Hollywood sound studios are now producing full-length motion pictures as well as filmed series for television.*

by Peter Bart

The relationship between the two visual mass media, television and motion pictures, has undergone a fascinating evolution in the last few years. When TV first appeared on the scene nearly two decades ago, the impact on the movie business was cataclysmic. Average weekly movie attendance was cut in half. Thousands of theaters went out of business. The movie moguls vowed they would fight TV to the death, and many feared that death would indeed overtake the once-imperious movie studios.

Now the situation has flip-flopped. Hollywood's anemic economy has grown robust again; the main reason for the recovery is that the studios that once pledged total war against TV have since learned to embrace the new medium. Today, the studio commissaries are humming once more, but the talk around most of the tables involves not movies but TV shows. The studio sound stages are busy throughout the year turning out filmed TV series. Even some of those old-line film-makers who still scorn TV admit that they could not make their motion pictures without the potential revenues that accrue from the sale of their films to the TV market. The only reason that the studios can continue to finance multimillion-dollar motion pictures is that they know they are assured of anything from $500,000 to $2 million from the eventual exhibition of these pictures on TV.

The arrangements between those one-time antagonists have even reached the point where the two media have begun to collaborate on the production of motion pictures. The pictures involved are the new "TV movies" that recently have gone into preparation in Hollywood. These are motion pictures financed jointly by TV networks and movie studios for exhibition first on TV and then in theaters. Traditionally, of course, the studios financed their own pictures and released them in theaters first and then, after completing their theatrical run, on TV.

The "TV movies" are rather controversial ventures in Hollywood. Some observers believe they will prove a great success and eventually will even dominate network prime time. Others believe they will prove a failure, that the studios eventually will go back to the old idea of showing pictures in theaters first rather than on TV. No matter what view is taken, everyone admits the new pictures represent a potentially significant innovation for both the movie and TV industries as well as a historic milestone in the cooperation between the two competitive media. Certainly, a decade ago no one in Hollywood would have believed it possible that the movie studios, once so bitterly opposed to the incursions of TV, would actually become happy business partners of the networks.

The need for the new TV movies was brought about by the mounting dependence of the TV stations and networks on movies. A few years ago, movies were relegated to the late evening hours on TV; they were considered grist for the insomniac trade. Today, hardly a night goes by without the networks presenting a major motion picture; and the local stations offer virtually a steady diet. Indeed, some observers argue that motion pictures have emerged as the most durable type of TV fare. The program casualty rate of new TV series, they note, has continued to soar in recent years. New series that look promising in the fall suddenly become "turkeys" in midwinter. Yet, the movies seem to have built up an incredible acceptance among sponsors as well as viewers.

However, there is one disturbing factor; there are not enough movies to go around. With some stations using 500 or more movies a year, it was inevitable that Hollywood's formidable backlog of motion pictures would be exhausted. And the studios have not been turning out new movies at a brisk enough rate to meet the demand. Hollywood, in fact, is turning out only 150 or so new pictures a year — hardly a breathtaking pace. Before World War II, the annual output totaled several hundred films.

Why is output lagging? There are several answers. For one thing, the costs of movie-making have risen so steeply in Hollywood that the studios simply cannot afford to turn out more films each year. Labor costs have soared; actors' demands have risen to unprecedented levels.

PETER BART is the Hollywood correspondent for the *New York Times*.

Because of these soaring costs, the relatively shallow supply of top-line actors, the shortage of talented writers and directors, plus myriad other factors, the movie studios have found in recent years that they cannot meet the burgeoning demands of TV for a "new product." Instead of supplying new pictures, the studios have merely been demanding more money for old ones. Hence, the asking price for a one-time showing of the David Lean classic, "The Bridge on the River Kwai," shot up to $2 million.

As a result of this crisis, the networks and studios are now trying to work out a new system of supplying pictures to TV at a reasonable cost without any significant decline in quality. The new system is built around the so-called "TV movie" — some skeptics say they are merely two-hour telefilms while optimists claim they are full-fledged motion pictures.

It is too early to determine just what shape and form the TV movies eventually will take, but, from early indications, they will differ from conventional movies in several ways. They will have lower budgets than most of the major studio productions. This, in turn, will mean that they may not normally have top-line stars or the action-packed spectacular scenes filmed on location that often characterize the big-budget pictures. They will, of necessity, deal with subjects that will hopefully be of interest not only to American audiences but also to audiences overseas — this is because, after their TV showing, they will be shown in theaters abroad.

The studio that has been most aggressive in pioneering the TV movie is Universal Pictures. Last year, Universal came out with four TV movies on a trial basis. Two of these — "The Hanged Man" and "See How They Run" — were shown on TV and got handsome ratings. Two others — "The Killers" and "The Plainsman" — were distributed through conventional channels — theaters — rather than on TV as initially planned. The reasons were never formally explained. It was understood that "The Killers" was deemed to have too much violence in it for TV consumption. And "The Plainsman" ended up costing considerably more (about $1.2 million) than most TV movies will cost.

This spring, Universal moved ahead with an ambitious slate of a dozen TV movies. NBC has the right to show the movies first on TV — in effect, a world premiere. Universal retains theatrical and syndication rights. This means that the studio eventually can profit from showing the films in foreign theaters or, in years to come, syndicating them to local TV stations around this country.

Universal's initial TV movies of 1966 reveal its approach to this type of film-making. The first, "Dragnet 1966" starring Jack Webb, revives the popular "honest cop" of the 1950s, Joe Friday, in a new case that will go before the cameras for about $600,000. Universal figures that, in an era of James Bond gimmickry, Joe Friday's realistic, workmanlike sleuthing may find a new audience. A second picture, "The Doomsday Flight," will star two venerable performers, Van Johnson and Edmund O'Brien, in a suspense film dealing with an airliner that has had a bomb planted on it. A third, "The Four Winds," will concern the Bataan march of World War II. War is one subject, Universal reasons, that strikes a chord of recognition both here and abroad. "The Four Winds" will team Doug McClure, an actor well known on TV, with Ricardo Montalban, an actor well known to movie audiences abroad.

The aim in all three pictures is to shoot them for under $1 million each — a novel ambition in inflation-prone Hollywood. Indeed, the whole emphasis on budget in the new TV movies represents a valuable exercise for film-makers here. "There's a tendency in Hollywood for the picture-makers to forget about costs," says M. J. "Mike" Frankovich, studio chief at Columbia. "Lots of people want to make daring and different movies. But not many are willing to gamble along with the studio. They won't take a small salary in return for a share of the profits."

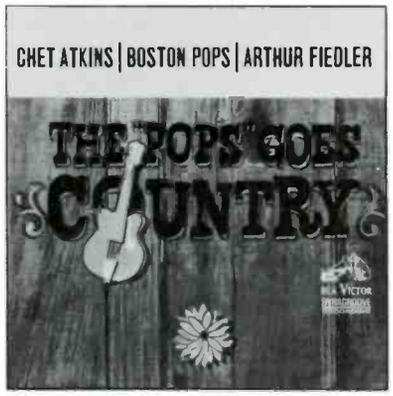
Because of this unwillingness to "gamble" on the success of a picture, Hollywood has never been especially adept at turning out movies keyed to lower budgets — something European picture-makers have long since mastered. Hollywood has excelled at the big budget spectacular — "My Fair Lady" or "The Sound of Music." But only rarely has Hollywood come up with low-cost gems such as "Marty" or "Lilies of the Field."

"The TV movies could perform a valuable service in demonstrating once again that it is possible to make a class picture on a modest budget," says one of Hollywood's best-known producers. Certainly, the know-how is there. Hollywood's craftsmen can create the most extraordinarily realistic sets without leaving their cavernous studio sound stages. For the movie "Hawaii," workers at the Samuel Goldwyn studios actually built a small 18th century vessel that pitched violently on hydraulic pumps and was doused by water hoses to make it appear as if it were enduring a storm at sea. (The noise of the pumps was so loud that Elvis Presley, shooting a picture on an adjoining stage, dispatched an aide to see if things could not be quieted down a bit.) In addition, the studio back lots are bedecked with a breath-taking array of sets. Anyone strolling through Universal's back lot will find a replica of a Parisian square; moments later he will be surrounded by the little stores and front porches of a small town in the deep South, and a few steps later he will be outside a saloon on main street in an Old West town. In Hollywood, almost any illusion can be created at the command of the director and cameraman.

Will the TV movies eventually dominate TV? No one knows for sure, of course. Some observers believe that the day of the motion picture on TV is only dawning at the present time. Others believe that the filmed TV series will outlast the present movie trend. Still others foresee the time when the grand old days of live TV will return anew.

Whether they endure or not, the TV movies at least will have established some interesting precedents in Hollywood — precedents of interindustry cooperation rather than civil war. The TV movies have demonstrated how two once-antagonistic industries can find the means of helping to solve each other's problems. The networks have helped supply new capital to the movie industry and have helped insulate the studios against some of the awesome risks of film-making. The studios, in return, have helped to satisfy the networks' seemingly insatiable appetite for "new product." Both have gained. And so has the TV viewer. ■

**"THE 'POPS' GOES COUNTRY":** *Chet Atkins, with Arthur Fiedler and the Boston Pops Orchestra (RCA Victor LM/LSC 2870).* The country's top pop guitarist in his first collaboration with Arthur Fiedler and the Boston Pops plays such enduring country favorites as "Country Gentleman," "Tennessee Waltz," "Cold, Cold Heart," "On Top of Old Smoky," and others. Richard Hayman has provided the arrangements, in which Chet is accompanied by his own bass and drum players and the 95-man Pops orchestra.




**"LIGHTLY LATIN"—PERRY COMO** *(RCA Victor LPM/LSP 3552).* Oddly enough, "Mr. Relaxation" has never made an album of Latin American music before this one. The tunes are chiefly bossa novas by Jobim, Bonfa, Barroso, and Caymmi and are as relaxed and casual as the singer. With "lightly Latin" rhythm, he sings "How Insensitive," "And Roses and Roses," "Meditation," "Quiet Nights of Quiet Stars," and others. Equally romantic are "Yesterday," "The Shadow of Your Smile," and the Nick Perito–Ray Charles' "Stay With Me."

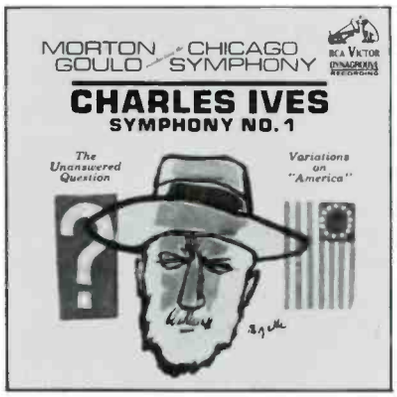

**"KATE SMITH ANNIVERSARY ALBUM"** *(RCA Victor LPM/LSP 3535).* From the more than 600 songs she has introduced in the 35 years since her first regular radio show, Kate Smith has chosen 24 to sing in her anniversary album. And what great hits they are! Arranged in medleys of three songs each are such all-time favorites as "Along the Santa Fe Trail," "Don't Fence Me In," "September in the Rain," "That Old Feeling," "Deep Purple," "Seems Like Old Times," "The White Cliffs of Dover," and "All the Things You Are."


# For the Records...

NEWS OF RECENT OUTSTANDING RCA VICTOR RECORDINGS


**SMETANA: STRING QUARTET IN E MINOR; DVORAK: STRING QUARTET IN A-FLAT; MOZART: STRING QUARTETS IN B-FLAT AND IN F:** *the Guarneri Quartet (RCA Victor LM/LSC 2887, 2888).* "A very important quartet is on its way," wrote Harold C. Schonberg in the *New York Times* of the four young American virtuosos who formed the Guarneri Quartet only two years ago. These debut albums contrast their versatility in the romantic and classic repertoire. The talented foursome are alumni of the Marlboro Music Festival, where they benefited from the inspiration and friendship of Rudolf Serkin, Alexander Schneider, and Boris Kroyt of the Budapest String Quartet.

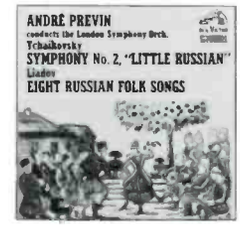

**MAHLER: SYMPHONY No. 6; BERG: LE VIN:** *Boston Symphony Orchestra with Erich Leinsdorf, Musical Director; Phyllis Curtin, soprano (RCA Victor LM/LSC 7044).* The performance of Mahler's "Tragic" Symphony by Mr. Leinsdorf and the Boston Symphony in November, 1964, was only the third full-scale performance of the work in this country. This recording, the first to use the 1963 Critical Edition of the score, was made shortly thereafter. Mr. Leinsdorf gives a masterful interpretation of this massive work. "Le Vin," Berg's concert aria with orchestra, is based on three poems by Baudelaire in the German translation by Stefan George. Phyllis Curtin is soprano soloist.

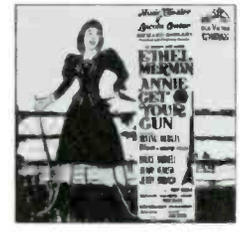



**CHARLES IVES: SYMPHONY No. 1; THE UNANSWERED QUESTION; VARIATIONS ON "AMERICA":** *Morton Gould conducting the Chicago Symphony Orchestra (RCA Victor LM/LSC 2893).* The first recording of an early but astonishingly mature symphony by the composer increasingly recognized as one of America's greatest, together with the rowdy, tongue-in-cheek "America" Variations, and the haunting, mysterious "Unanswered Question." Morton Gould, who came upon the unpublished manuscript of the symphony by accident, led the Chicago Symphony in the premiere of the work last fall. The Chicago Symphony now has an exclusive RCA Victor Red Seal contract.





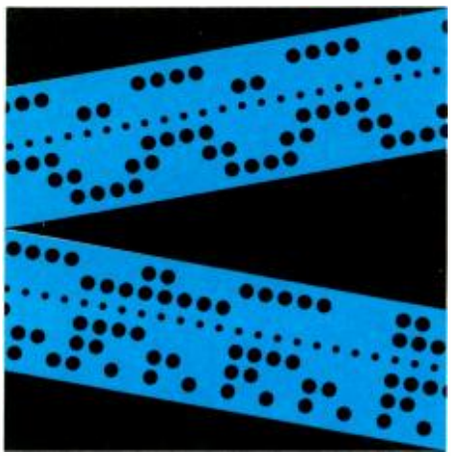




OTHER CURRENT RELEASES

# Electronically



# Speaking...

## RESERVATIONS BY COMPUTER

A common access computer system that can serve as a central clearinghouse for airline reservations and flight information will go into operation within several months at RCA Communications' international telecommunications center in New York City. The service, called AIRCON, will have as its initial subscribers two major international carriers, Scandinavian Airlines System and Swiss Air Transport Company.

AIRCON features two Model 4104 computers, built by RCA's research and development center in Van Nuys, Calif., which are capable of handling more than 250,000 messages a day. At the outset, it will primarily handle administrative and reservations traffic. Subscribers flying routes within North America will be able to interrogate seat inventories of subscribing intercontinental airlines and arrange through-bookings in seconds. Intercontinental airlines will also be able to obtain information on passenger inventories of airlines in North America.

## OFFSHORE MICROWAVE SYSTEM

A few years ago, engineers and geologists of the Shell Oil Company had to travel by helicopter or boat to offshore drilling rigs to examine earth strata being penetrated. Now, they are able to follow progress at the rigs from onshore locations through a RCA microwave system that instantly relays information in digital and facsimile form.

Installed in 1964, Shell's system is being expanded to include four stations of microwave equipment that will provide additional facilities for voice, data, and other communications between shore points and platforms at sea. The existing system provides 90 communications channels connecting Shell offices at New Orleans and Morgan City, La., with 10 offshore locations and eight points on shore. Once the offshore well is in production, its meters are read and necessary pumps, valves, and other equipment are controlled remotely by microwave.

## HIGH-VOLTAGE ELECTRON MICROSCOPE

A high-voltage electron microscope with the capacity to penetrate metallurgical and other specimens many times thicker than those used in conventional electron microscopy is destined to become one of the nation's most powerful new research tools.

The microscope is powered by a 500,000-volt power supply and will enable scientists to reveal and study ultra-small structures never before seen. RCA is designing and building the system for the Department of Material Sciences, School of Engineering and Applied Science, of the University of Virginia.

The extremely high voltages generated in the microscope will permit study of specimens 1/25,000th of an inch thick. For accurate study, an electron beam of a conventional electron microscope can penetrate specimens no thicker than 1/250,000 to 1/125,000th of an inch. Information obtained from the much clearer specimen images of the new microscope could lead to advances in the development of improved materials for space vehicle construction and in the control and treatment of diseases.

## WEATHER WATCHING

Man still is not able to do anything about the weather, but recently, while standing in the street, he was able to tell what it looks like from outer space.

Through a window of RCA's Exhibition Hall in Rockefeller Center in New York, passers-by could observe a weather satellite ground station receiving and recording weather pictures from the ESSA 2 and Nimbus 2 satellites. RCA's Astro-Electronics Division in Princeton, N.J., made the camera systems and much of the electronic gear aboard both spacecraft.

The camera systems on ESSA 2, one of the two operational TIROS satellites in orbit, and on Nimbus 2, an experimental satellite, can automatically transmit weather pictures to simple, inexpensive ground stations similar to that which was on display at the Exhibition Hall.

## NEW FORCE IN SUPERCONDUCTORS

A pioneering experiment has revealed for the first time the identity of a newly observed force in superconductors that could provide a key to eventual new types of electric generators and other devices.

The experiment identifying the force was devised by Dr. Judea Pearl, a physicist at RCA's David Sarnoff Research Center, Princeton, N.J., in connection with studies relating to the use of superconductivity to store information in computers. He found that the force is analogous to the so-called magnus force that causes a spinning ball to move sideways as well as forward when it is thrown, the force that makes it possible for a baseball pitcher to throw a curve. In the case of the ball, the force is exerted by the difference in air pressures against the side of the ball spinning forward and the side spinning away from the direction of travel. In superconductors, a similar effect occurs when magnetic lines of force are moved from one side of the material to the other. This causes the simultaneous movement across the material of tiny electric currents circulating around the lines of force; the result is an electric potential along the length of the material.

## SPEECH RECOGNITION SYSTEM

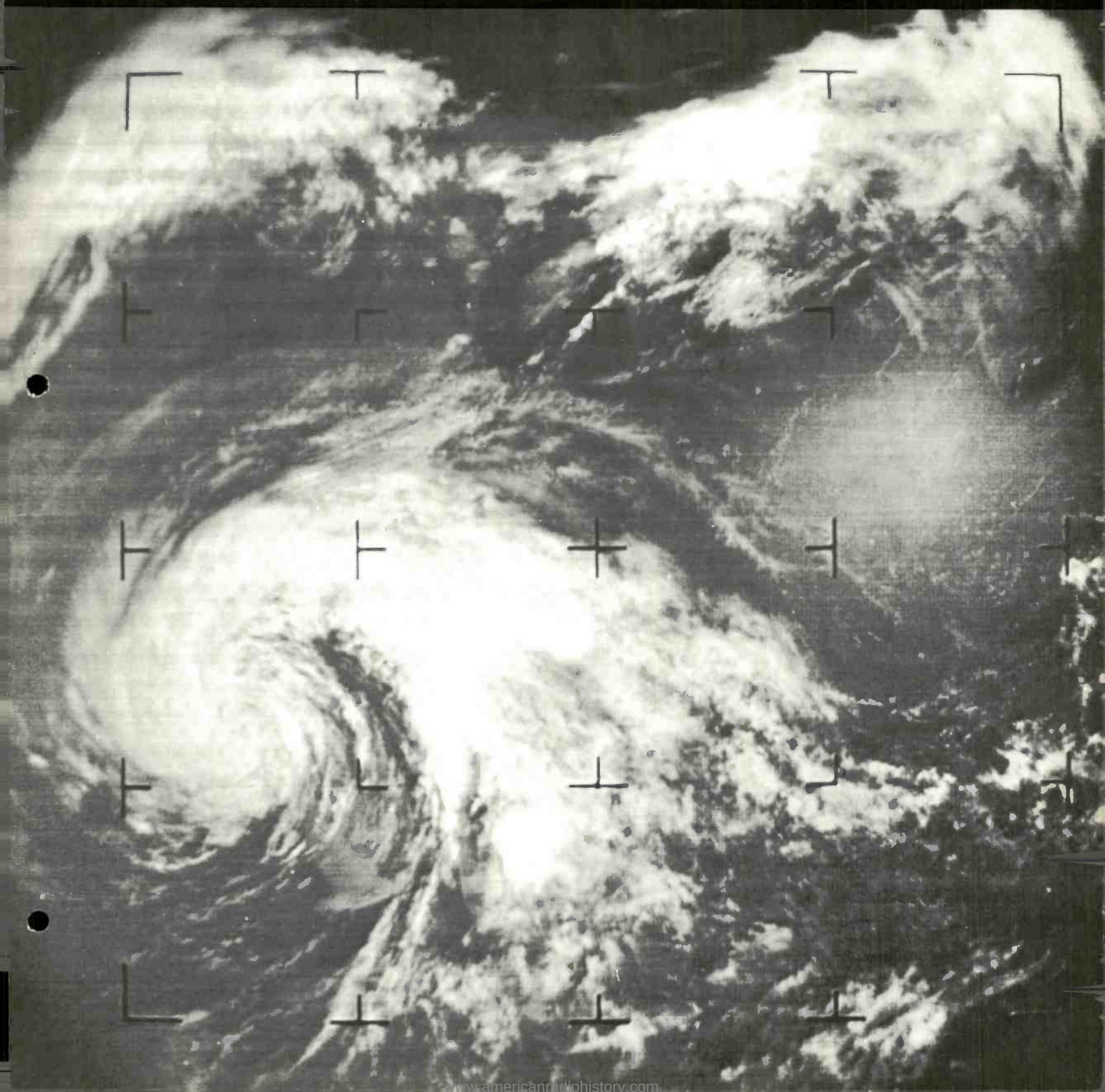
Direct voice control of typewriters, telephones, computers, and other machines moved a step closer with the recent development of an experimental Speech Recognition System for the United States Air Force. Employing unique electronic circuits that function like living nerve cells, the system is believed to be the most accurate voice recognition device for isolated words ever developed.

Built by RCA's Applied Research organization, Camden, N.J., to permit voice conversations from spacecraft to earth with a small fraction of the power needed by conventional means, the system is expected to lead directly to such developments as voice control of telephone dialing, programming of computers by oral command, voice-controlled typewriters, and automatic translation of speech messages into any language.

The system identifies the smallest units of speech, called "phonemes," by abstracting their more salient features through circuits called "analog threshold logic elements." Of the 40 phonemes in the English language, the machine can recognize 28.

In its present configuration, the equipment recognizes the initial consonant and the following vowel in a consonant-vowel-consonant word such as "mad," taking into account the influence of the following vowel on the consonant. Further experimentation will be directed at producing circuitry that will determine the influence on the consonant of a preceding vowel. The system will then be able to identify all phonemes in complete discrete words.

On June 9, the earth-orbiting satellite ESSA 2 took this picture of Hurricane Alma, the first of the season, swirling over the southern half of Florida. The tip of the Florida peninsula is discernible below the eye of the hurricane. Built by RCA for the U.S. Environmental Science Services Administration, ESSA 2 is providing continuous pictures of the world's weather to ground stations in many parts of the world.



# ELECTRONIC AGE

RCA *Summer 1966*

*Electronic Films: An Emerging Technology*