

**PIONEERING
IN
TELEVISION**

prophecy and fulfillment

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pioneering in television

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and
fulfillment***

excerpts from speeches and statements
by **Brigadier General David Sarnoff**,
president of Radio Corporation of America

c o n t e n t s

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f o r e w o r d

DAVID SARNOFF, thirty years ago — in 1916 — envisaged the “radio music box,” which came into being in 1920. Now it is known everywhere by millions of people as the radio receiver — an ear to all the world. Since that time, Brigadier General Sarnoff as a leader in all phases of radio, advanced this new art as a science and an industry. His statements on communications, broadcasting and television reveal his sound business judgment and keen foresight; a great faith in science and a vision that has inspired scientists, inventors, research men and engineers. He has been a pioneer in pointing the way through the wilderness of the unknown in radio and electronics.

In 1922, he conceived that broadcasting could render a great service to the public if it were conducted on a national scale rather than on merely local lines. Four years later, in 1926, he planned and organized the National Broadcasting Company as the first nation-wide

network to make the best programs available for broadcasting throughout the country. Later, he extended NBC's programs internationally.

The purpose of this booklet is to bring together General Sarnoff's statements on radio's latest development — television — so that they may serve as a historic record of progress in the face of many obstacles, a challenge to the imagination of youth and a chart for the future of television as a service of entertainment and information to the American people. His prophecies have become realities.

A staunch advocate of research, General Sarnoff sees the hope and opportunities of tomorrow in the new knowledge gained today as men of science continue their advance across new frontiers. He looks to television as a new picture-window opening out upon the world from homes of rich and poor alike.

The Television Broadcasters Association at its first Annual Conference on December 12, 1944, presented General Sarnoff with the following citation: "*For his initial vision of television as a social force and the steadfastness of his leadership in the face of natural and human obstacles in bringing television to its present state of perfection. The Committee on Awards wishes to call him The Father of American Television.*"

A handwritten signature in cursive script, reading "J. G. Harbord".

CHAIRMAN OF THE BOARD
RADIO CORPORATION OF AMERICA



DAVID SARNOFF
PRESIDENT, RADIO CORPORATION OF AMERICA

PIONEERING IN TELEVISION

STATEMENTS BY DAVID SARNOFF

television within range of achievement

I believe that television, which is the technical name for seeing instead of hearing by radio, will come to pass in due course. . . . It is not too much to expect that in the near future when news is telegraphed by radio—say to the United States, of important events in Europe, South America or the Orient, that a picture of the event will likewise be sent over by radio and both arrive simultaneously. Thus it may well be expected that radio development will provide a situation whereby we will be able actually to see as well as read in New York, within an hour or so, the event taking place in London, Buenos Aires or Tokyo.

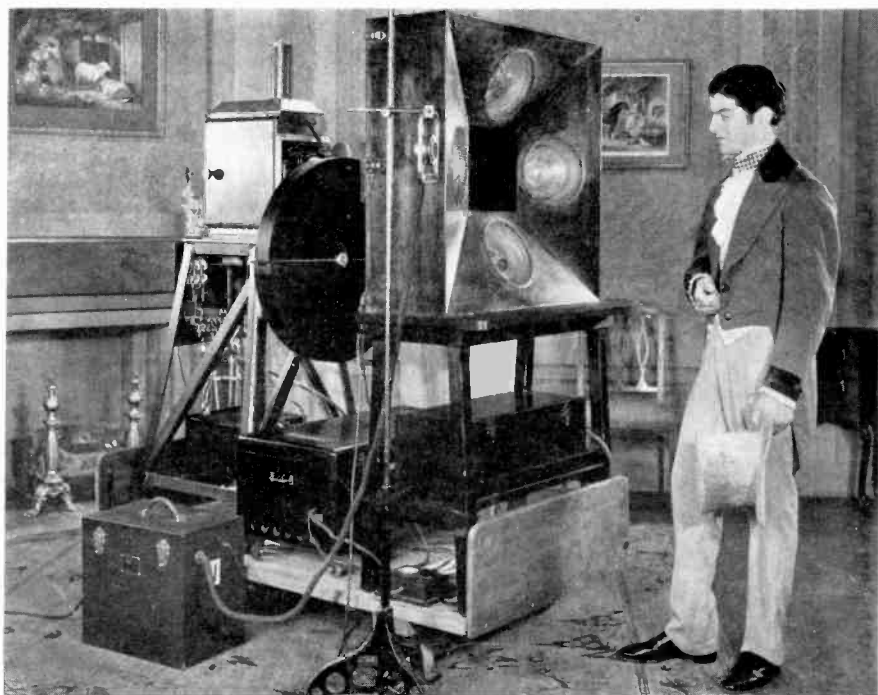
I also believe that transmission and reception of motion pictures by radio will be worked out within the next decade. This would result in important events or interesting dramatic presentations being literally broadcast by radio through the use of appropriate transmitters and, thereafter, received in individual homes or auditoriums where the original scene will be re-enacted on a screen, with much the appearance of present day motion pictures.

This re-enactment may, of course, be accompanied by music or speech of the original performance, thus conveying the impressions of sight and sound simultaneously to the broadcast listener and observer. The problem is technically similar to that of radiotelephony though of more complicated nature; but, within the range of technical achievement. Therefore, it may be that every broadcast receiver for home use in the future, will also be equipped with a television adjunct by which the instrument will make it possible for those at home to see as well as hear what is going on at the broadcast station.—*Extract from Memorandum on "Radio Broadcasting Activities", submitted by David Sarnoff to Directors of RCA on April 5, 1923.*

joining sight to sound in radio

. . . With the inspiring demonstrations recently made . . . of television, or the art of distant seeing, we have passed the point of conjecture as to its scientific practicability. It is an accomplished fact. Not only by wire but by radio can an image be instantly flashed from point to point, so that it appears as an animated or moving picture of the subject thus photographed. True, tremendous technical facilities were required for the feat of bringing to a group of spectators in New York the voice and movements of Secretary Hoover as he sat at his desk in Washington. But this is only the laboratory stage.

The possibilities of the new art are as boundless as the imagination. But this much is certain: In the sphere of communication man will forever seek a medium of transmission in pace with his thoughts and desires. It is to the glory of man that he has never



Mechanical scanning equipment was used in the RCA-NBC experimental television station W2XBS, New York, in 1928.

quailed before the apparently insurmountable obstacles of space and time. In the circumstances, it is inconceivable that he will not make the fullest possible use of a medium of communication which bridges the distance between himself and the objects of his interest. —*Address before the Chicago Association of Commerce, Chicago, Illinois, June 8, 1927.*

the theatre of the home

. . . With great motion picture theatres forming huge centers of entertainment, with neighborhood picture houses in every city, with radio and the “movies” at every crossroad, it might seem at first thought an extraordinary effort of the imagination to vision virtually millions of “little theatres” added to the constellation of entertainment made possible by radio, talking pictures and the modern phonograph. And yet the progress of the electrical arts inevitably points in this direction. A separate theatre for every home, although the stage may be only a cabinet and the curtain a screen — that, I believe, is the distinct promise of this era of electrical entertainment.

. . . While still far from exhausting the possibilities of sound, research and laboratory development are now raising the curtain on an entirely new art—sight transmission by radio.

. . . Important as has been our progress in the development of sight transmission, great technical problems still remain to be solved before such a service can be established upon a practical basis. Some of the factors involved are readily appreciated when one considers that television programs of continuing entertainment value would require the transmission of approximately 20 pictures or more per second, each picture the equivalent of somewhere between 5,000 and 10,000 picture elements. . . . New channels of communication must be provided in space and they must be made relatively free from electrical interference.

In the organization of a broadcasting service by television the question immediately arises how a spontaneous event may be placed before the greatest possible number of spectators, allowing

for the fact that such events are apt to occur in the day time, the difference in time in various parts of the country, and the family gathering hours in the evening.

Nevertheless the opportunities for entertainment and education which television brings into view are much greater than its service problems. Television could be harnessed to the motion picture screen so that a great event might be simultaneously recorded in a number of key cities throughout the nation and the talking motion-picture film distributed again by television to millions of homes some hours after the actual occurrence. Television, when it does come upon a practical service basis, promises to supply a vast invisible channel of distribution for motion pictures in the home.

There is little in the field of cultural education that cannot be visioned for the home through the new facilities of electrical communication. Assume sufficient progress in the television art, and every home equipped for radio reception may, at certain times, become an art gallery. The great works of painting and sculpture in the art galleries of Europe and America lie buried there, insofar as the vast majority of the world's population is concerned. Television, advanced to the stage when color as well as shadow would be faithfully transmitted, could bring these treasures vividly to the home. The Louvre and Metropolitan could then extend their cultural influence to millions of homes. Conceive the exhibition of such works of art in the home, accompanied by comments and explanations of the proper authorities. Just as sound broadcasting has brought a new sense of musical appreciation to millions of people, so could television open a new era of art appreciation.—*Reprinted from The New York Times, July 13, 1930.*

when millions listen in

. . . At the present time an entirely new era of radio communication—radio television—is opening before us. I believe that a simplified and moderately priced television receiver practicable for home use will be developed. At this moment, however, television is still in the laboratory stage.

In the true sense of the word, television will come when sta-



Seeing by television in 1928: cabinets were bulky and screens small.

tions regularly, through remote control, broadcast visual objects in the studio or current happenings anywhere in the world; when reception devices make these objects and scenes discernible in millions of homes; when a service shall have been established to bring such informative, educational and entertainment sights to the homes, or schools or theatres equipped to receive them.—*From The Rotarian, April, 1931.*

television today and tomorrow

. . . The sweep of events during 1930 and the first months of 1931 has been very substantial indeed. Television has been brought definitely nearer commercial development by the research and technical progress of the Radio Corporation of America during this period.

One year ago, television was a subject of engineering conversation and a topic for technical dispute. It now has progressed beyond that point. Today, transmission of sight by radio is a matter of accomplishment, not of speculation.

It must be understood, however, that the present sporadic activities in this direction cannot be classed as a practical service.

They are purely experimental, but as such deserve encouragement and merit public interest.

The present status of television might be likened to the condition of radio in the immediate pre-broadcasting era, when amateurs were beginning to hear faint sounds through the air. Voices and music were passing through space in those early days of radio; comparably, there are actually some images passing through the air today. They are being received by established experimental stations, and by amateur operators in various sections of the United States. In this connection, it should be observed that the early success of radio broadcasting was stimulated in no small measure by the amateur wireless operators of that day. Similarly, the amateur operator in television is now playing his part in the development of this new service.

. . . The Radio Corporation of America is conducting its



Felix the Cat and Mickey Mouse were the "stand-ins" for engineering tests in the early days of television.

present experimental developments in television through a large research staff in the RCA-Victor plant at Camden, New Jersey. When television emerges from this experimental stage it will be handled as a service by the National Broadcasting Company.

. . . The effect of television upon the present established radio industry will be beneficial. There will be no interference between the broadcasting of sound and of sight. These services will supplement each other and complete the impression upon the human mind by reaching it through both the ear and the eye. Television broadcasting stations will operate on wavelengths different than those now used for the broadcasting of sound. An entirely different receiver will be necessary; radio sets now used for sound reception are not equipped to receive television.

In the practical sense of the term, television must develop to the stage where broadcasting stations will be able to broadcast regularly visual objects in the studio, or scenes occurring at other places through remote control; where reception devices shall be developed that will make these objects and scenes clearly discernible in millions of homes; where such devices can be built upon a principle that will eliminate rotary scanning discs, delicate hand controls and other movable parts; and where research has made possible the utilization of wavelengths for sight transmission that will not interfere with the use of the already over-crowded channels in space.

The Radio Corporation of America is pursuing the foregoing development aggressively in its laboratories and will not attempt to market television equipment commercially this year, as it is concentrating its efforts upon the primary technical developments to be completed before undertaking the manufacture and sale of television sets on a commercial basis.

The motion picture industry need experience no alarm over the impending advent of television.

Transmission of sight by radio will benefit not only the radio industry; it also will prove a welcome stimulant, a pleasant tonic to all the entertainment arts.

There will be no conflict between television in the home and motion pictures in the theatre. Each is a separate and distinct service. . . . And television in the home will not displace the motion picture in the theatre.



Left — A neon lamp, just above motor, “painted” images on the screens of 1928 television receivers. Right — In 1929, Dr. V. K. Zworykin demonstrated his all-electronic television receiver.

Man is a gregarious creature. Granting that we can develop 26,000,000 potential theaters in the homes of America, public theaters will continue to operate because people will go there in response to the instinct for group emotions, and to see artists in the flesh. These are human demands which television in the home cannot satisfy.

. . . Television, when it arrives as a factor in the field of entertainment, will give new wings to the talents of creative and interpretive genius, and will furnish a new and greater outlet for artistic expression. All this will stimulate and further advance the art of motion picture production.

The potential audience of television in its ultimate development may reasonably be expected to be limited only by the population of the earth itself.

Since the dawn of the new era of electrical entertainment, untold millions have been added to our audiences. It is interesting

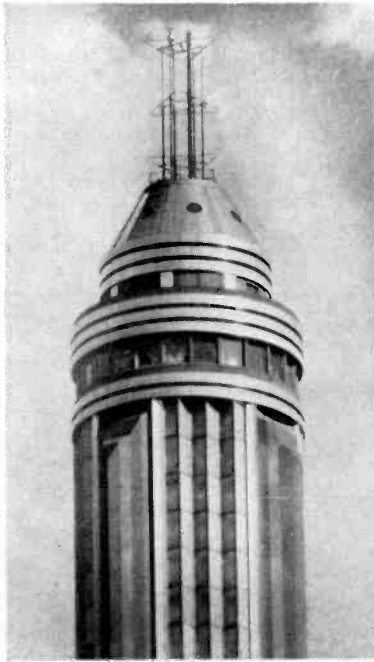
to compare the opportunities of this new era with those of the past. The life-time audience of Demosthenes was not as great as a one-night audience of Amos 'n' Andy. Napoleon and Kaiser Wilhelm, showing themselves in their splendid regalia before all their spectators, never in their lives were seen by as many eyes as saw Richard Dix in "Cimarron". The sound of all the guns and cannons fired in all the wars since the dawn of time did not reach as many ears as does the crow of the proud Pathe rooster on the talking screen.

This vast increase in the entertainment audience has been made possible by the introduction of modern science into the older arts. And now television will come to open new channels, to provide new opportunities for art and the artist and to create new services for the audiences of all the world.

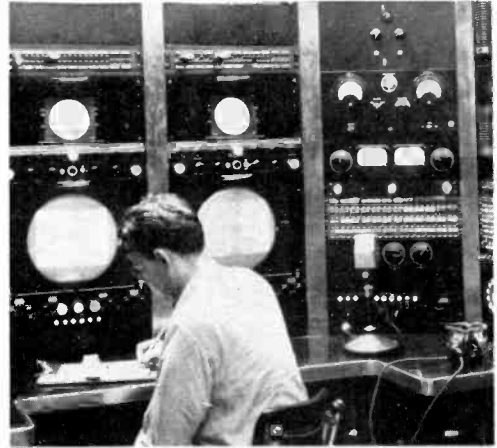
The instantaneous projection through space of light images produced directly from objects in the studio or the scene brought to the studio by remote control involves many problems. Special types of distribution networks, new forms of stagecraft, and a development of studio equipment and technique will be required. With these must come a new and greater service of broadcasting, both of sight and sound. A new world of educational and cultural opportunities will be opened to the home. New forms of artistry will be encouraged and developed. Variety and more variety, will be the demand of the day. The ear might be content with the oft-repeated song; the eye would be impatient with the twice-repeated scene. The service will demand, therefore, a constant succession of personalities, a vast array of talent, a tremendous store of material, a great variety of scene and background.

But even more appealing to the individual, is the hope that television may, at least in a measure, enable man to keep pace with his thoughts. The human being has been created with a mind that can encompass the whole world within the fraction of a second; yet, his physical senses lag woefully behind. With his feet, he can walk only a limited distance. With his hands, he can touch only what is within reach. His eyes can see at a limited range, and his ears are useful at a short distance only.

When television has fulfilled its ultimate destiny, man's sense



NBC's television antenna (left) and transmitter room (below), which were installed in 1931 at Empire State Building, 1,250 feet above sidewalks of New York.



of physical limitation will be swept away, and his boundaries of sight and hearing will be the limits of the earth itself. With this may come a new horizon, a new philosophy, a new sense of freedom, and greatest of all, perhaps, a finer and broader understanding between all the peoples of the world.—*A Statement Issued at Hollywood, California, May 18, 1931.*

a demonstration of progress

. . . There has been much discussion about television for a number of years, and perhaps there never has been a development upon which there has been a greater expenditure of engineering effort in the same period of time. I foresee the continuation of these efforts for many years to come. But we have felt that we have reached a point in our experimentation where we might review our progress. I believe we are at a stage which warrants the conclusion that television ultimately will take its place alongside sound broadcasting as a real and vital service.

We have arranged this demonstration in the spirit of the greatest possible cooperation with our licensees, so that you might be kept abreast with the progress of our laboratory research work and might judge for yourself the extent of the technical progress we have made in television.

I want to mention in this connection what every one of you gentlemen know: that there is a great deal of difference between a television demonstration like this in which we are now participating, and a practical, feasible, commercial television service, so attractive to the individual that a widespread demand for receiving equipment will be created. All of you recall that a great many years were required for the up-building of the extensive system of sound broadcast transmitting stations over the country. Probably just as much time, or more, will be necessary for the up-building of an adequate sight broadcast transmitting system.—*Televised Speech at NBC Empire State Building Studios, May 16, 1932.*

the iconoscope is perfected

It has been the policy of the management to refrain from definite prediction as to the time when television might be brought from the research laboratory and offered on a commercial basis to the American public.

Definite progress has been made each year in research and development incident to sight transmission by radio. Outstanding in television research during the past year was the perfection by RCA engineers of the "iconoscope"—an electric eye—which has advanced the technique of television by facilitating the pickup of studio action and permitting the broadcast of remote scenes, thereby giving to the television transmitter the function of a camera lens. Through the use of the iconoscope, street scenes and performances in studios have been satisfactorily transmitted and received by television, on an experimental and laboratory basis.

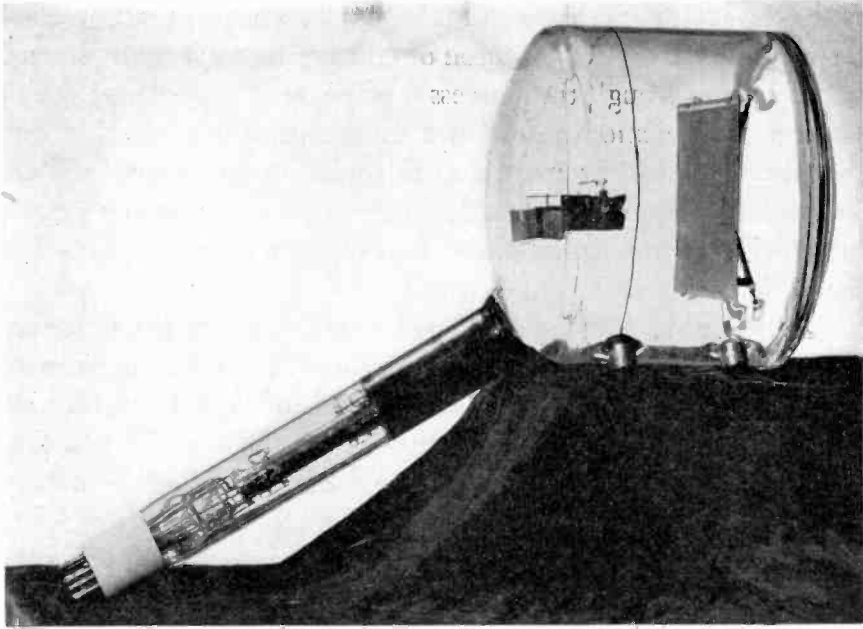
Nevertheless, some important problems relating not only to the technical side, but also the commercial side of television still

call for solution. These problems relate principally to the cost of erecting and operating the necessary television transmitting stations, their interconnection for a wide-range service, the price at which television receiving sets can be successfully manufactured and sold to the public, and the production of suitable programs. While it is impossible to anticipate the exact time when this development can be introduced on an industrial basis, it may nevertheless be said that the progress made by the Corporation's laboratories and engineers, especially during the year under review, has brought us much nearer the goal, when transmission of sight will supplement transmission of sound.—*From RCA Annual Report for 1933, issued February 1934.*

planning a field demonstration

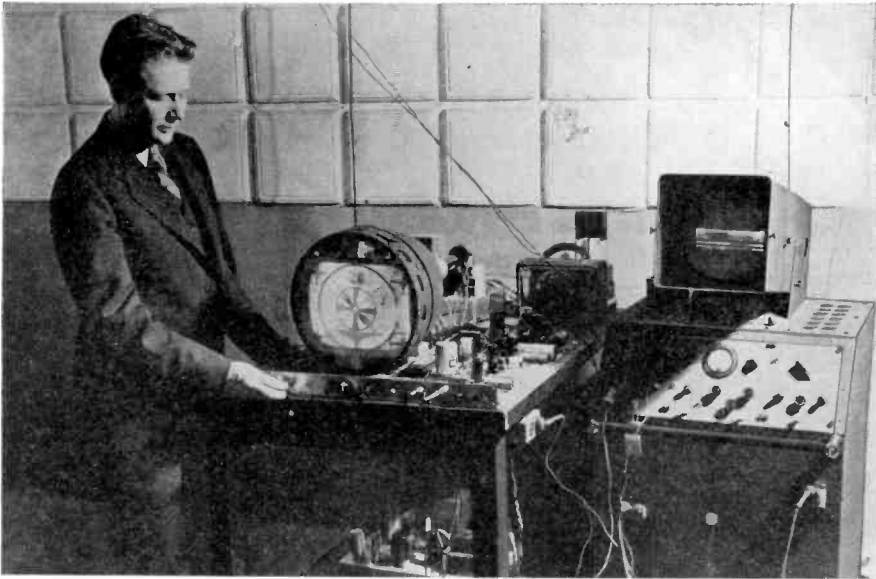
Continued research in the field of ultra-short waves and in the technique of visual transmission and reception has maintained your Corporation's position in the forefront of television development. Our laboratory efforts in this direction have been guided by the principle that the commercial application of such a service could be achieved only through a system of high-definition television, which would make the images of objects transmitted clearly recognizable to observers. In this respect it is notable that transmission results attained by RCA in laboratory experiments meet or go beyond the foreign standards indicated as satisfactory for the inauguration abroad of experimental television service. Similarly, cathode ray tube reproduction, as developed in our laboratories, provides a larger field of vision for the picture received than has been hitherto attainable. In addition, RCA's development of the "iconoscope"—an electric eye that facilitates the pick-up of studio action and permits the broadcast of scenes outside the studio—has been further advanced.

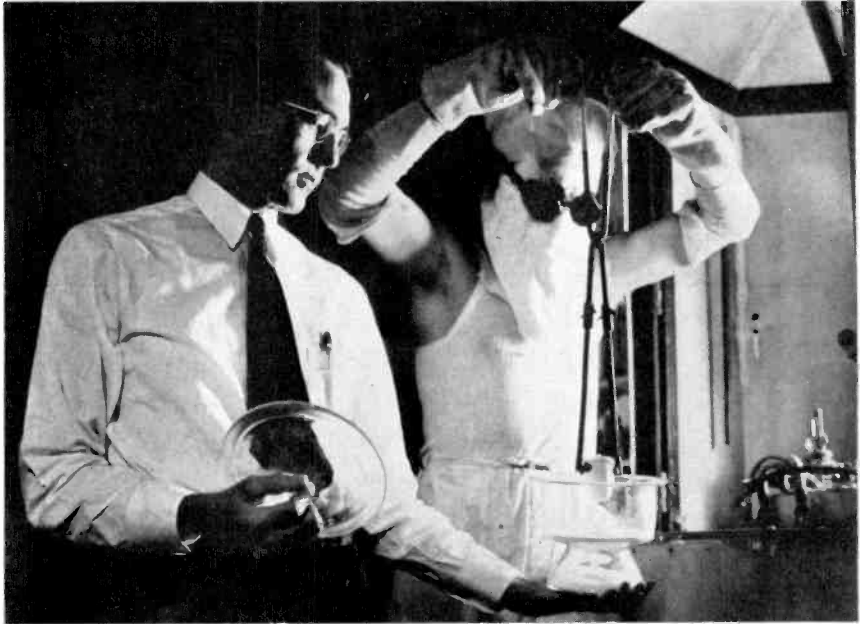
Viewed, however, from the standpoint of public service our own studies agree with the conclusions reached abroad by competent engineering and public authority. These conclusions are that sound broadcasting and sound receiving equipment comprise the fundamental broadcasting and receiving facilities of the nation,



Iconoscope, electronic "eye" of television, invented by Dr. V. K. Zworykin, now Associate Research Director, RCA Laboratories.

The Kinescope, television's receiving tube, also developed by Dr. Zworykin, undergoing laboratory tests.





Fluorescent materials, which give off visible light when struck by electrons, were developed by RCA chemists for television tubes.

The estimated cost to the RCA of this project will be approximately one million dollars.

In order that the promise, as well as the present limitations, of the art be thoroughly understood, I shall review briefly the present status of television and the position of RCA in this field.

RECEPTION

Our research and technical progress may be judged by the fact that upon a laboratory basis we have produced a 343-line picture as against the crude 30-line television picture of several years ago. The picture frequency of the earlier system was about 12 per second. This has now been raised to the equivalent of 60 per second. These advances enable the reception, over limited distances, of relatively clear images whose size has been increased without loss of definition.

From the practical standpoint, the character of service possible in the present status of the art, is somewhat comparable in its limitations to what one sees of a parade from the window of

an office building, or of a world series baseball game from a nearby roof, or of a championship prize fight from the outermost seats of a great arena.

TRANSMISSION

In the present state of the art, the service range of television from any single station is limited to a radius of from fifteen to twenty-five miles. National coverage of the more than three million square miles in the United States would require a multitude of stations with huge expenditures, and presents a great technical problem of interconnection in order to create a network system by which the same program might serve a large territory.

Existing and available wire systems are not suitable for interconnecting television stations. Therefore, radio relays must be further developed or a new wire system created to do the job now being done by the wires which connect present-day broadcasting stations.

RELATIONSHIP OF TRANSMITTER AND RECEIVER IN TELEVISION

. . . Television is a highly complicated system of transmitting and receiving elements with thousands of interlocking parts, each of which must not only function correctly within its own sphere of activity, but must also synchronize with every other part of the system. In broadcasting of sight, transmitter and receiver must fit as lock and key.

On the other hand, broadcasting of sound permits a large variety of receiving devices to work acceptably with any standard transmitter. Notwithstanding the great progress that has been made in sound broadcast transmission, a receiving set made ten years ago can still be used, although with great sacrifice in quality. This is not true in television, in which every major improvement in the art would render the receiver inoperative unless equivalent changes were made in both transmitters and receivers.

Important as it is from the standpoint of public policy to develop a system of television communication whereby a single event, program or pronouncement of national interest may be

broadcast by sight and sound to the country as a whole, premature standardization would freeze the art. It would prevent the free play of technical development and retard the day when television could become a member in full standing of the radio family. Clearly, the first stage of television is field demonstration by which the basis may be set for technical standards.

. . . As in other related fields, the Radio Corporation of America is undertaking to encourage, develop and coordinate the research, engineering and technical processes by which a new art and a new industry may spring from the original root of radio communications. Television demands the most effective coordination of the equipment, facilities and services embraced by the operations of the various units of the RCA. It requires the utilization of the best engineering and manufacturing experience of the RCA Manufacturing Company* in the production of television equipment; of the research facilities of the RCA Laboratories for the development of new television tubes; of our experience in the construction of transmitting stations; of the studio, program, and broadcast technique created by the National Broadcasting Company; and of the general experience of RCA Communications.

. . . In announcing this plan, I wish to emphasize the clear distinction that must be made between the coming field demonstration stages of television, and the ultimate fulfillment of the promise of world-wide transmission of sight through space — an achievement which will be second only to the world-wide transmission of sound through space. . . .

While the magnitude and nature of the problems of television call for prudence, they also call for courage and initiative without which a new art cannot be created or a new industry established. Your Corporation has faith in the progress which is being made by its scientists and its engineers, and the management of the Radio Corporation of America is exploring every path that may lead to an increasing business for the radio industry and to a new and useful service to the public.—*Statement delivered at Annual Meeting of RCA Stockholders, New York City, May 7, 1935.*

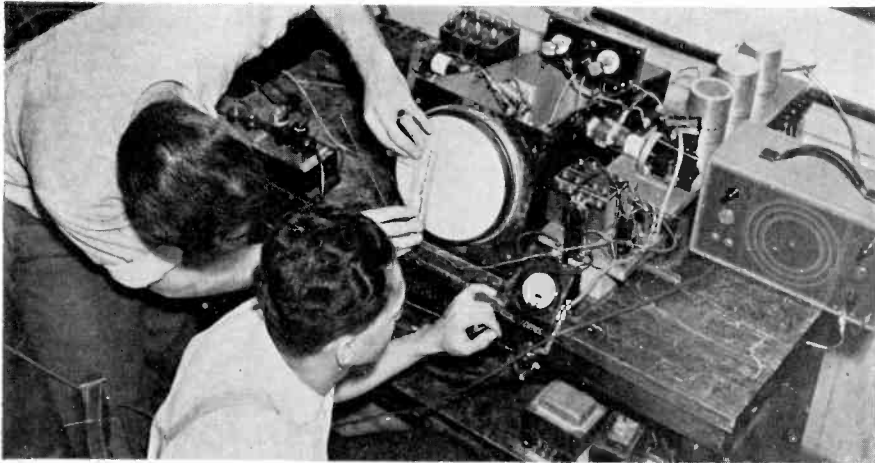
* Became RCA Victor Division, Dec. 31, 1942.

first field tests in New York

. . . The New York area has been selected as the one in which the experimental field tests will be conducted. The television transmitter is located on the Empire State Building, and test receivers will be operated by technical personnel of the RCA organization throughout this area. The transmitter will be connected by radio with the television studio, now under construction in the NBC plant, RCA Building, in Radio City, New York. The installation is practically complete, and within a month or two the first tests should commence.

This does not mean that regular television service is at hand. It will be necessary to coordinate a number of important elements before television on a regular basis of service can be established. For example, it will have to be determined how far the transmitter can send good television pictures; also with what consistency and regularity pictures may be transmitted with the system in its present state of development. We must investigate and define the possibilities of the television camera for indoor and outdoor pick-up.

These are the essential pioneering stages in the development of an art in which considerable expenditures must be made for



RCA research workers inspecting the face of an experimental Kinescope, upon which motion pictures from a distance are reproduced.

research before returns can be expected. As the work goes on, it may be necessary to return to the laboratory, from time to time, to seek the solution to practical problems encountered in the field. But the RCA experimental television project is proceeding on schedule, and your management is confident that it will continue to progress at an encouraging rate. . . .—*From RCA Annual Report for 1935, issued February 1936.*

new advances shown to press

. . . In view of the public interest in the promise of sight as well as of sound through the air, we have invited you here today to witness an experimental television test so that the progress in this new and promising art may be reflected to the public factually rather than through the haze of conjecture or speculation.

You will recall that our field tests in television began only on June 29 of this year. That date marked the beginning in this country of organized television experiments between a regular transmitting station and a number of homes. Since then we have advanced and are continuing to advance simultaneously along the three broad fronts of television development — research which must point the road to effective transmission and reception; technical progress which must translate into practical sets for the home the achievements of our laboratories; and field tests to determine the needs and possibilities of a public service that will ultimately enable us to see as well as to hear programs through the air. On all these fronts our work has made definite progress and has brought us nearer the desired goal.

First and as of immediate interest, let me tell you the progress of our field tests. As you know, we have been transmitting from our television station on top of the Empire State Building in New York City which is controlled from the NBC television studios in the RCA Building. We have observed and measured these transmissions through a number of experimental receivers located in the metropolitan area and adjacent suburbs. The results thus far have been encouraging, and instructive. As we anticipated,

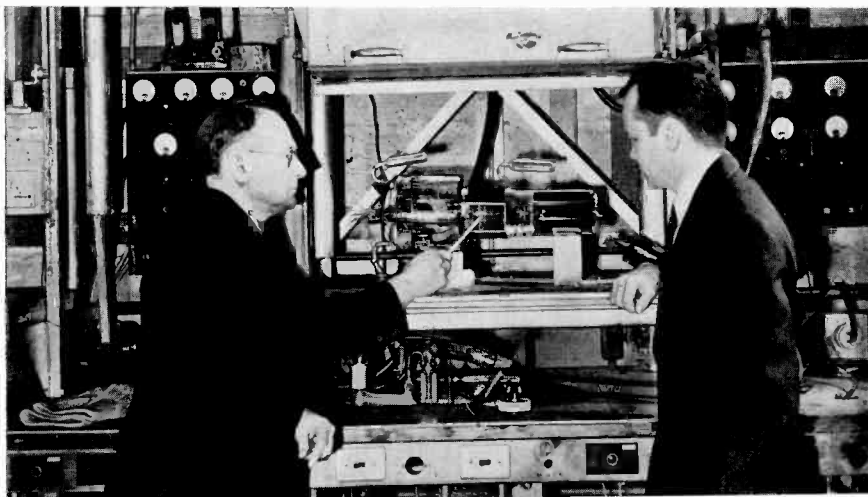


By increasing the number of scanning lines in each picture frame, the detail and definition in television images have been vastly improved. This series of photographs shows, upper left, 60-line definition; upper right, 120-line; lower left, 441-line, and lower right, 525-line.

many needs that must be met by a commercial service have been made clear by these tests.

We have successfully transmitted through the air, motion pictures as well as talent before the televisor. The distance over which these television programs have been received has exceeded our immediate expectations. In one favorable location due to the extreme height of our transmitter, we have consistently received transmissions as far as 45 miles from the Empire State Building.

The tests have been very instructive in that we have learned a great deal more about the behavior of ultra-short waves and how to handle them. We know more about interferences, most of which are man made and susceptible of elimination. We have surmounted the difficulties of making apparatus function outside



Dr. V. K. Zworykin and E. W. Engstrom, Vice President in Charge of Research, RCA Laboratories, study the operation of an experimental television tube.

of the laboratory. We have confirmed the soundness of the technical fundamentals of our system, and the experience gained through these tests enables us to chart the needs of a practical television service.

We shall now proceed to expand our field test in a number of ways. First, we shall increase the number of observation points in the service area. Next we will raise the standards of transmission.

In our present field tests we are using 343-line definition. Radio Corporation of America and the radio industry have, through the Radio Manufacturers Association, recommended to the Federal Communications Commission the adoption of 441-line definition as a standard for commercial operation. Our New York transmitter will be rearranged to conform to the recommended standards. That also means building synchronized receivers to conform to the new standards of the transmitter. Synchronization of transmitting and receiving equipment is a requirement of television that imposes responsibilities upon those who would furnish a satisfactory product and render a useful service to the public. On the one hand, standards cannot be frozen prematurely or progress would be prevented, while on the other

hand, frequently changing standards means rapid obsolescence of television equipment.

. . . While we have thus proceeded on the technical front of television, the construction and operation of television studios have enabled us to coordinate our technical advance with the program technique that a service to the home will ultimately require. Today, you are the guests of RCA's broadcasting unit—the National Broadcasting Company. Under the direction of its president, Mr. Lenox Lohr, the NBC has instituted a series of television program tests in which we have sought to ascertain initial requirements.

Ten years ago the National Broadcasting Company began a national service of sound broadcasting. Now it enters upon its second decade of service by contributing its facilities and experience to the new art of television.

One of the major problems in television is that of network syndication. Our present facilities for distribution of sound broadcasting cover the vast area of the United States and serve its 128,000,000 people. Similar coverage for television programs, in the present state of the television art, would require a multiplicity of transmitters and network interconnection by wire or radio facilities still to be developed.

Our program is three fold; first we must develop suitable commercial equipment for television and reception; second, we must develop a program service suitable for network syndication; third, we must also develop a sound economic base to support a television service.

From the standpoint of research, laboratory development, and technical demonstration, television progress in the United States continues to give us an unquestioned position of leadership in the development of the art. In whatever form such progress may be evident in other countries, we lead in the research which is daily extending the radio horizon, and in technical developments that have made possible a transmitting and receiving system that meets the highest standards thus far obtainable in field demonstration.



During early field tests of RCA's all-electronic television system in New York, a small group of NBC engineers made observations with receivers in their homes.

We are now engaged in the development of studio and program techniques that will touch upon every possibility within the growing progress of the art. The distinction between television in this country and abroad is the distinction between experimental public services undertaken under government subsidy in countries of vastly smaller extent, and the progressive stages of commercial development undertaken by the free initiative, enterprise and capital of those who have pioneered the art in the United States.

While the problems of television are formidable, I firmly believe they will be solved. With the establishment of a television service to the public which will supplement and not supplant the present service of broadcasting, a new industry and new opportunities will have been created.—*Television Statement to Press, November 6, 1936.*

progress here and abroad

During my five weeks stay abroad, I studied the latest developments of television in Europe. While interest is shown everywhere in this new branch of the radio art, greater progress has been made in England than elsewhere in Europe.

Nevertheless, the experience to date with television in England has only served to emphasize the formidable nature of the problems which must be solved before a satisfactory service of television to the public can be rendered and a new industry soundly established.

The question is often asked: "Is England ahead of the United States in television?" I shall try to answer this question by stating the facts as I have now observed them on both sides of the Atlantic.

The B.B.C. (British Broadcasting Corporation) has been operating its television transmitter, located at Alexandra Palace in London, for about a year. The range of this transmitter is more than 25 miles and covers all of London and its immediate vicinity. The system employed is known abroad as the Marconi E.M.I. Television System which is fundamentally based on the RCA Television System first developed in the RCA Laboratories in the United States. Under an exchange of patent licenses, this British Company may use RCA patents in England and, in turn, RCA and its American licensees may use British patents in the United States.

Each side is therefore in a position to benefit from developments and improvements made by the other.

. . . Some fifteen British radio manufacturers have been offering television receiving sets to the public at prices ranging between \$200 and \$500 each. . . .

During one year's operation of a public television service in England, less than 2000 receivers in all have been sold to the trade and less than 1000 are actually in the hands of the public. There is but one television transmitter in London, and I was informed that it will probably be two years more before a second transmitter is erected in any other part of England.



David Sarnoff (center), President of RCA, sits in the NBC television studio with Lenox R. Lohr, then President of NBC, and Grover Whalen in 1937 to sign a contract for RCA participation in New York World's Fair 1939.

The foregoing represents the present status of television in England despite the fact that geographically its problem is simple compared with the vast area to be served by a television service in the United States. Also it is to be noted that in England the costs of erecting a television station, the establishment of a special organization, and the furnishing of television programs, have been paid by the Government out of license fees paid by the public annually for the privilege of listening or seeing by radio.

The range of the RCA television transmitter atop the Empire State Building now operated by the NBC from its television studios in the RCA Building in New York City, is approximately the same as that of the BBC station in London. The television receivers installed in the homes of our experts, who have been carrying on field tests during the past year, are likewise of the same order of performance as those in use in England.

The major problem of television, in both countries, is to provide a program for the home that will meet public requirements and maintain public interest.

To place television on a commercial basis in the United States, it is necessary to establish a sufficient number of sending stations, that must be interconnected and able to furnish a regular service at least to the population residing within the principal market areas of our country. The erection of such stations, the provision of necessary interconnecting facilities, and the establishment of a regular program service that would meet public requirements and hold public interest, call for vast financial expenditures before any returns can be reasonably expected.

I firmly believe in the American System of private enterprise, rather than Government subsidy; of free radio to the home, rather than license fees paid to the Government by owners of receiving sets; and I have no doubt, that in due time, we shall find practical answers to the practical problems that now beset the difficult road of the pioneer in television. The road calls for faith and perseverance as well as ingenuity and enterprise but it is a road that holds a great promise for the public, for artists and performers, and for the radio industry.—*Statement on Arrival in New York on the S. S. Paris, September 25, 1937.*

improvements in RCA television

Foremost, perhaps, in public interest was the continued technical development of television. Improvements in the RCA system of television in 1937 took place both in the laboratory and in field tests under actual operating conditions.

Engineering studies and investigations of the requirements of a practical television system have already led to a ten to twelve-fold increase in sensitivity of the Iconoscope — the electric eye or pick-up tube — and its associated equipment. This improvement makes possible the reception of clearer and larger images and extends the possibilities of television programs.

RCA developed mobile television units during 1937, for pick-up of outside scenes remote from the studios. NBC will use these units in the present year to augment its knowledge of television program technique gained through having staged about 130 studio demonstrations. Approximately 250 artists, musicians and personalities participated in these demonstrations.

Significant advances were made in 1937 toward determining the fundamental standards for an American television system to meet the requirements of our nation, with a territory of 3,000,000 square miles and a population of 130,000,000 people. Our experiments with television in the past 18 months improved the system by increasing its capabilities and efficiency, thus enabling it to move closer to the inauguration of a television service for the American home. . . .—*From RCA Annual Report for 1937, issued February 1938.*

program service to the public

. . . It is my purpose now to inform this Board and its Television Committee of the latest plans and policies of the RCA for further advancing the development of television. The results of the experimental field tests of television in the New York area conducted by the RCA and its broadcasting and manufacturing units, have convinced us that television in the home is now technically feasible.

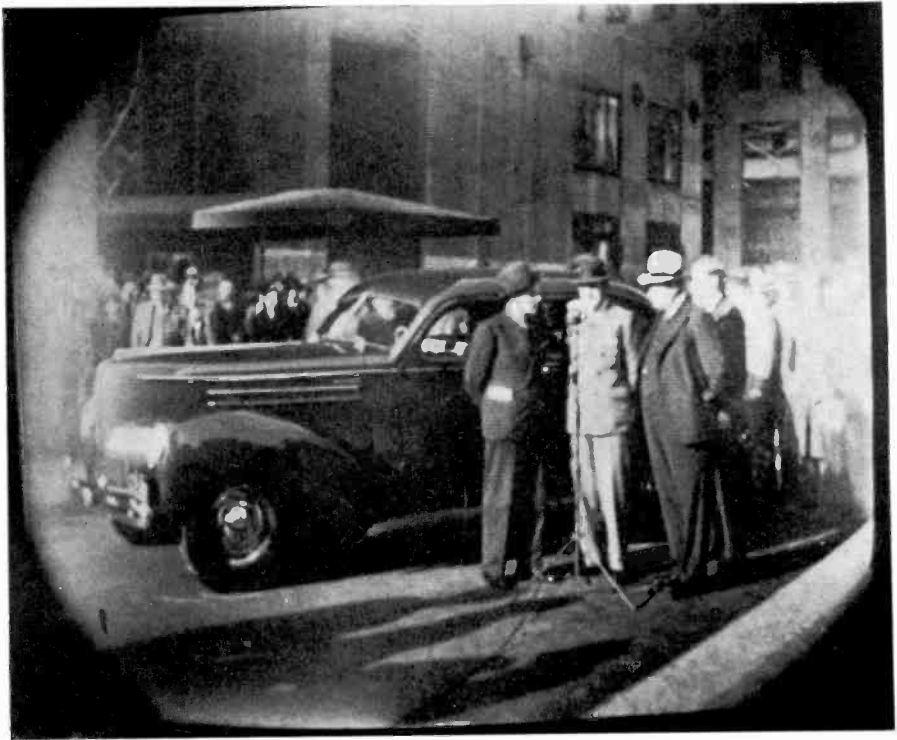


In 1938, John Golden (left), Broadway producer, appeared before the television camera with David Sarnoff, and foresaw television bringing "a new and glorious era in the world of the theater."

We are aware, however, that many technical, artistic and financial problems still confront those who would establish an acceptable and regular public service of television programs to the home. These problems must be solved before a national service of network television programs can be made available to the public. Meanwhile, RCA, which has pioneered in the development of television, has made substantial progress, first in its research laboratories, and second, through its field tests and experimental broadcast programs. We believe that the problems confronting this difficult and complicated art can be solved only by operating experience gained from actually serving the public in their homes.

Therefore, RCA proposes to take a third step in the solution of these problems by beginning a limited program service to the public from its New York television transmitter on the Empire State Building. This transmitter will serve an area having a radius of approximately fifty miles.

As publicly announced some time ago, RCA proposes to demonstrate television to the public at the New York World's Fair which is expected to open on April 30, 1939. The National Broadcasting Company contemplates that by the time the Fair opens, it will be on the air with television programs for at least two hours out of each week. Recent reports in the public press are to the effect that the Columbia Broadcasting System contemplates installing its television transmitter in the Chrysler Building



Television's first preview of a National Automobile Show, broadcast by NBC in New York in December, 1938.

in New York City. These reports further indicated that television programs will be transmitted from this station by the time the World's Fair opens.

The RCA Manufacturing Company, which built and sold the television transmitter to Columbia, has offered and is prepared to sell television transmitters to broadcasters and others who may desire to enter this new field.

RCA believes that the development of its television system has now reached a stage where it is practicable to supply television receivers to satisfy the demand of the public in those localities where television transmissions are now or may become available. Therefore, it is planning to manufacture a limited quantity of television receivers which it expects to market by the time the World's Fair opens. We are informed that a number of other radio manufacturers in the United States are also preparing to manufacture and sell television receivers in such areas as may be served with television programs.

Only a little more than six months remain between now and the time the World's Fair is expected to open. Those who desire to market television receivers by that time will find it necessary to make their plans now for manufacturing them. RCA is prepared to assist its licensees who may desire to manufacture television receivers, and so far as practicable, will be glad to sell to them such television parts as they may wish to purchase. Our television test equipment is now complete at RCA's license laboratory. We will continue to measure and test television receivers for licensees as we have done for them with sound broadcast receivers. Engineers and executives of our licensees seeking additional information will be welcomed at RCA laboratories, manufacturing plants and broadcasting studios.

Opportunities to compete in the erection of television transmitters, the establishment of television program services, and the manufacture and sale of television receivers to the public, are available to the radio industry and to others in the United States. We hope that full advantage will be taken of these opportunities to help build a new industry and to establish a greater public

service.—*Statement to Radio Manufacturers Association, October 20, 1938.*

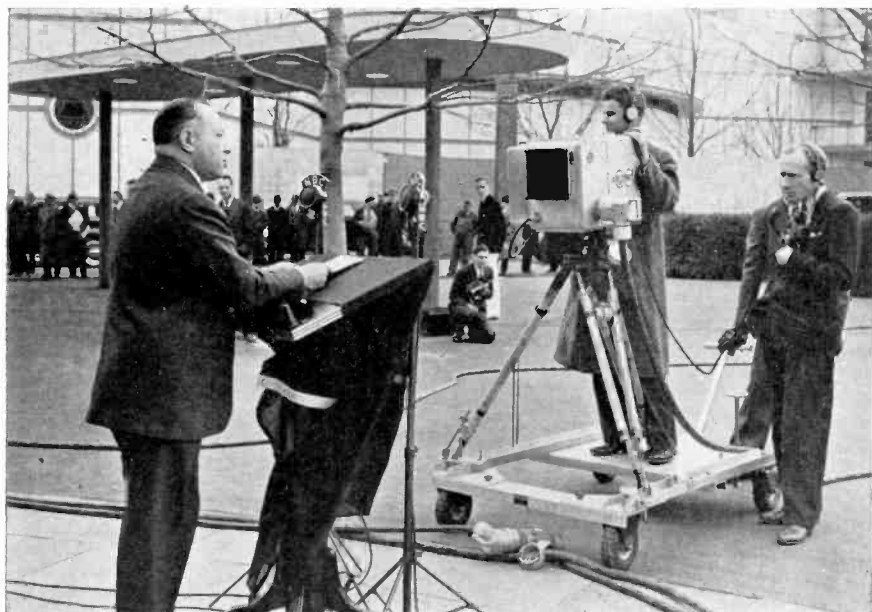
the promise of intercity networks

. . . Several important technical developments contributed to the improvement of the RCA television system during 1938. New Iconoscope tubes made possible greater efficiency in televising both outdoor and studio scenes; new transmitting tubes produced greater power for launching the television images into space; and a new transmitting antenna provided the solution to a difficult technical problem of transmission. There were advances in reception, also, and here again new tubes gave increased efficiency of operation, enabling a reduction in the number of tubes necessary to a complete receiver.

Much is being learned as to studio technique and the pick-up of events and programs originating outdoors. Television programs produced in 1938 included dramatic productions, a Broadway stage show, vaudeville, comic opera, news events, and the televising of motion picture film. Successful outdoor tests and demonstrations employing television mobile units have been given in New York City and Washington, D. C.

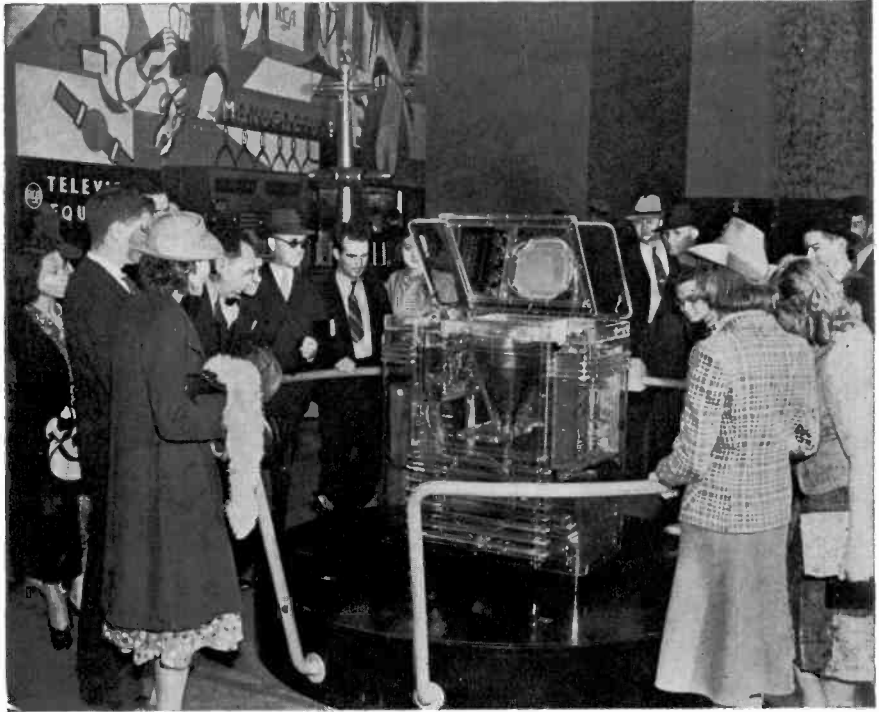
RCA conducted 134 television demonstrations during the year for audiences largely made up of important representatives of industry, advertising, engineering, and the press.

Before network television service, comparable to existing sound broadcasting facilities, can be realized, many economic and technical requirements will have to be met. Means must be developed for interconnecting stations, either by radio or cable. The possibility of relaying television programs between stations by radio holds interesting promise, as shown by further experiments conducted by the RCA Laboratories in 1938, and this work is receiving active attention in the present year. The establishment of television stations in network connection is a long-range program, and it will probably require many years to achieve, first, regional, and ultimately national network service. . . .—*From RCA Annual Report for 1938, issued February 1939.*



Standing before the television camera at the New York World's Fair in the Spring of 1939, David Sarnoff introduced television as a new industry. Below — Mr. Sarnoff, as he appeared on television receivers.





Enclosed in a glass cabinet, an RCA television receiver attracted great attention at the New York World's Fair.

the birth of an industry

. . . Today we are on the eve of launching a new industry, based on imagination, on scientific research, and accomplishment. We are now ready to fulfill the promise made to the public last October when, after years of research, laboratory experiments and tests in the field costing millions of dollars, the Radio Corporation of America announced that television program service and commercial television receivers would be made available to the public with the opening of the New York World's Fair.

Ten days from now, this will be an accomplished fact. The long years of patient experimenting and ingenious invention which the scientists of the RCA Research Laboratories have put into television development, have been crowned with success. I salute their accomplishments and those of other scientists both here and abroad whose efforts have contributed to the progress of this new art.

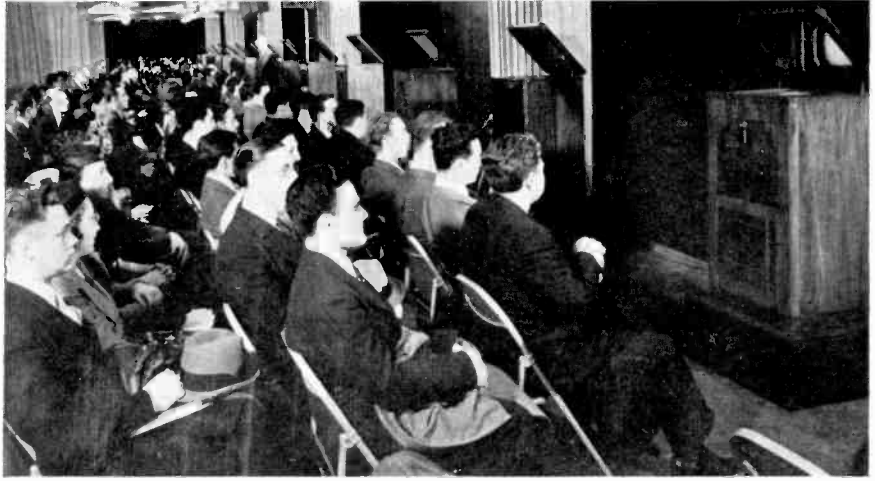
On April 30th, the National Broadcasting Company will begin the first regular public television program service in the history of our country; and television receiving sets will be in the hands of merchants in the New York area for public purchase. A new art and a new industry, which eventually will provide entertainment and information for millions, and new employment for large numbers of men and women, is here.

. . . And now we add radio sight to sound. It is with a feeling of humbleness that I come to this moment of announcing the birth in this country of a new art so important in its implications that it is bound to affect all society. It is an art which shines like a torch of hope in a troubled world. It is a creative force which we must learn to utilize for the benefit of all mankind.

This miracle of engineering skill which one day will bring the world to the home, also brings a new American industry to serve man's material welfare. In less than two decades, sound broadcasting provided new work for hundreds of thousands of men and women, added work in mines and forests and factories for thousands more, and aided the country and its citizens economically by causing the flow of hundreds of millions of dollars annually. Television again bids fair to follow in its youthful parent's footsteps, and to inherit its vigor and initiative. When it does, it will become an important factor in American economic life. Also, as an entertainment adjunct, television will supplement sound broadcasting by bringing into the home the visual images of scenes and events which up to now have come there as mind-pictures conjured up by the human voice.—*Delivered at Dedication of the RCA Exhibit Building, New York World's Fair, April 20, 1939.*

social influences of television

. . . Finally television is becoming adult, integrated in its technical standards and practices, with a cathode-ray system which has been uniformly adopted by the engineers of the radio industry. Yet, its maturity thus far has been attained only within the protecting confines of the homes and workshops of its scientific



Students of New York University watching a scientific demonstration by television, which is regarded as a natural medium for group instruction and education.

guardians. This Spring it graduated from this protective environment, and was thrust out to make its way in the world. What will it offer to mankind, and what response will mankind make to it?

. . . We have some basis for predicting the probable *primary* social effects of television by regarding it as an extension of the present system of aural broadcasting.

. . . Television will finally bring to people in their homes, for the first time in history, a complete means of instantaneous participation in the sights and sounds of the entire outer world. It will be more realistic than a motion picture, because it will project the present instead of the past. Aural radio already has demonstrated the greatly heightened psychological significance, to the listener, of feeling that he is present at the radio performance, as a member of an audience listening to living performers. The sensation that one is participating in an event actually taking place at the precise moment of hearing it is quite different and much more intense than the sensation one has in witnessing a sound picture or hearing a record of the same event, later on. With the advent of television, the combined emotional results of both seeing and hearing an event or a performance at the instant of its occurrence become new forces to be reckoned with, and

they will be much greater forces than those aroused by audition only. The emotional appeal of pictures to the mass of people is everywhere apparent. We have only to regard the success of motion pictures, tabloid newspapers and modern picture magazines, to be convinced of this.

Let us consider next what sort of program material television may present to its audience. Radio programs today cover almost every conceivable type of material that may be of value as entertainment, instruction and news. But while the scope of television programs will be equally broad, it is clear that the relative emphasis on the various types of subject matter can be changed to advantage. In aural radio we tend to emphasize program material that may be enjoyed without the use of vision; hence music forms a major part of aural radio programs. In television it will be natural to emphasize types of program material where the addition of visibility will enhance the emotional effect — such as drama, news, or sporting events.

Radio already has made significant contributions to novel dramatic forms and materials. Experimentation is constantly going



Variety shows are popular with the audience of NBC's pioneer television station, WNBT, New York.

on, under the daily pressure of providing ever-changing programs. Famous dramatists, actors and producers are turning in increasing numbers to radio as a new and important medium, and the intellectual standard of much radio drama is in the best tradition of the legitimate theatre. With the advent of television, a new impetus will be given to this form of art, and we may expect it gradually to take the place of some other types of programs which now occupy a large part of radio time.

While some television dramas may be recorded on film, for convenience or for network distribution, it is not certain that the standards, methods or artistic ideas of the present-day motion picture industry will control the material presented. Radio has always been an independent force, and has broken new ground in what it has done. A first-class radio program is like no theatrical or motion picture presentation that ever was. It is a new thing in the world. Similarly, it is quite likely that television drama will be a new development, using the best of the theatre and motion pictures, and building a new art-form based upon these.

It is probable that television drama of high caliber and produced by first-rate artists, will materially raise the level of dramatic taste of the American nation, just as aural broadcasting has raised the general level of musical appreciation.

Advertisers who sponsor radio programs will be given new possibilities of appeal through the medium of television. We need not fear, however, that this will mean an increase in the amount of "sales talk." In fact, it is probable that pictures or demonstrations of the product with the briefest possible messages will take the place of the more extensive announcements which are necessitated by the limitations of aural radio.

Political addresses will be more effective when the candidate is both seen and heard, and is able to supplement his address with charts or pictures. Showmanship in presenting a political appeal will be more effective than mere skill in talking, or the possession of a good radio voice; while good appearance may become of increasing importance, with the audience observing the candidate in close-up views.

An outstanding contribution of television will be its ability



Wendell Willkie's nomination for President by the Republican National Convention in 1940 was televised and relayed from Philadelphia for broadcasting throughout the New York area by NBC.

to bring news and sporting events to the listener while they are occurring. The widespread public participation in events such as those which occurred during the European war crisis in the summer of 1938, and the intensity of the mass emotions aroused thereby, have given us a glimpse of the possibilities of this phase of radio. It may readily be imagined what will be the results when television adds to the effect of reality by projecting the vision as well as the hearing of the audience to the scene of action.

Some social scientists have pointed out the greater possibilities of propaganda when presented by television. The great mass of the human race is not critical, and temporarily, at least, may be swayed by appeals to the emotions rather than to reason. In European countries which have succumbed to dictatorships extraordinary changes have been brought about in a very short time, with the aid of radio propaganda, in the expressed beliefs and actions of vast populations. These have been led to accept whole ideologies contrary to their former beliefs, because of skill-



NBC television camera at the Polo Grounds, New York.

fully presented ideas which have been spread to every home in the land with the speed of light and with a minimum of effort. The advent of television makes it even more important than heretofore to preserve for radio broadcasting in our country the precious right to freedom of discussion, and to guard against its exploitation for transmitting propaganda intended to arouse destructive class struggles, racial animosities or religious hatreds.

Educational institutions are gradually adopting mechanical inventions as aids to teaching, and radio receivers as well as phonographs are becoming increasingly familiar sights in schoolrooms. Because of these, the children of today have heard immeasurably more good music, and are more keenly conscious of world history in the making, than those of the previous generation. The possibilities of sound motion pictures for vitalizing and dramatizing scientific subjects, geography and history have been demonstrated; but schools are slow to make use of these because of the expense of the films, and the lack of organization among the hundreds of thou-

sands of school administrations where cooperation is necessary in such a large-scale undertaking. With television we may find the educational uses of radio increasing; for while children may be bored and restless when merely listening to a speaker without seeing him, living pictures will capture and hold their interest.

There is another aspect of television which is important, and this is the nature and effects of its by-products. New instrumentalities have been developed, specifically for the purpose of transmitting visual intelligence by radio. These include iconoscopes, or devices for converting a light image into electric currents, amplifiers of wide frequency range, high powered, ultra-short wave transmitters and kinescopes which reproduce the original image by converting electric currents into light. All these devices are beginning to find applications in fields remote from television, and, as familiarity with them grows, their fields of application no doubt will be extended.

The whole subject of electron optics, or the control of electron beams by electric and magnetic fields, has received great attention because of its importance in television devices. This has led to a whole new range of possibilities in optical devices. Applications of this to astronomy, and in other fields where weak or distant sources of radiation must be dealt with, are future possibilities.

Some of the fields in which these television devices may bring about important advances are in marine or aerial navigation, by permitting vision at night or in fogs through the use of infra-red rays; in metallurgical, chemical, physical and biological research; in manufacturing processes as substitutes for human vision or for control purposes; in national defense; for advertising or display use in department stores, in showing goods exhibited at a central point throughout the store or in show-windows; for personal or business communication in transmitting visual intelligence as we now transmit the voice by telephone; in printing and copying devices; in new photographic or motion picture devices where "light amplification" may be used to advantage; and in any other fields where an automatic, never-failing substitute for the human eye may be useful.

I have suggested some of the more immediate possibilities in the effects upon society of the advent of television. What of the more distant future, or *derivative* effects?

It seems to be the general opinion of authorities on population trends that life in the United States several decades from now will differ in important respects from that of the present time. The chief events which are anticipated are a continued increase in leisure time, an increase in the average age of the population, and a greater geographic decentralization or distribution of industry. The application of television devices will affect and be affected by these occurrences.

. . . All this provides a picture of a population which may increasingly center its interest once more in the home; a population with ample leisure time, of predominantly mature years, and widespread distribution, in individual small houses which they will be able to afford because of the development of low-cost home construction and increased income per family. With such a setting, radio-television will be a vital element in the lives of these people. It may become their principal source of entertainment, education and news. It will link together in mind and spirit these vast numbers of individual homes, as the high speed automobile roads and airways will link them together physically.

We may also anticipate a rising standard of culture, with universal education of both adults and children. . . .

We have seen how much the general level of musical taste in this country has already been raised by the widespread radio broadcasting of good music. People to whom such matters as grand opera and symphonic music were unknown fifteen years ago are becoming increasingly familiar with them. With television, a similar widening cultural development in appreciation of the best in drama, the dance, painting and sculpture may be expected. Through television, coupled with the universal increase in schooling, Americans may attain the highest general cultural level of any people in the history of the world.

What of the effects upon existing institutions, such as motion pictures, the theatre, schools and churches?

The motion picture industry may become an important source of supply of recorded programs to television broadcasters, where such recordings may serve the purposes of program material more conveniently than direct transmission of living actors. There are other possibilities too for cooperation between the motion picture industry and television. Each should be able to stimulate the other and this should result in an enlarged service to the public.

With a rising cultural level, we may expect also an increase in the number of creative artists working with the materials of the theatre. Such artists will be used not only by the television broadcasting systems; they will find additional outlets for their creative energies. Through these new developments we may see a rebirth of local community theatres for the production of legitimate drama, musical performances, dances, and the like.

The school systems will probably make increasing use of television as part of the educational program; for with this medium



*NBC presents Philip Foster and Mary Patton in "Copperhead,"
a television drama.*



Anton Dolin and Alicia Markova, ballet dancers, performing before NBC's television cameras.

it will become possible for the best teachers in the land to give carefully prepared and illustrated lectures to millions of children simultaneously.

Church broadcasting will rise to new spiritual levels, for with television the listeners can participate most intimately in the services of the greatest cathedrals; they will not only hear the ministers and the music, but see the preacher face to face as he delivers his sermon, witness the responsiveness of the audience, and observe directly the solemn ceremonies at the altar.

Thus, the ultimate contribution of television will be its service towards unification of the life of the nation, and at the same time the greater development of the life of the individual. We who have labored in the creation of this promising new instrumentality are proud to launch it upon its way, and hope that through its proper use America will rise to new heights as a nation of free people and high ideals.—*Reprinted from Journal of Applied Physics, Vol. 10, July 1939.*

first public service of television

. . . The outstanding radio development of the year 1939 was the introduction by Radio Corporation of America of the first public service of television in the United States. Upon the opening day of the New York World's Fair — April 30, 1939 — RCA's broadcasting service, the National Broadcasting Company, inaugurated in the New York Metropolitan area the nation's first regular television program service. At the same time, the RCA Manufacturing Company began the sale of television receivers in this area.

Since that date, NBC has maintained a regular schedule of television programs — drama, fashion and variety shows, round table discussions, demonstrations of art, music and domestic science, sports events of all kinds, and motion pictures.

The quality of television images broadcast by NBC has shown steady improvement in brilliance and clarity. A new type of Iconoscope or pick-up tube — the "Orthicon" — was developed by RCA Laboratories and tested with great success by NBC. This type of Iconoscope, far more sensitive than any heretofore employed, and requiring less brilliant light on the subjects televised, will be available to all television stations during the present year. Similarly, the latest types of television transmitters developed by RCA are available to all stations, through the RCA Manufacturing Company. RCA has licensed competing manufacturers, in consideration of royalty payments, to make and sell such transmitters, as well as television receivers.

Two important new television developments are now technically ready for public service.

One is a system of television radio relays, different from any other system so far devised, which offsets the distance limitations of ultra-short waves. This new RCA system makes possible the establishment of intercity television networks comparable to the wire networks of sound broadcasting. This development makes it feasible to set up a radio relay system for television linking New York City, for example, with Washington, D. C., and with Boston, Mass., and other intermediate cities.

Such a network would bring television programs within reach of approximately 20,000,000 persons, or, roughly, one sixth of the nation's population. Programs could originate, as well as be received, in any city which is part of the system.

The new RCA television relay system is a marked advance in the development of radio transmission, because of the success achieved in dealing with the wide frequency channels necessitated by television. It makes use of specially designed automatic relay stations operating on frequencies many times higher than those used by regular television broadcasting stations.

Each relay station in the new system contains both receiving and transmitting devices, mounted on a 100-foot steel tower. The system employs highly directional, or beam-like, transmission, and RCA frequency modulation developments. The radiated power required for operation of each station is less than 10 watts. The distance between relay points averages some 30 miles, and each relay station operates automatically and unattended.



The RCA television receiver as introduced in 1939.

The other new television development is the improved projection of large screen television images, of a size and clarity suitable for theatre presentation. Large screen television will permit the showing of current events and other programs to large audiences. The relay system described above offers a practical means for distributing television programs to theatres, whether in a single locality or in the several cities of a television network. . . .—*From RCA Annual Report for 1939, issued February 1940.*

opportunity for a new industry

. . . The board of directors and the management of the Radio Corporation of America are of the considered opinion that television offers the opportunity for the creation of a new industry, new employment, and new services; that its introduction now is not only timely but important; and that substantial progress in the art can come only after its introduction upon a commercial basis. The four main questions with regard to television, judging from current discussion, are:

First, should the introduction of television on a commercial basis wait until all the engineers of the entire industry have agreed on technical standards of transmission and reception?

Second, would further research be retarded by the sale and public acceptance of the television receivers now on the market?

Third, will the public suffer from excessive obsolescence due to improvements in the new art?

Fourth, will competition be helped or hindered through the commercial introduction of television by those in the industry who are now ready, able, and willing to go ahead?

I propose to deal with these four questions in order.

The Radio Corporation of America believes that in an art such as television there can be no shorter cut from promise to performance than through the process of laboratory development, field test, and service to the public.

If the industry is left free to determine, through experimentation and test, the competitive advantages of every system, the

practical standards prevailing in any given period will represent the best that the art has attained.

The Radio Corporation has never proposed nor urged the freezing of standards. Nor is such action necessary to create the television industry and the new public services that would flow from it.

It is a fallacy to assume that the commercial introduction of television, on any standard now conceivable, would affect the continuance of research in this art, or prevent the adoption of higher standards of service and performance.

The triumph of television lies in the fact that science, research, and experimentation have made possible the addition of the electrical eye to the electrical ear in radio.

Because it recognized this as a fundamental development, the Radio Corporation of America has invested more than \$10,000,000 in research, development, experimentation, patents, field tests, and actual program service. For more than 10 years, five major engineering groups of the RCA organization, including its broadcasting and manufacturing, have been engaged in a coordinated attack on the problems of transmission, reception, tube development, radio relaying, and programming. Hundreds of engineers have been engaged in developing television, and the current rate of expenditure for this work by the Radio Corporation of America alone is about \$2,000,000 annually.

But these expenditures are only a drop in the bucket to what will be required for further research and development in the next 20 years. Almost two decades have elapsed since the introduction of sound broadcasting on a commercial basis, but improvement still continues; and I can safely say there is little we have achieved today that will survive the next 10 years.

The television research achievements by the Radio Corporation of America to date have been set forth publicly in 229 papers and reports to scientific societies, 671 additional technical reports, and 2 major text books, a total of approximately a thousand engineering studies. We believe that, far from retarding the achievement of higher standards of television transmission, the Radio Corporation of America has done more to develop high television



Engineers inspecting an RCA 1-kilowatt television transmitter.

standards than any other organization in the United States.

While I am on the subject of research, let me refer to the importance of increasing not merely the size of the television picture, but of the television audience; in other words, to give more people in more communities the opportunity to enjoy television and to participate in its activities. I submit that a greater public interest will be served at this time by research toward the methods that would extend television service to as many homes as possible, rather than in improvements that would merely add to the size or the definition of the picture now enjoyed by the few.

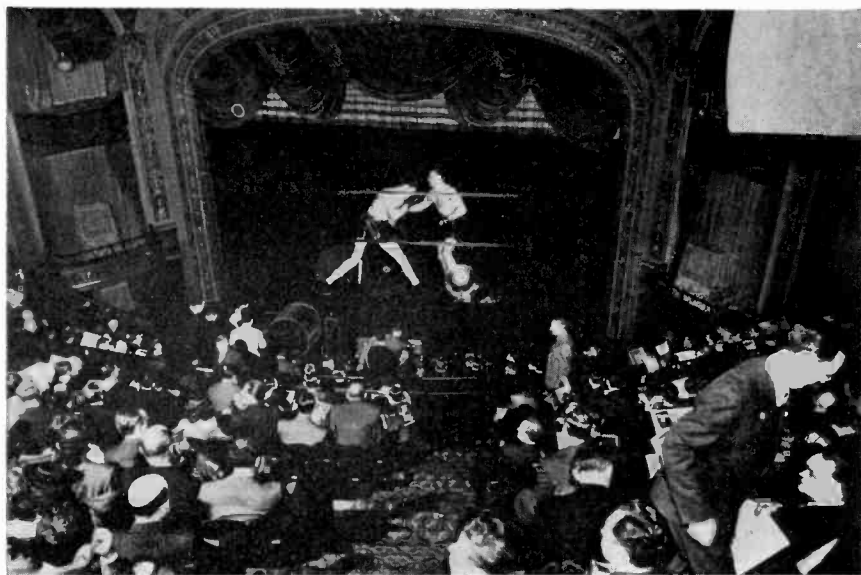
To meet this need, the Radio Corporation of America has developed a radio relay system designed to extend the service of television to the public on a Nation-wide basis.

The Radio Corporation of America is ready, if commercial television is authorized, to ask for a license from the Federal Com-

munications Commission for the construction of such a radio relay system, using higher frequencies than have ever before been utilized. Such facilities could serve broadcasters with programs moving simultaneously in both directions.

Home television receivers giving pictures as large as 18 by 24 inches are now being developed in our laboratories. We shall also soon make available theater television-receiving equipment which will project pictures upon full-size motion-picture screens.

. . . Nothing that would make present television equipment of continuing value to the purchaser has been neglected by the Radio Corporation of America. In the first place, the standard set offered to the public at the lower prices made possible by commercial production, includes not only sight reception but the most modern sound receiver the company has been able to produce. Even if higher standards should entail ultimate obsolescence of the television element the purchaser would still have a first class receiving set with sound reception on three bands — international short wave, standard broadcasting, police and aviation — unaffected by any changes in television transmission.



Large-screen theater television, with projected images measuring 15 by 20 feet, was demonstrated by RCA in New York in 1941.

The Radio Corporation of America welcomes the keen competition promised in the industry in the development of the television art. The promise of this competition is increased, not lessened, by the present disagreement among a few engineers as to standards of transmission and reception, and the methods by which the highest standards may best be achieved.

The phenomenal growth of radio in our country is due largely to the fact that the industry has had available, through licensing the many inventions developed by those who spent millions of dollars to bring the art out of the laboratory and into commercial use. About 50 manufacturers are licensed by the Radio Corporation under its own patents and also under those of other domestic and foreign companies from which the Radio Corporation has acquired the right to grant such licenses.

It is the firm belief of the Radio Corporation of America that a truly new industry and new service and new employment could be created on a scale that would affect our whole economy, through the development of television, that would give our own country leadership in this new art. I believe that, given the opportunity, American ingenuity and enterprise can, in a reasonable time, develop a new industry in television amounting to about a billion dollars annually.

The present radio broadcasting industry is approximately \$600,000,000 a year, and it employs approximately 400,000 men; therefore, if my figure of \$1,000,000,000 should be reached, it might mean as many as 500,000 or 600,000 additional people employed in time. . . .—*Statements in hearings before the Committee on Interstate Commerce, United States Senate, 76th Congress, Third Session on S. Res. 251—April 10 and 11, 1940.**

* *Editor's Note*—On May 27, 1940, the Federal Communications Commission changed the rules it had previously announced on February 28, 1940 to permit "limited commercial operation" as of September 1, 1940 and returned television to an experimental existence.

milestone in human affairs

. . . On June 27, 1940, a social and political event took place which may well be regarded in the future as a milestone in human affairs. On that day, for the first time in history, a spellbound audience of ten thousand or more people in New York City and its vicinity witnessed the nomination of a candidate for President of the United States at the Republican National Convention in Philadelphia, nearly one hundred miles away. The members of this audience, seated comfortably in their homes and in restaurants or other public places, were aurally, visually, and immediately transported to the distant scene by the modern miracle of television. The time was a critical one in the history of the nation; the event one of traditional significance; and its outcome a subject of the greatest interest to millions of people. Many of those in the television audience saw a substantial part of the entire Convention proceedings, which were broadcast by television for more than thirty-three hours, over a period of five days; and they were so absorbed that it was given one of the highest audience program ratings of the year.

. . . What of advertising, or sponsored programs? In order to support television as a business venture, television stations eventually must sell time for these as is done by sound radio broadcasting systems. The National Broadcasting Company has studied and analyzed television as an advertising medium for more than five years, and has had more than a year of experimentation with programs presented over the air to the public.

Advertisers and advertising agencies have been kept constantly informed of the progress in television broadcasting, through lectures, letters, monographs, and visits to the studios. In addition to these forms of contact, invitations have been extended to members of the advertising industry to work with us in creating programs having advertising value, at no cost to the sponsors during this experimental period. As a result of this, 148 individual programs of this character were developed during the first eight months of operation, in conjunction with sixty-seven advertisers representing sixteen major industries. A large amount

of data has thus been accumulated on the advertising potentialities of television, and the audience response to these experimental programs has been excellent.—*Reprinted from The Annals of The American Academy of Political and Social Science, Philadelphia—January, 1941.*

commercial television authorized

Last Friday, May 2, the Federal Communications Commission issued an order authorizing commercial operation of television broadcasting stations, effective July 1, 1941.

The Radio Corporation of America, the pioneer in television research and development in the United States, has always been and is today a believer in the possibilities of the transmission of sight through radio.



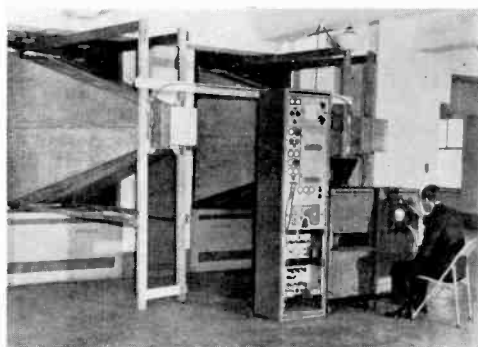
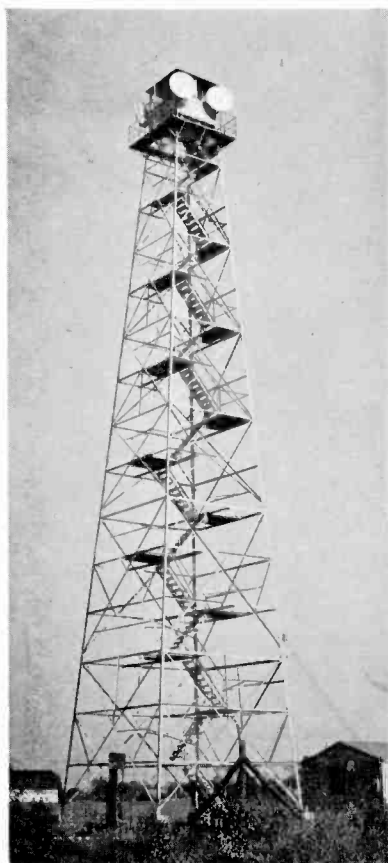
One of the first commercially-sponsored television programs to be broadcast by NBC featured a popular brand of hats.

The company is engaged in reviewing the whole subject of television in the light of the new order just issued by the Commission. Important new factors which now must be considered are the increasing demands upon our facilities and technical experts made by the requirements of national defense, and the matter of priorities, which may affect the establishment of new services.

We may have to divert engineering, facilities and labor more and more from normal work to operations essential to the national interest; we may have to work under reduced allotment of materials in order to complete our obligations to defense. We cannot foresee today the further demands that may be made upon us. . . .

. . . The electron microscope, an achievement of RCA Laboratories, is one of the world's scientific wonders. Yet it works its miracles by the use of radio tubes, similar in principle to those which make possible the radio set in your home. Incidentally, this important new development is one of the tangible results of our research work in the field of television.—*State-*

Left — Automatic, unattended radio relay towers similar to this one can be used to link television stations into networks. Below—Huge horn-like antennas were used in radio relay experiments conducted by RCA in 1941.



ment at the 22nd Annual Meeting of RCA Stockholders, RCA Building, May 6, 1941.

television aids national defense

. . . Television in 1941 advanced in RCA Laboratories and in the field. It will continue to do so in 1942. As a post-war industry, television holds great promise of becoming a new radio service to the public. Television today is testing its wings over the New York area through NBC's pioneer television station WNBT. Its immediate assignment like that of all radio—research, manufacturing, communications and broadcasting—is national defense.* All radio is enrolled and lined up to insure final victory. When the victory is achieved, radio will be "At the Ready" for the important post-war role which will be assigned to it by Peace.—*National Defense Dominates Radio, Review of 1941 and Plans for 1942, released December 22, 1941.*

television instructs air-raid wardens

. . . Television, which holds tremendous possibilities as a post-war industry, is establishing a reputation for itself in the civilian defense program, through its timely service in educating air-raid wardens and the public in air-raid precautions. More than 85 police precinct stations in the New York area are equipped with television receivers for reception of the air-raid programs, telecast several times each week by NBC in cooperation with the New York Police Department. . . .—*Statement at the 23rd Annual Meeting of RCA Stockholders, RCA Building, May 5, 1942.*

war developments to aid television

. . . Television, operated by NBC in New York, has played an important role in air-raid instructions and civilian defense. Its

* *Editor's Note—Following the Japanese attack on Pearl Harbor, RCA development of television for peacetime uses was interrupted for the duration.*



When war came NBC made its video facilities available for mass-training of air-raid wardens and for other civilian defense activities.

laboratory status is a war secret, but those confident of the success that marks wartime developments, expect television to emerge from this war in such form as to make possible a great post-war industry. . . .—*RCA in 1942, Review . . . and a Preview, released December 1942.*

long distance sight

. . . The electronic tube is also the “eye” of television — a coming new industry and service after the war. Science in the post-war era will roll up the blackout shades of our radio “windows” so that we may look across the countryside, and eventually see across the hemispheres. . . .—*Statement for broadcast on June 12, 1943 on Inter-American University of the Air.*

the threshold of a new era

. . . When this war ends, we shall be on the threshold of a new era in radio — an era in which man will see, as well as hear, distant events. The first two decades of this Century belonged to wireless telegraphy. The second two decades featured sound broadcasting; the third two decades promise television. It is not too bold to predict that the fourth two decades will introduce international television with pictures in color.

. . . We have much to learn about the microwaves, in which is wrapped up this new world of individualized radio. Tiny electron tubes may make it possible to design radio receivers and transmitters no larger than a fountain pen, a cigarette case, a billfold, or a lady's powder-box. Some day people may carry television screens on their wrists as they now carry watches. As the useful spectrum of radio approaches the frontiers of light, the apparatus will become simpler and more compact.

Today science is leading us out of a world in which radio has been blind. Tomorrow we shall have radio sight. By this I do not mean that we shall look only at pictures in motion that travel through the air. Radio-vision will have many uses. It will serve wherever sight is needed. For instance, it will be used to prevent collisions on highways and railroads, on sea lanes and on the airways of the world. Radio will be the new eye of transportation and commerce. Applications of radio optics are unlimited. With radio ear and eye to guide them, the great stratoliners will be super-human in their instincts of hearing and seeing as they speed through space with passengers and freight. Radio, which made the world a whispering gallery, will turn it into a world of mirrors. . . .—*Address before the Lancaster Chapter of The American Association for the Advancement of Science, November 11, 1943.*

postwar promise of television

. . . Radio as an industry is fortunate to have television as a postwar development of great promise and popular appeal, able to open a new era in service to the public.

There should be no expectation, however, that when the war ends the air will be transformed overnight to television. It will require from 3 to 6 months to get the machinery in operation to resume the manufacture of civilian broadcast receivers. It may require a year after approval of standards and full authorization of commercialization of television broadcasting by the Federal Communications Commission before television sets are available within the price range from \$200 to \$300. Production of television receivers is not the only task. Television transmitters must be erected. Interesting programs must be planned. Automatic radio relay stations must be built to link key cities into a network. That is no one-year job. . . .—*RCA in 1943, Review . . . and a Preview, released December 1943.*

war research advances television

. . . Television is rapidly advancing under the impetus of wartime research and engineering, and holds much promise for the future. Television will one day be a great new industry and a great public service. The world is going to *see* by radio after this war, just as it *heard* by radio after the last war. . . .—*Address to Graduating Class in Engineering at New York University, January 28, 1944.*

plans await war's end

. . . Television — its commercial progress impeded by shortages of vital materials and of technicians — continued to hold the close attention of the NBC executive, engineering and programming staffs. Extensive plans for sight-and-sound broadcasting await the war's end and the settlement of a number of important technical questions. Meanwhile, WNBT, NBC's pioneer television station in New York, broadcast a variety of programs on a regular and increasing schedule. . . .—*RCA Annual Report for 1943, issued February 1944.*



RCA television picture tubes, prewar at the left and postwar at right.

The smaller of the two tubes shown above is used to project the images reproduced by the large-screen home receiver below.



color to come later

. . . It's my guess that you will want at least one new device. That's a combined radio-and-television set. A handsome piece of furniture, about the size of your present console radio, it is likely to prove the most popular feature of your home of tomorrow. It will sell at retail for about \$250, maybe somewhat less. It will show pictures as large as a tabloid newspaper page on a screen, or twice that size projected on the wall.

You will tune in movies, plays, operas, baseball games, boxing matches, street scenes, and actual news events. The black-and-white images will be sharp and clear, with plenty of depth of focus. Later on, color will be added. . . —*Reprinted from The American Magazine, June 1944.*



Dr. V. K. Zworykin (left) displays the Iconoscope, television's first electronic "eye," and Dr. Albert Rose, of RCA Laboratories, shows the recently developed Image Orthicon, which can "see" by candlelight, or by the light of a match.

television by candlelight

. . . Television, today, is testing its electronic eyesight just as the radiophone was testing its voice in 1919. As soon as this war is over the curtain of Time again will drop, and again all the props of communications will be shifted for a new act. The scene will be television — a camera alongside the microphone just as the microphone took its place alongside the wireless key in 1920. And the new camera will have an electronic eye as sensitive as the human optic, for it will see all that the eye can see in a room lighted by the candles on a birthday cake. . . .—*Radio Age, October 1944.*

America must be ready

. . . I was very happy that Dr. Zworykin (Associate Research Director, RCA Laboratories) put the calendar back a bit and reminded me of the days when he first came to my office. He was not as much of a dreamer as he would have you believe. In fact, he was a very good salesman. I was the dreamer for I believed him. He explained to me the intricacies of the Iconoscope and the storage principle, about which I did not know very much then and do not know too much today. But he did make it very clear in response to my question as to how much it would cost; that it would cost about \$100,000. I was the dreamer, for since then it has cost more than \$10,000,000. However, I have no regrets.

With all the genius that has been exhibited before you tonight, I still believe that the sum total of their imaginations will, five years or ten years, or twenty years from tonight, be regarded as having fallen far short of the realities.

. . . I am thrilled . . . to find on an occasion such as this, such perfect unanimity, such harmony within the industry that I have not known for twenty-five or thirty-five years. I have not heard anybody argue tonight about frequencies or colors or dimen-

sions or lines, and I submit, Ladies and Gentlemen, that this is a good place and this is a good time to bury those arguments.

I do not believe that anyone in America, in any organization, has any different purpose or different objective. Surely, we all know that television is not a finished art. We hope it will never be finished, for when an art is finished, the industry is finished too.

Surely we all know that there are bound to be developments as we go on from year to year, but we cannot wait for the unknown developments to reach a point of perfection in the laboratory before we make the products available for service to the public.

. . . I have seen the technical developments in the field of television in several countries in Europe, primarily in England, which, I believe, is far ahead of any other country in Europe in the technical development of television.

. . . in my judgment there is nothing on the other side that is technically superior or in advance of the technique of television in the United States. I do not believe that they are ahead of us technically.

Having said that much to you, however, frankness compels me to add that in the matter of *planning* for the *use* of television immediately after the European hostilities cease, I believe that England is far ahead of the United States in that planning.

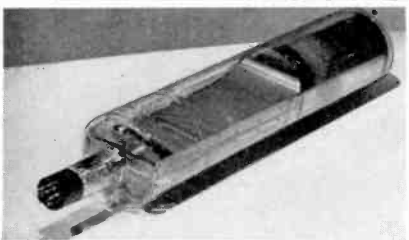
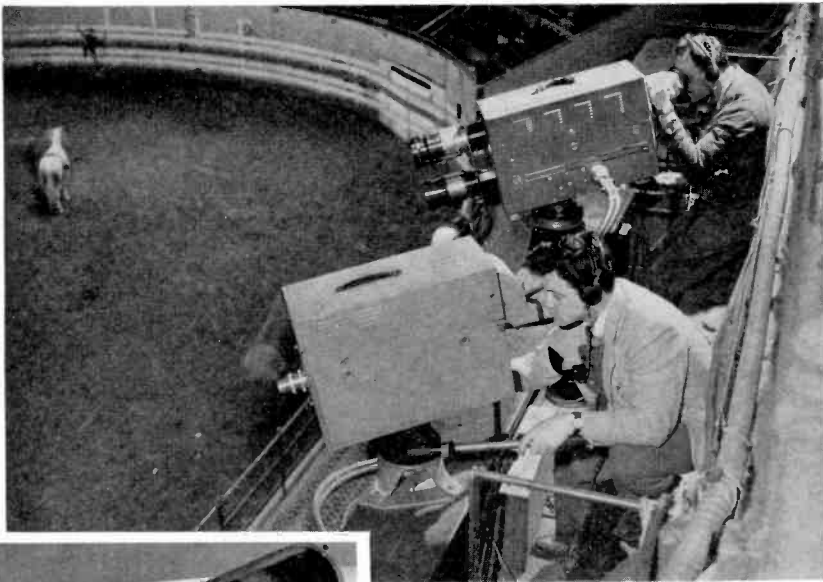
. . . Unless such remaining differences as may exist within the industry are composed, and unless the United States proceeds with its planning for a public service of television, as soon as the war is over and as soon as materials and the necessary frequencies are made available, I believe that England will once more take the lead in the establishment of television as a public service.

Of course, their problems are somewhat different from ours. Their country is smaller. The problems of inter-connection will be smaller but nevertheless, we have solutions that can be applied to the larger problems which exist in America. We have larger resources and I think larger manpower and organization to solve these larger problems.

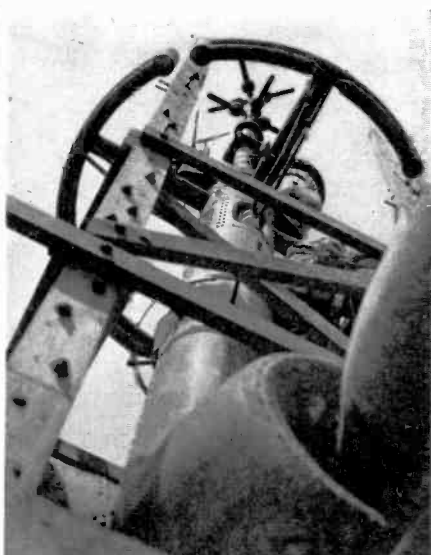
We enter now a new phase in the development of television. Whatever its possibilities or whatever its limitations, one thing you may be certain of, there is not only national but world-wide interest in the great promise of television as a post-war art and a post-war industry. That nation which establishes television first, will undoubtedly have the first great advantage in establishing its designs, its patterns, its standards in the rest of the world and thus gain a great advantage in the export market.

It is of vital importance to America not only from the standpoint of rendering a new service made possible by television, but from the standpoint of not being out-distanced in the important export fields, that we be ready at least as soon as any other exporting nation of the world may be ready, and I should hope sooner.

. . . I subscribe to all the predictions which have been made



NBC television camera, equipped with the sensitive RCA Image Orthicon, picks up a rodeo performance in Madison Square Garden, New York. Inset—RCA Orthicon tube, forerunner of Image Orthicon.



*Left — The appearance of NBC's futuristically designed television antenna atop the Empire State Tower in New York was changed in the Fall of 1945 by the addition of new structure (right) to enable field tests of a new RCA 288-megacycle video transmitter. Below—
The new high-frequency transmitter.*



here tonight. I believe that television has a boundless future. I believe that it will be a greater industry and a greater art than broadcasting, but I do not believe that the two are mutually competitive or mutually exclusive.

Rather, I believe that sight and sound will be united in order to serve the human brain by the ear as well as the eye with a message of information, of entertainment, of culture, and of Government.

Therefore, I would not place any limits on anyone's imagination about the wide scope and the untold possibilities of this great art but I should like to make just one observation.

. . . let us not lose sight of the fact that while electromagnetic waves travel through space with the speed of light — 186,000 miles a second — the radio wave can carry a lie with the same speed that carries the truth. Since they both travel with the same speed the use made of these radio instrumentalities is vitally important.

It will be even of greater importance when, to the art of exposition, there will be added the art of demonstration, when sight and sound combine to bring its message into every home in our land and in the world. May that message be of good will and of peace for a world that needs both.—*Address delivered at The First Annual Conference of The Television Broadcasters Association, Inc., December 12, 1944.*

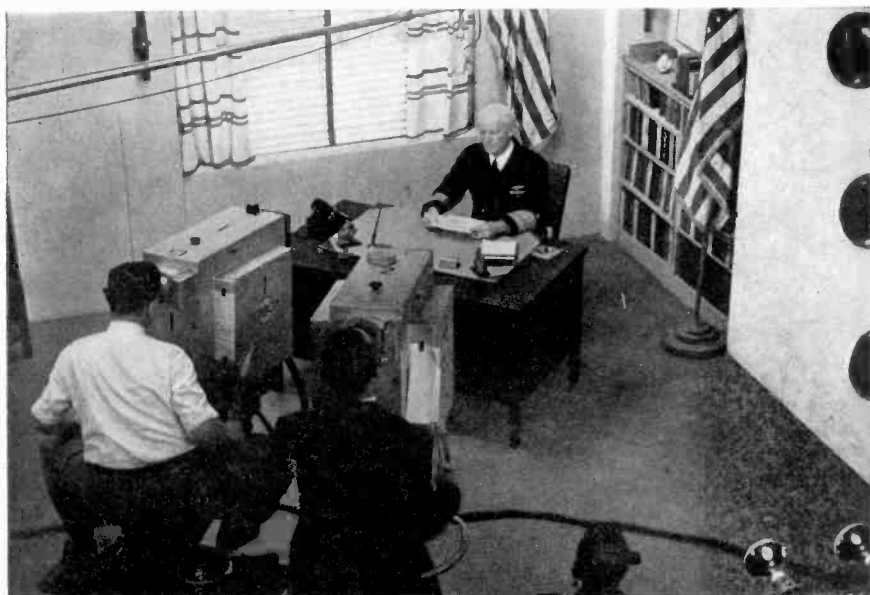
television brings new magic

. . . Television enables us to see action at a distance. After the war by the use of television techniques we shall be able to reach out and operate many of these actions that we see. Just as human fingers press buttons and triggers, snap switches, and release energy to make wheels turn or control machines and vehicles, radio-electronic fingers touch off new magic. . . —*RCA in 1944, Review . . . and a Preview, released December 1944.*

television programs expand

. . . Despite wartime handicaps, the Company greatly increased the schedule of television programs broadcast over NBC's pioneer New York television station WNBT. Many of these programs are relayed to, and broadcast by, WPTZ, Philadelphia, and WRGB, Schenectady, this being the world's first television network operation. Among the most appreciative viewers of these programs are convalescent veterans in nine Army and Navy hospitals in and around New York, in each of which a group of television receivers has been installed by RCA and NBC. Station WNBT is on the air regularly five nights a week with boxing, wrestling and other sports events from Madison Square Garden or St. Nicholas Arena, New York, "live talent" shows produced in the NBC television studio in Radio City, and news and entertainment films.

A weekly feature in which the television audience shows intense interest is *THE WAR AS IT HAPPENS*, consisting of up-to-



Admiral of the Fleet Chester W. Nimitz, in October, 1945, greeted convalescent servicemen via television from NBC Radio City studio.

the-minute releases of U. S. Army and Navy war films. Motion picture film was flown daily to New York from the national political party conventions in Chicago and transmitted promptly to the television audience. On election night, continuous visual bulletins and tabulations of returns were televised, supplemented by personal appearances of NBC commentators. . . .—*RCA Annual Report for 1944, issued February 1945.*

international television expected

Scientific wartime developments promise a rapid postwar expansion of television, wherever Governments encourage its use. As one of the foremost steps toward international solidarity we should study the promising uses of television in helping to preserve the peace.

Let there be no doubt that the world eventually will have international television. It will be a new educational force with a double appeal to eye and ear, put at man's disposal by science, to give him a new and more intimate understanding of his neighbors. Pictures are an international language. They convey clearer and quicker impressions than words spoken in a foreign tongue, or written in a foreign language. Nations will then see themselves as others see them, for the world is destined to go sight-seeing by radio. People everywhere will understand, as never before, how freedom functions in Democracies. . . .—*Delivered upon receiving the American Nobel Center's "One World" award, February 18, 1945.*

RCA ready for television expansion

. . . As the outstanding pioneer in television, RCA today is ready to expand this new science and art into a service of sight-and-sound broadcasting to the American public.

As a further step in its leadership, the company has developed an advanced model of a projection type television receiver. By

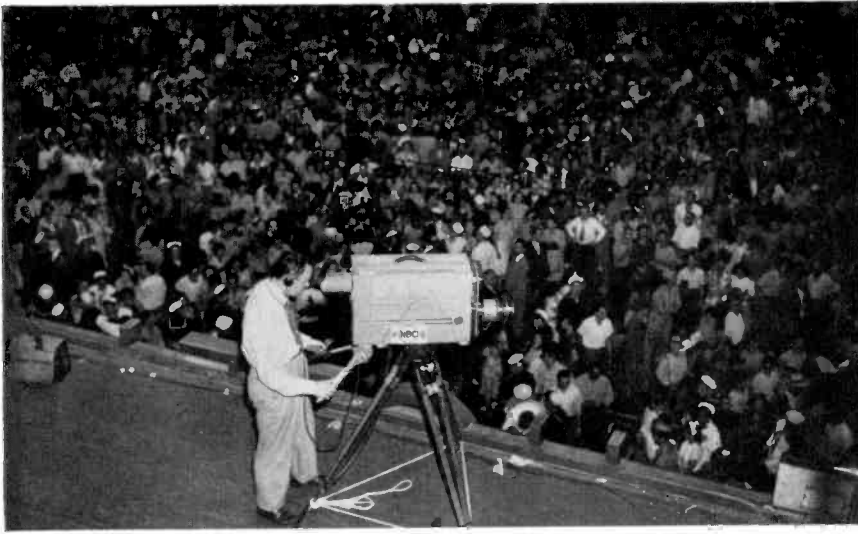
means of a highly efficient optical system — a revolutionary development in the field of television — the receiver produces an 18 by 24-inch picture in motion. The size and clarity of the images, as well as the technical improvements, including a molded plastic lens, which reduce cost and make the system economically practical for the home, have been recognized as marked advances in the art. The pictures already rival the home-movie in detail and brilliancy. . . .—*Statement at the 26th Annual Meeting of RCA Stockholders, RCA Building, May 1, 1945.*

looking ahead in radio

. . . Today the world is on the threshold of television. The go-ahead signal for this new industry and service awaits only the end of the war. Science has laid the groundwork with remarkable efficiency. Broadcasting in 1970 may be known as telecasting because radio sound and sight will be in combination. Eventually television will reach every area of the globe that is now covered by sound broadcasting.

The experimental “radio music box” which amazed the world between 1915 and 1920, will serve the eye as well as the ear as the history of radio repeats itself during the next twenty-five years. It would seem reasonable to expect that many millions of television sets will serve American homes within the next ten years. Today, more than 50,000,000 broadcast receivers are in American homes. The day will come when all of them will be replaced by television with its programs featuring both sound and sight.

Those who purchased a “radio music box” in the Twenties did so in order that they might enjoy concerts, lectures, music recitals and sports events, which were advertised as “going on in the nearest city.” Within the next decade or two, those who acquire television receivers are destined to go sightseeing by radio — not only to the nearest city but to cities across the continent and across the seas. Television will be a mighty window, through which people in all walks of life, rich and poor alike, will be able



NBC televises the crowds celebrating V-J Day in Times Square.

to see for themselves, not only the small world around us but the larger world of which we are a part. Let us hope that this promised expansion of our physical vision may also broaden our outlook on life.—*Tune-In Magazine*, July 31, 1945.

future influences of science

. . . Since the war ended, General H. H. Arnold, commanding the U. S. Army Air Forces, has revealed that flying rockets which can be directed to targets far beyond the horizon are a definite possibility; no longer a dream. Television gives them an eye. From a distance, radio controls them in flight. So deft, so all-seeing is this control, that from the launching site, the operator can guide the winged missile as if he were inside its shell. If he sees that it is not going to hit the target he can turn it quickly; he can even make it loop-the-loop! The very thought of thousands of these television-eyed monsters of destruction coming up over the horizon of the sea as a storm cloud may well cause us to shudder. They might be loaded with warheads of atomic power, some to strike and wipe New York off the map while others guided westward, to turn Pittsburgh, Detroit, Chicago and other cities



Mounted in the nose of an airplane, special RCA airborne television equipment gives ground observers a bird's-eye view of great areas of land or sea as the pilot sees them.

into death and dust. No longer is the suicide flier needed; television can do his task — and more.

. . . I tell you the bomber with a television eye is no myth; neither is the radio controlled rocket.

It rests with man how television, atomic power, electronics, and all the other forces of science are to be used. In man's will lies the answer to the future influence of science on the world. If harnessed for useful purposes the world will go into an era of wonders never before believed possible. Man will be able to look around the world by television, with the same facility that he now listens around the world by radio. Historic events such as the

Japanese surrender on board the battleship *Missouri* in Tokyo Bay will no longer encircle the earth only as sound. They will be seen and heard as sight and sound in tandem.

Nor should we think of television only as an optic nerve over which entertainment and information flow pictorially, for it has many other uses which may even dwarf its performance in the home and theatre. Wherever transport needs vision, television will help to provide it. The airplane will see by television and radar; so will ships on the Seven Seas. Similarly, wherever industry needs an eye, television will provide it. It will watch over industrial processes and machines; it will go into places the human eye cannot reach. Fireproof eyes will be put into furnaces to scan chemical reactions. Tunnels will have these radio eyes as will conduits and mines.

. . . A radio signal circles the globe in one-seventh of a second. Before a mail-laden plane could get off the runway in Australia, radio could be delivering mail from Melbourne — in Washington or London. Furthermore, radio could televise an



NBC telecasts the 1945 Army-Navy football game at Philadelphia.

important scene or event, anywhere, so that all the world might see it instantly and simultaneously. Radio travels with the speed of light. Television is light and radio combined.

I told my friend that in the future, a person will write a letter or a message that will be put on a belt moving in front of a television eye. In a split second that letter or message, exactly as written, will appear in England, South Africa or China. There, it will be automatically reproduced by a photographic process for delivery in minutes — not hours as required by even the fastest airplane.

My friend began to smile. His conception of the future of



RCA table model television receiver.

communications was changing. He was startled when I told him that eventually we may be able to take a sealed letter or document and flash it across the hemispheres without opening the envelope. That again is a television possibility — and it's not fantastic. If X-rays can look through the human body and through steel, why should it not be possible for the television eye to look through a paper envelope? This would make possible a radio mail system. . . .—*Address delivered at the American Academy of Political and Social Science, Philadelphia, Pennsylvania, October 5, 1945.*

a post-war progress report

Our research men and engineers have built a practical all-electronic television system for the transmission and reception of excellent pictures in black-and-white. There is every reason why television should go ahead as a service to the public. Frequency allocations, rules and regulations for commercial television service have been approved by the Federal Communications Commission. Any further technical advances—and they will be continuous—will bring new benefits in television to the public. If we wait for all the new developments of the future, the American people will always be waiting for the enjoyment of television and will be denied its thrills in the present.

The television policies of Radio Corporation of America and its subsidiaries are:

1. The RCA organization will continue research and development in all phases of television. Technically, this includes black-and-white, color, three dimensional views, transmission, reception and network distribution. Artistically and educationally, this means development of program technique through use of motion pictures, live talent, outdoor scenes, news events, sporting events and other features of local and national interest.
2. The RCA Victor Division—a pioneer in television engineering and design—will manufacture the finest possible television equipment for sale to broadcasters and the public.
3. The National Broadcasting Company—a pioneer in tele-

vision broadcasting—will continue development of television broadcasting and program service to American homes and schools, and will develop plans for the establishment of a nationwide network of independent television stations.

4. The Radio Corporation of America will continue to make available to its licensees all of its inventions in this new field of television as it has done in broadcasting and other fields of electronics.

Television as an art and a new service naturally introduces new economic and artistic problems. While they are by no means easy to solve, many of them are similar to those which confronted the pioneer broadcasters. American ingenuity solved the problems of sound broadcasting and can solve the problems of television.

We are confident that this progress report is the forerunner of further achievements. We shall continue pioneering in all phases of television. We shall move television forward from a local to a regional basis; thence to a national service and eventually, we hope to see it function on an international scale.

. . . The time has come in television when the networks must assume the responsibility to introduce and to advance the new art of sight-sound broadcasting and to make their television programs available by whatever means may be found technically and economically feasible to the independent stations associated with their networks.—*Statement made at demonstration of latest developments in television, including improved black-and-white pictures and color pictures in three dimensions, at RCA Laboratories, Princeton, New Jersey, December 13, 1945.*

networks in prospect

. . . Television networks are in prospect as automatic radio relay stations are being built to relay television from city to city. At the same time the coaxial cable, another artery of television, is being extended; already New York is linked with Washington by means of this new cable, and it is moving into the South toward Dallas, Texas. Gradually, radio relays and coaxial cables will

grow out across the country to link coast with coast—and to provide a nationwide service of sight and sound.

Before nationwide television is possible, however, there must be hundreds of transmitters to supplement the nine commercial stations now on the air. These transmitters will begin to be generally available late in 1946, and by the end of 1947 considerable activity in television broadcasting may be expected.

Television will be widely utilized throughout commerce and industry. Department stores will use it so that the public may shop by television; through intra-store television, merchandise will be displayed throughout the stores at “telesite” salons.

. . .

War made vision a vital part of electronic communications. Airborne television perfected by RCA has been demonstrated to reveal how an “eye” in the nose of a plane scans the terrain while a small portable transmitter flashes the panorama to a distant screen on which observers see it exactly as the pilot. And now radar — a direct offspring of television — will be applied commercially, especially to aviation and navigation, for it is a new all-seeing “eye” for the pilot, whether in the cockpit of a plane or on the bridge of a ship. Radar in the control towers at airports, will bring the sky, the runways, and nearby planes, into view whether the weather be thick or the night cloudy and dark, with all lights obscure.

In the field or air navigation, RCA has devised a complete system for preventing collisions, controlling traffic, performing instrument approaches and in the general navigation of aircraft. Unique in its combination of television and radar techniques, this new system is called Teleran.

The miracle of radar and the advent of postwar television, make 1945 a year to be remembered as beginning the third cycle in the evolution of radio: First, there was wireless telegraphy; second, broadcasting of the human voice and music, and now the world enters the third cycle — the era of radio sight. . . . — *Radio in 1945-46, Review . . . and a Preview, released December 1945.*

advances in television

. . . While war halted television for civilian purposes, the research and engineering which applied television techniques to warfare, produced advances that now make possible a greatly improved television system. The many new electron tubes and devices of visual radio, evolved during the past five years for ultra-high frequency military purposes, now are integral parts of television, radio relays and other branches of radio communication.

. . . As an outstanding contribution to the advance of television, the Image Orthicon is more than 100-fold more sensitive than any previous television camera "eye." It sees whatever the human eye can see, even in the light of a match or a candle. Thus television is made so effective that its pictures may be transmitted at any time of day or night or from any place either indoors or outdoors, or in a dimly lighted theater.

The kinescope, or picture tube, used in television receivers, also emerged from the war vastly improved. RCA developed a method for backing up the fluorescent screen with a thin metallic film, which greatly intensifies picture brilliance and contrast.

During 1945, a 300-megacycle television transmitter reached the development stage at which field tests could be made of a complete system utilizing such an installation. Pictures of excellent quality were received within a four-mile radius of the Laboratories at Princeton. In order to test the system under conditions more representative of a broadcasting service, the transmitter will be operated in New York City through a new antenna on the Empire State Building.

. . . Among RCA Victor's new products in this field (television) is the greatly improved television camera utilizing the supersensitive Image Orthicon tube. A micro-wave transmitter and receiver for relaying television programs from athletic fields or other outside points to the main transmitting station also have been developed. Demonstration of an advanced developmental large-screen television receiver for the home has revealed its practicability. . . . An improved direct-viewing cathode-ray tube

for television receivers reproduces pictures so bright that they may be viewed clearly in a fully lighted room.

. . . NBC's television program schedules underwent rapid expansion during the past year. A weekly series of full-length dramatic productions, including many leading plays of the theatre with top professional talent, were televised in the NBC studio and broadcast by the Company's New York station, WNBT. Boxing bouts from Madison Square Garden and other arenas, baseball, football, hockey, basketball, tennis and other sports events, as well as newsreels, were on the schedules every week. On Navy Day, President Truman was televised for the first time while delivering his Navy Day address in Central Park, New York. The coaxial cable between Philadelphia and New York enabled the New York television audience to witness the Army-Navy football game at Philadelphia on December 1. On February 12, 1946, the cable was put into operation between Washington and New York, and the ceremonies at the Lincoln Memorial in Washington were televised and relayed to New York as the first television broadcast from the Nation's capital.

In addition to its New York station, NBC applied for television station licenses in Washington, Cleveland, Chicago and Los Angeles. . . . — *From RCA Annual Report for 1945, issued February 1946.*

signposts for the future

. . . As a pioneer in television, NBC will continue to develop television broadcasting and program service, as well as plans for the ultimate establishment of a nationwide network of independent television stations. A new antenna — the most modern in the world — built at RCA Laboratories, recently was installed atop the Empire State Building in New York City for use by WNBT, the pioneer television station of the National Broadcasting Company.

The Federal Communications Commission has granted licenses to NBC to construct and operate commercial television stations in Washington, D. C., and Chicago, in addition to the Company's station in New York. When these stations are on the

air, the Nation's Capital and the mid-west will be the source of many NBC television programs. New York and Washington already are connected by coaxial cable, over which television programs can be exchanged between those two cities. The first eastern television network comprising Washington, Philadelphia, New York and Schenectady was opened experimentally on February 12th, this year, when the television audience along the Atlantic seaboard watched the Lincoln Birthday ceremonies at the Lincoln Memorial in Washington. As the cable is extended, or radio relay stations are erected, Chicago and other cities will be linked into television networks which ultimately will operate coast-to-coast. NBC has applied for additional commercial television station licenses in Cleveland and Hollywood.

In June, the Louis-Conn fight in New York will be televised by NBC. This championship bout promises to be as historic in television as the Dempsey-Carpentier fight was in sound broadcasting. Twenty-five years have passed since that memorable broadcast by RCA revealed radio's great popular appeal. Now television opens a new era in sports for the public to see as well as hear by radio.

As stockholders and broadcast listeners, you will be interested in the general outlook for television. War, of course, halted civilian television. But now the research and engineering which made radar and airborne television possible for wartime purposes, provide a greatly improved television system including radio relay stations, more sensitive cameras and clearer pictures for the home.

Over the past few months, vastly improved black-and-white pictures, color pictures, and even color in three dimensions, have been demonstrated at RCA Laboratories. The black-and-white pictures produced by the RCA all-electronic system provide greater detail, brilliance and contrast than ever before achieved in television. The demonstrations have proved that the RCA television system is ready for greater service to the public.

We firmly believe that color ultimately will provide an added interest in certain television programs for the home as it does in certain motion pictures for the theater. However, the majority of television programs will, we believe, continue to be in black-

and-white, as they are in the movies, even when color is available. Although color processes have been available to the movies for many years, only 6 percent of the feature motion pictures shown in the theater today are in color.

Adding color to television involves new techniques and new devices which still are in the laboratory stage. That part of the radio spectrum in which a color television system is likely to be operated is yet to be thoroughly explored. Moreover, standards for apparatus that can function in this portion of the spectrum first must be agreed upon by the radio industry and next approved by the FCC. The equipment must be field-tested, made commercially practical and manufactured at prices within reach of the consumer. All this already has been achieved by the present system of black-and-white television. It still remains to be done by any system of color television before it can be said to be ready for use in the home.

Although color pictures can be produced by a mechanical system, we do not believe it is the most desirable system for home use. We believe that an all-electronic system of color television is the better method, and that when it is perfected it will make obsolete quickly any method of mechanical color that may be adopted in the interim. Our scientists, therefore, are hard at work in developing an electronic system of color that will have many advantages over any conceivable mechanical system. When a modern and practical color television system for the home is here, RCA will have it.

Meanwhile, we are going forward with the television plans which we announced publicly and outlined in the latest Annual Report to our stockholders.

The RCA Victor Division — a pioneer in television engineering and design — will manufacture the finest possible television equipment for broadcasting purposes and receivers for the home. We expect that RCA television receivers will begin to reach the market in the Autumn. Our new instruments will incorporate the latest scientific improvements derived from all phases of radio, including FM, Radar and Television. . . — *Address delivered at 27th Annual Meeting of RCA Stockholders, May 7, 1946.*

ALL-ELECTRONIC COLOR TELEVISION CREATED BY RCA

Statements by:

*Brigadier General DAVID SARNOFF, President
Radio Corporation of America*

*DR. C. B. JOLLIFFE, Executive Vice President in Charge
of RCA Laboratories Division*

*NILES TRAMMELL, President
National Broadcasting Company, Inc*

Issued at First Public Demonstration of All-electronic Color Television,
RCA LABORATORIES DIVISION, Princeton, N. J., October 30, 1946

All-Electronic Color Television Created By RCA

Electronic color television pictures, produced by all-electronic means, were demonstrated publicly for the first time on October 30, 1946, by Radio Corporation of America at RCA Laboratories, Princeton, N. J.

The demonstration, revealing a revolutionary development in radio science, proved that flickerless, all-electronic color television is practical without rotating discs or other moving parts.

This new system, the engineers explained, is a complete departure from mechanical color, shown in various forms since 1925. In announcing this important advance, RCA officials pointed out that the time period estimated by their engineers in December, 1945, when they said five years would be required to bring any color system to the present status of black-and-white television, still holds.

It was further disclosed that a simple, inexpensive radio-frequency converter makes it possible to introduce this all-electronic color television system without causing obsolescence of black-and-white television receivers.

A new color slide television camera, developed by RCA and used in the demonstration, produces signals from 35 mm. Kodachrome slides. Transmission of the picture on the slide is achieved in natural colors when a light beam from a kinescope is focused through the slide and separated into component colors by a system of mirrors and photo-electric cells.

Each of the three transmitted images—red, blue and green—is of the same number of lines, that is, 525; also the same horizontal scanning rate and the same picture repetition rate of 30 pictures a second as in present commercial television broadcasting.

The receiving set is equipped with three 3-inch kinescopes, which separately received the signals representing red, blue and green. This trio of kinescopes is called a Trinoscope. From it the three color images are optically projected into a brilliant composite picture which appears on a 15 x 20-inch screen in

natural color, free from any flicker, color fringes or break-up of color.

By this new advance in television, *simultaneous* color transmission, instead of *sequential* transmission, color by color, is achieved.

Converter Overcomes Obsolescence

Since the electrical characteristics and all of the standards of the green image—including the synchronizing pulses—are identical to those of the present black-and-white standards, any broadcasts from color stations using the electronic simultaneous system can be received clearly on black-and-white receivers by the addition of the easily installed radio-frequency converter. No modifications whatever are required inside the set.

This converter will enable present-day television sets to receive color programs and reproduce them in black-and-white, even when transmitted on ultra-high frequencies. Thus, existing receivers will not be made obsolete by the introduction of color at some future date. On the contrary, their usefulness will be extended. For example, if a football game is broadcast by a color transmitter, the owner of a black-and-white receiver can see it in black-and-white. Even one of the first television sets introduced by RCA at the time of the World's Fair in 1939 can be adapted to tune-in the electronic color pictures in black-and-white.

Likewise, it will be possible for electronic color television sets to receive the broadcasts of black-and-white stations. Furthermore, when electronic color television is established as a broadcasting service, the black-and-white receivers will be able to reproduce the color broadcasts in monochrome. Engineers explained that this cannot be done with any known system of mechanical color.

Officials of RCA pointed out that a station owner can begin with a black-and-white broadcast service. He may operate a monochrome transmitter on low frequencies and also an electronic color transmitter on ultra-high frequencies using the signal of the color camera to operate both transmitters. With such a dual arrangement, the problem of obsolescence for the broad-

caster as well as the viewer is reduced to a minimum. In fact, the broadcaster would thereby be able to render service in both black-and-white and color from the same station.

REALIZATION OF A PRINCIPLE

Brig. General David Sarnoff, President of Radio Corporation of America, in commenting upon the development said:

"The realization of this universal system of television, which transmits and receives both color and black-and-white pictures with equal quality, is as far-reaching as was the creation of an all-electronic television system which supplanted the mechanical discs used in black-and-white television when it first began. The realization of all-electronic color is as significant in television as electronic recording was over mechanical recording on phonograph records, or the present color movies over the early mechanical color on the screen.

"It is with great pride and satisfaction that I congratulate the men who have created all-electronic color television in our Laboratories," said General Sarnoff. "They have enabled RCA, the creator of all-electronic black-and-white television, also to create all-electronic color television which has been the dream of radio scientists from the beginning.

"The new RCA electronic color television system will be available to the entire radio industry. The development is so important in contributing to television leadership for our country that we have decided to demonstrate it publicly as apparatus becomes available for each successive step. We begin with the current demonstration in which still pictures are used, but which sufficiently establishes the basic principle; it will be followed by the transmission and reception of color pictures in motion, then outdoor scenes and finally electronic color television on large-size theatre screens."

TIMETABLE FOR FUTURE DEMONSTRATIONS

Dr. C. B. Jolliffe, Executive Vice President in Charge of the RCA Laboratories Division, declared that this development in

television, which establishes an all-electronic system of color transmission and reception, takes the issue of color television out of the range of controversy. All-electronic television, he said, is far superior to any mechanical system of color with its rotating discs and other well-known limitations.

“The problem is no longer how to transmit and receive color pictures by an all-electronic method, because the basic principles have now been solved,” said Dr. Jolliffe. “The problem that still challenges is how to operate television broadcasting as a steady and regular service to the public on the higher frequencies, whether in black-and-white or in color. To open the high-frequency spectrum and to make it commercially useful will require propagation studies under broadcasting conditions, development of new circuits, new tubes and new cameras, all of which must be field-tested before commercial standards can be recommended by the industry for approval by the Federal Communications Commission.

“Although we have solved the all-electronic color television problem, it will require a number of years to establish color television as a service to the public,” said Dr. Jolliffe. “What we have done today is to demonstrate the realization of the principle of simultaneous electronic color television. The apparatus used in the demonstration is purely experimental as developed in the Laboratories. It is not commercial equipment, but it reveals that the American people will be assured of the finest color television instruments in the future as they now have in all-electronic black-and-white television.

“Let me emphasize that the most important fact to remember in regard to color television is that any commercial system, whether it be mechanical or electronic, depends upon the ultra-high frequency spectrum in which the necessary band width for color exists. No matter how far the development of the principle and the apparatus has gone forward, there must yet be complete exploration and tests in the field of the behavior and limitations of ultra-high frequencies. We expect to complete our development of electronic color television apparatus before the ultra-high



Ray D. Kell, engineer in charge of research on television equipment at RCA Laboratories, points to the Trinoscope in RCA's all-electronic color television receiver.

frequency spectrum is made ready for its use in a commercial way.

“This demonstration, therefore, does not change the time period estimated by us in December, 1945, that it would require five years to bring a color system to the present position of black-and-white television.

“We will move along rapidly in this development, but no matter how many years pass before the ultra-high frequency spectrum is harnessed for commercial color television service, no one need fear that the black-and-white television set of today is destined for quick obsolescence. The inexpensive converter takes

care of the problem. In the meantime, the development of both black-and-white and color television will continue to advance, and eventually will increase the service to the public.

“We have demonstrated a principle that now enables us to go forward with a timetable which is not based on a scientific theory but on the required engineering of equipment,” said Dr. Jolliffe. “The system already has been perfected to a point where we now could show motion picture films or outdoor scenes in electronic color, except that we have not had the time necessary to build the essential equipment.”

Dr. Jolliffe disclosed that the RCA timetable for future demonstrations of color television is divided into five stages, the first of which as shown today featured still pictures televised from color slides on a large screen 15 x 20 inches. There is no flicker. Blending of three colors—red, blue and green—is achieved simultaneously to produce a perfectly natural picture.

The remaining stages in the timetable of laboratory demonstrations of electronic color television were outlined as follows:

Motion picture films within 3 months.

Live-action studio scenes by the middle of 1947.

Outdoor action scenes by the latter part of 1947.

Large-screen theatre-size pictures in 1948.

“RCA scientists and engineers have a complete plan for this schedule and our laboratory tests reveal that this is practicable,” added Dr. Jolliffe. “We need only time to produce the necessary equipment such as cameras and tubes, so that a demonstration can be made in approximately one year, that will include all five stages at the same time, that is, the complete range of universal all-electronic color television—in motion, indoors and outdoors.”

In conclusion, Dr. Jolliffe stated that success in achieving all-electronic color television is the result of team-play among the scientists and research men in RCA Laboratories. He described their achievement as “a coordinated and concentrated attack by scientists, which writes a new chapter in television and industrial research.” He said that as a result, color television has moved into the modern Electronic Era and will take its place

ultimately alongside the RCA all-electronic black-and-white television system, which is presently bringing news, entertainment and championship sports events to observers in New York, Philadelphia and along the Atlantic seaboard as far south as Washington, D. C.

NBC COLOR TELEVISION PLANS

Niles Trammell, President of the National Broadcasting Company said that as a broadcaster, he was delighted with the news that an all-electronic color television system had been achieved at RCA Laboratories.

"We are mindful, as the scientists at the Laboratories have pointed out," said Mr. Trammell, "that new apparatus must be built and field-tested before color television can be brought to the home in a state of practicability to serve the public. In this task our engineers with their practical knowledge of broadcasting, will cooperate in every way with the scientists. We will include the new RCA electronic color system in our plans to establish nationwide television, for this practical color system can be fitted into an expanding service."

PRESS REPORTS ON RCA ALL-ELECTRONIC COLOR TELEVISION

Newspaper and magazine writers were invited to witness the first public showing of the all-electronic color television system created by RCA. Excerpts from some of their reports follow:

Motion Picture Daily

"A complete departure from mechanical color. . . . By this new advance in television, simultaneous color transmission instead of sequential transmission, color by color, is achieved. . . . Existing television receivers will not be made obsolete by the introduction of color."

New York Daily News

"A revolutionary innovation. . . . Existing black-and-white television receivers need not become obsolete when electronic color takes the air. . . . A simple inexpensive radio-frequency con-

verter makes it possible for the black-and-white set to pick up color programs and reproduce them in monochrome. Furthermore, it will be possible for electronic color television sets to receive the broadcasts of black-and-white stations. . . . Thus that bugaboo of television set owners—obsolescence—has been solved at last!”

New York Herald Tribune

“A major advantage lies in the fact that television receivers bought today will not become obsolete if this color system is adopted. They can be cheaply converted to the proper wavelength, and by using only one of the three channels, will produce black-and-white television with all the accustomed clarity and fidelity. . . . In the Princeton studios the color images were satisfactory.”

New York Journal of Commerce

“A revolutionary development in radio science. . . . Demonstration shows that all-electronic color television is practical.”

New York World Telegram

“Flickerless, all-electronic color television dispensing with rotating discs and other moving parts was demonstrated publicly for the first time by Radio Corporation of America. . . . The demonstration proved that color television can be practical without driving black-and-white television receivers into obsolescence.”

Radio Daily

“An all-electronic color television system was demonstrated publicly for the first time in history at RCA Laboratories. . . . The demonstration was for the purpose of proving that the new development in radio science was flickerless and practical without use of rotating discs or any other moving parts.”

The New York Times

“A revolutionary advance in television. . . . Technically, it supplants the 20-year-old mechanical system of transmitting each color separately—first red, then blue and finally green with the persistence of human vision blending the separate hues into the

composite picture. . . . As seen here today on a receiver with a screen 15 x 20 inches, the RCA images were virtually free of flicker and of good brilliance."

The Sun

"The new RCA electronic color television system will be available to the entire radio industry. . . . It (this demonstration) will be followed by the transmission and reception of color pictures in motion, then outdoor scenes, then finally electronic color television on large-size theater screens."

The Wall Street Journal

"Television, up to now, has depended upon a mechanical rotating filter to obtain its color. RCA's new system does away with the rotating filter, using instead a combination of electronic tube, mirror and photo-electric cells to obtain natural shades. . . . The color quality of the images left nothing to be desired."

United Press

"Both images and colors were sharply defined. . . . Pastels appeared as faithfully as if the pictures had been projected on a screen with a lantern slide. . . . Brigadier-General David Sarnoff, President of Radio Corporation of America, said the demonstration was intended to show, shortly after its birth, one of the greatest developments in radio history."



RCA - NBC firsts in television

- 1923—Dr. V. K. Zworykin, now Director of the Electronic Research Laboratory, RCA Laboratories Division, applied for patent on the iconoscope, television's electronic "eye." (December 29).
- 1929—Dr. V. K. Zworykin demonstrated an all-electronic television receiver using the kinescope, or screen tube, which he developed. (November 18).
- 1930—Television on 6 x 8-foot screen was shown by RCA at RKO-Proctor's 58th Street Theater, New York. (January 16).
- 1930—NBC began operating W₂XBS, pioneer experimental television station in New York. (July 30).
- 1931—Empire State Building, world's loftiest skyscraper, was selected as site for RCA-NBC television transmitter.
- 1932—RCA initiated field tests with 120-line, all-electronic television. (May 25).
- 1936—Television outdoor pickups demonstrated by RCA at Camden, N. J., on 6-meter wave across distance of a mile. (April 24).
- 1937—RCA announced development of electron projection "gun" making possible television pictures on 8 x 10-foot screen. (May 12).
- 1937—Mobile television vans operated by RCA-NBC appeared on New York streets for first time. (December 12).
- 1938—Scenes from Broadway play "Susan and God," starring Gertrude Lawrence, telecast from NBC studios in RCA Building. (June 7).
- 1939—RCA and NBC introduced television as a service to the public at opening ceremonies of New York World's Fair, featuring President Roosevelt as first Chief Executive to be seen by television. (April 30).

- 1939—Improved television “eye” known as the “Orthicon” was introduced by RCA. (June 7).
- 1939—Major league baseball was telecast for the first time by NBC, covering a game between the Brooklyn Dodgers and Cincinnati Reds at Ebbets Field. (August 26).
- 1939—First college football game—Fordham vs. Waynesburg—televised by NBC in New York. (September 30).
- 1939—RCA television receiver in plane over Washington picked up telecast from NBC station in New York, 200 miles away. (October 17).
- 1940—RCA demonstrated to the FCC, at Camden, N. J., a television receiver producing images in color by electronic and optical means employing no moving mechanism. (February 6).
- 1940—New York televised from the air for the first time by a plane equipped with RCA portable television transmitter. (March 6).
- 1940—Television pictures on 4½ x 6-foot screen demonstrated by RCA at annual stockholders meeting in Radio City. (May 7).
- 1940—Coaxial cable used for first time in television program service by NBC in televising Republican National Convention at Philadelphia and transmitting scenes over New York station. (June 24).
- 1941—Demonstrating television progress to the FCC, RCA exhibited the projection-type home television receiver featuring a screen 13½ x 18 inches.—Television pictures including a prizefight from Madison Square Garden and a baseball game at Ebbets Field, Brooklyn, were projected on a 15 x 20-foot screen in the New Yorker Theatre.—Scenes at Camp Upton, Long Island, were automatically relayed by radio to New York establishing a record as the first remote pick-ups handled by radio relay stations. (January 24).
- 1941—Color television pictures in motion were put on the air by NBC in the first telecast in color by mechanical means from a television studio. (February 20).

- 1941—RCA-NBC made successful tests with first projection-type color television receiver using mechanical methods. (May 1).
- 1941—NBC's television station WNBT became the first commercially licensed transmitter to go on the air. (July 1).
- 1942—First mass education by television was initiated by RCA-NBC in training thousands of air-raid wardens in the New York area. (January 23).
- 1943—NBC televised major sports and other events at Madison Square Garden for wounded servicemen in television-equipped hospitals in the New York area. (October 25).
- 1944—NBC announced plans for nation-wide television network to be completed possibly by 1950. (March 1).
- 1945—RCA demonstrated projection-type television home receiver featuring screen approximately 18 x 24 inches. (March 15).
- 1945—Films of Japanese signing surrender documents on board *USS Missouri* were telecast by NBC station WNBT, New York. (September 9).
- 1945—RCA Image Orthicon tube of supersensitivity was introduced as solution to major problems in illumination of television programs and outdoor pickups. (October 25).
- 1945—NBC's expanding television program service included these outstanding events: President Truman at Navy Day exercises in New York; coverage of the New York Herald Tribune Forum, and climaxing record coverage of the year's major sports events by televising the Army-Navy football game, professional football games and college contests.
- 1945—Greatly improved black-and-white television pictures and color television in three dimensions featuring live talent were demonstrated by RCA at Princeton, N. J. The color system was mechanical; the black-and-white all-electronic. (December 13).
- 1946—Airborne television as developed during the war by RCA and NBC in cooperation with U. S. Navy, U. S. Army

Air Forces and the National Defense Research Council was demonstrated at Anacostia Navy Air Station. (March 21).

- 1946—First world's heavyweight championship fight to be seen on television featured Louis-Conn at Yankee Stadium, New York, televised by NBC and transmitted to Washington, D. C., via coaxial cable. (June 19).
- 1946—Post-war television receivers introduced by RCA Victor Division. (Sept. 17).
- 1946—Color television pictures on 15 x 20-inch screen produced by all-electronic means were demonstrated publicly for the first time by Radio Corporation of America at RCA Laboratories, Princeton, N. J. A simple radio frequency converter was announced that enables black-and-white receivers to reproduce in monochrome the programs of color television stations operating on high frequencies. The converter also enables all-electronic color receivers to receive the programs of low or high frequency black-and-white transmitters. This will make it possible to introduce all-electronic color without causing obsolescence of black-and-white television receivers. (October 30).



