RADIO

Television from the Skies

Ultra-short waves follow straight paths, reaching out from 30 to 50 miles. So television is taking to the air to make longer ranges possible.

By A. C. MONAHAN

➤ TELEVISION IMAGES ride on short waves that act very differently from the longer ones used in the ordinary radio broadcast, or in inter-continental signals. The result is, television is local, while radio broadcasting is world-wide.

With your radio set you can pick up music or talks transmitted from far-distant stations in Havana, Buenos Aires, London, Moscow—practically anywhere on the earth. With your television receiving set, however, you can usually pick up pictures from a television station not more than 30 to 50 miles away.

This is because the relatively short television waves travel in straight lines through unobstructed paths. Ground waves of long-wave broadcasting follow the curvature of the earth for several hundred miles until their intensity becomes too weak for reception. Sky waves from a radio station go upward at an angle, and are reflected back to earth by the outer layer of atmosphere that is electrically charged. It is these that make it possible to receive broadcasts thousands of miles away.

Waves Don't Bounce Back

The very short waves that carry television images, on the other hand, do not bounce back from the "radio roof." They act like beams of light, travelling in straight lines. The practical result is that they can reach just about as far as you can see from the top of the sending tower. That is not apt to be more than 50 miles, and is usually nearer 30. This is called the "line-of-sight" distance, and the horizon is referred to as the usual limit of television reception.

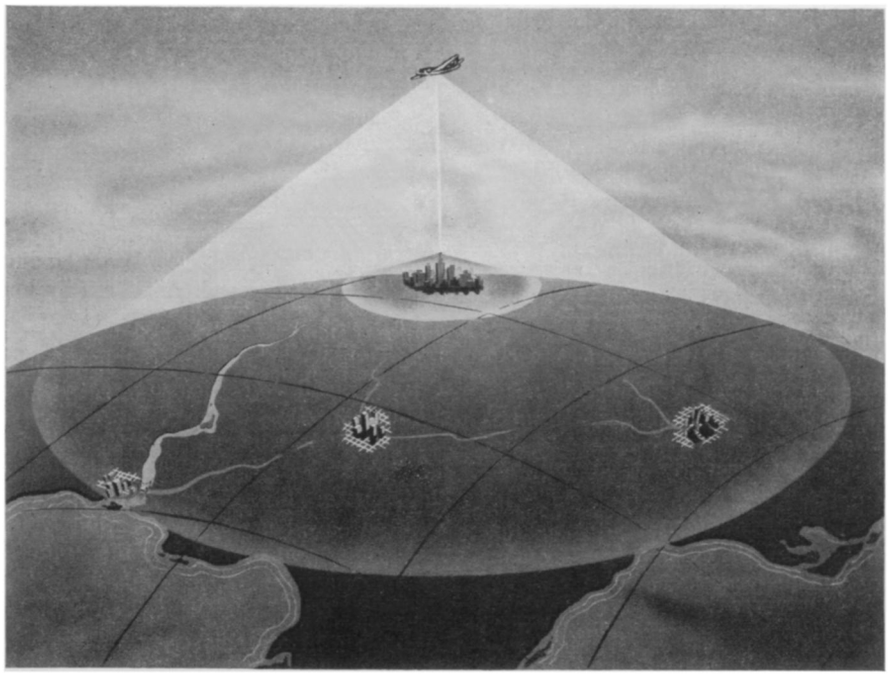
The higher the transmitting antenna is above the level earth, the farther away is the horizon, and the greater is the area of reception. For this reason, television broadcasting stations are erected on high towers on as high elevations as possible. But even then, their programs can be picked up by receivers in ordinary homes only within a circle of 30 to 50 miles in radius.

The length of a wave dissipated into space by the antenna of a transmitting system is the distance a single wave travels while it is being formed. This depends upon the time required to generate a single wave, which in turn depends upon the frequency of the energizing circuit in the transmitter; that is, the number of electrical cycles or vibrations per second.

Mountain Peaks Help

An exception is the new television transmission station erected atop Mt. Wilson, about 20 miles from Hollywood, Calif., at an elevation of 6,000 feet. Because of surrounding lower terrain, it is thought the reception area will be 100 miles in radius, and that this single station will serve all of the southern California coastal area. Stations erected on other high isolated peaks may also be able to serve larger areas.

Television broadcasting, including the



TAKING TO THE AIR—Television broadcasts beamed from airplanes flying six miles up in the air can supply programs to people living within a radius of 200 miles.

cameras and equipment to give action-talking events as they occur, is costly. Large audiences must be served if programs are to be financially feasible. The population within a 30 to 50 mile radius is not ordinarily enough. The program from a single originating station must be spread over a much greater area. How to carry the talking pictures to sufficiently large areas is one of the great problems of the television industry.

Systems of Pickup

A system of relay stations seems to be the answer. One plan under trial includes ground-based radio relays on towers that will pick up programs from the air and rebroadcast them. Another system uses relays fed by coaxial cable from originating transmitters. A third proposes airborne relays carried aloft either by planes or blimps. Probably all three will be used eventually.

At least two ground-based radio relay systems for airborne television waves are under construction. One is between New York and Boston; the other between Chicago and Milwaukee. In the first of these installations the relays will be from 30 to 40 miles apart, making eight jumps between the two cities.

To help carry the radio waves from one relay to the next, large lenses will be used. They are metal lenses that can focus the radio waves in much the same way that a glass lens focuses light. In appearance, however, they bear no resemblance to the familiar optical lens.

Each is an array of metal plates placed somewhat like the cross slats on a window blind, but designed to focus the radio waves as effectively as a solid lens might focus them if due regard is given to the fact that the edge of the wavefront is advanced, rather than retarded, in transit.

Cables Are Expensive

Television images can be transmitted short distances by special telephone wires, but not far because the electrical losses are too great. They can be transmitted almost unlimited distances by coaxial cable, however, but coaxial cable is expensive to manufacture, install and maintain. When used part time for telephone communication and part time for television, its use is economically feasible.

A coaxial cable is a lead-covered flexible tube containing, usually, from six to eight conductors. Each conductor is a copper tube about the size of a lead pencil, with a heavy copper wire extending throughout its length and held by plastic disks in its center, out of contact with the tube. Each tube can accommodate a television channel or 480 telephone channels.

To cover the United States with enough coaxial cable to connect all the principal cities would cost an enormous sum. It is estimated that a single coaxial cable across the country, without the repeater stations, would cost $100,000,000 and take five years to complete. It would still be only an East-West link, and would provide only a few feeders for North-South zones.

Stations in the Air

The plan of carrying television relay stations high in the air by planes or blimps is ingenious but promising, and is a natural development for air-minded America. In some ways the airplane plan has advantages over the blimp plan. The planes can ascend to higher levels, and consequently can give television coverage to a greater area. The relative merits of the two have not yet been determined.

In the plan using airplanes, now under experimental development, giant planes of the heavy bomber or cargo type may be used. They will travel in lazy circles five miles or more above the earth, receive programs from ground-based stations and rebroadcast them.

It is estimated that a plane in the stratosphere 30,000 feet above the earth

Do You Know?

When *lawns* are sprayed with the 2, 4-D weed killer to destroy dandelions and plantains, it may be expected that the growth of the grass will be checked somewhat by the spraying; the check is usually only temporary, however.

Rat control requires continual attention; rats begin to breed at three or four months of age, the gestation period is about 23 days, the average litter is probably ten, and one female may have from six to ten litters a year.

An instrument for *remote measurement* of humidity at room temperatures, developed by the Army, uses two fine wire thermocouples, one of which is continuously wetted by a wick.

In the Dominican Republic, where much *coffee* is raised and used, it is considered bad luck to drink coffee while standing.

Abundant quantities of *helium,* the lightweight, noninflammable balloon gas, are now available for industrial and medical applications.

Liquid soap can be made from surplus Napalm, a gasoline thickener used in flamethrower fuel, by a process developed by the Army.

would send out short waves that would blanket the earth's surface like a giant inverted ice-cream cone covering an area over 400 miles in diameter. This is an area equal to the combined areas of New York, Pennsylvania and New Jersey.

Can Also Relay Programs

The system proposes airborne transmitters and relays. The same aircraft which broadcasts programs will serve to relay these programs to other transmitting planes. Cruising about at 30,000 feet above the earth, seven planes can provide complete New York-Los Angeles broadcasting and relaying coverage. Eight additional planes would provide coverage for nearly four-fifths of the country's population.

Relaying between the aircraft is relatively simple since the line-of-sight distance at 30,000 feet is over 400 miles. Moreover, the high altitude minimizes the effects of ground interference which troubles ground transmission.

Proposed system of airborne relays to rebroadcast programs received from ground stations must not be confused with the system, already successfully demonstrated, of airborne cameras and television equipment that take and transmit action pictures, with sound, of events as they occur on the earth below. The television images may be picked up by television receivers within range, or by relay stations for transmission and rebroadcast. With this equipment, a military staff 200 miles from the fighting front could view the battle as it progresses.

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ENGINEERING

Nuclear Energy for Ship Propulsion

➤ AN ATOMIC powered warship could travel a million miles, (back and forth across the Atlantic 160 times) on one fuel charge, Harry A. Winne, General Electric Company vice-president, declares.

Ship propulsion is likely to be the first practical power application of nuclear energy, he explained.

Since atomic power for marine propulsion could be used more freely than oil so far as weight is concerned, Mr. Winne foresees important increases in the power and speed of any class of merchant or fighting vessel.

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