

Airborne Relay for Intercontinental TV



The French Air Force radar-testing "Bretagne" bomber was specially outfitted as an intercontinental TV relay station.

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Successful French attempt links North Africa to Europe by means of single plane relay station.

THE first successful attempt at using an airborne relay for intercontinental television transmission took place last summer with Africa and Europe the continents involved. Planned and developed by *Radio Télévision Française (R.T.F.)*, this airborne relay was used twice. On July 14th, Bastille Day, programs originating in Algiers were relayed across the Mediterranean to France and telecast over the entire French television system, which covers roughly 80 percent of the country.

On September 4th, General de Gaulle's historic speech inaugurating the Fifth Republic was telecast throughout France and relayed across the sea to the North African television transmitters.

A single plane was used for both transmissions, the waves thus crossing the Mediterranean in two jumps. The first attempt will be described in some detail since both operations were practically identical. The feat becomes all the more remarkable when it is realized that the decision to relay the first program was taken on July 8th—just six days before the actual telecast. Only the video signal was transmitted via the airborne relay system to be described.

The Links

A special transmitter, radiating towards the plane, was set up in Bouzareua. It received the signal through two microwave links, one coming from the control center in Algiers and the other one from the Cap Matifou TV transmitter. Two links were used to insure continuity of the program in case of a failure in one of the microwave systems. Actually, no failure occurred.

The special transmitter had a peak power of 500 watts and used an antenna with a gain of 18 db. The antenna was oriented 15 degrees east of true north. The frequency was 173.4 mc. and the polarization horizontal.

This transmitted signal was received by the plane flying in circles of 12-mile radius at an altitude of 20,000 feet. The flight was made within a carefully chosen zone, east of the Balearic Islands. In the plane the signal was demodulated, amplified, and used to modulate a 500-watt transmitter which operated on 212.85 mc. and whose antenna was oriented toward France.

No automatic device could be relied upon to correctly orient the two antennas aboard the plane so two engineers, with the help of the gyro compass, continuously monitored and oriented the receiving and transmitting antennas. In

France, again for precautionary reasons, two receiving stations had been installed—one near Marseille and the other in the Black Mountain range. This latter installation was the one actually used. Both receiving stations were linked by microwave to one of the TV transmitters of the national chain. The link used covered 120 miles in a single jump to feed the 200 kw. transmitter covering the southwestern portion of France. From there the program was distributed throughout the country over the permanent microwave-coaxial system that links the thirty-odd transmitters comprising the national network.

The Audio Signals

As mentioned previously, only the video portion of the transmission was relayed over the airborne link. To avoid unnecessary risks and to eliminate over-elaboration of the



The engineer is orienting one of the directional antennas installed on the plane. Receiving equipment is at the right.

equipment which had to be carried by the plane, the sound was transmitted over an entirely different route. The audio portion was sent through the trans-Mediterranean submarine telephone cable, then through post office telephone links to Paris—from which point it was distributed over the television chain.

It is the custom in France to telecast on a nationwide basis only such programs as would be of national interest. However, there is a permanent system, called "Eurovision," linking together the national chains of practically all Western European countries. This means that programs of

international interest could be telecast from England to Austria and from Norway to Italy at the flick of a switch. For example, the recent coronation of Pope John XXIII was transmitted from the Vatican via "Eurovision." Jet planes were used to carry both kinescope and video tape recordings of the ritual to the U. S. for early televiewing.

The French Air Force cooperated in these intercontinental TV transmissions by lending a "Bretagne" bomber, equipped for flight test of radar units, for the project. It had available a 27½-volt, 7 kw. d.c. power supply plus a rotary converter which provided 5 kilowatts of 50-cycle, 117-volt a.c. Because of weight limitations a 500-watt transmitter was considered to be the largest that could be handled.

The receiver was a high quality commercial model, modified to pass only 7 mc. instead of the 10.5 mc. of the 819-line French picture. The small loss of detail was compensated



Two 4-element retractable yagis were used beneath the fuselage.

by an improved signal-to-noise ratio. At 20,000 feet every signal within the frequency range came in loud and clear—radar, beacons, marine traffic, FM and TV stations from Italy and Spain, etc. The reception was considered proof of the advantage of reduced bandwidth in this application.

The video output of the receiver was visually controlled and fed to a sync signal re-generator which reshaped the line and frame sync signals. This completely re-generated signal was then fed to the 500-watt transmitter.

The transmitting and receiving antennas were simple 4-element yagis, connected to coaxial feeders through a bazooka circuit for good impedance matching. They were supported by retractable masts which could be extended to 8 feet below the fuselage after take-off.

The phone link on 77 mc. took care of intercom requirements between engineers on board the plane and in Africa.

The intense field, generated by the transmitter, permeated the entire plane and degraded the accuracy of the navigational equipment aboard. In addition, the engineers found it a full-time job keeping the transmitting antenna in line with the land-based receiving station. For this and other reasons, the signal received in France varied over very wide limits and a sync re-generator had to be brought into operation at the receiving sites. Although the reception was of somewhat varying quality, on the average it was about on a par with "Eurovision" programs originating in countries with 405- or 625-line systems.

These original results were bettered in the September telecast in which the direction of the program transmission was reversed. Previous experience with the airborne relay was of great help and, as a result, the picture quality, as received in North Africa, was decidedly improved ranging from fair to good.

All-in-all it can be said that the experiments were successful—demonstrating to engineers and the public alike the feasibility of such transmissions. These trials now take their place alongside a number of E.T.F. "firsts" which include direct transmissions from submarines, from deep sea diving bells, from caves, coal mines, helicopters, jet test planes, racing cars, etc. Perhaps the day of trans-oceanic TV is not as distant as we thought!

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Map at the right shows how signals originating in North Africa were relayed by a high-flying plane to France. Link was also used for signals originating in France and destined for Africa.

