



Communications News

MOBILE AND MICROWAVE RADIO

VOLUME 1, NUMBER 1

CAMDEN, N. J.

WINTER, 1952



**MOBILE
COMMUNICATIONS EQUIPMENT
INSURES UNINTERRUPTED
SERVICE**

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MOBILE AND MICROWAVE RADIO

Vol. I, No. 1

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Communications News

MOBILE AND MICROWAVE RADIO

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RCA-Victor Division

EDITORIAL VIEWPOINT

New Frontiers

SINCE the early years of the century when wireless was proving to be a useful means of communication with ships and distant lands, there have been ever widening fields and increasing demands for radio. Shortly after World War I the United States took steps to forestall foreign domination of wireless, leading to formation of Radio Corporation of America. Under RCA leadership world-wide radio circuits were built and national broadcasting was established, making America the center of radio communications. RCA research has brought such developments as sound movies, the electron microscope, television, and microwave. It will be our policy to provide news of pioneering developments that promote effective use of mobile and microwave radio.

Industry on the whole has not awakened to the full advantages to be achieved through use of these new tools. When the Federal Communications Commission issued revised regulations in 1949, use of two-way radio was authorized for various types of land vehicles engaged in commerce, industry, and science. Substantial savings were realized in the time required to contact men in vehicles and privately operated mobile radio systems began to spread. At the same time microwave networks built by RCA were proving to be more reliable than wirelines for transmission of telegraph and teletype messages and telephone conversations. Impulses transmitted by RCA microwave are being employed for automatic control of distant operations—controlling equipment, reading meters, and exercising complete remote supervision. These unique developments forecast the dawn of a new era for industry and public service agencies. COMMUNICATIONS NEWS will lead the way in demonstrating how mobile and microwave radio can be effectively utilized in our modern economy.

RCA MOBILE AND MICROWAVE RADIO TERMINOLOGY

"Carfone" is RCA mobile radio equipment designed for 152-174 mc operation.

"Fleetfone" is RCA mobile radio equipment designed for 30-50 mc operation.

RCA 960 mc Microwave radio equipment is designed for "Short-Haul" application.

RCA 2000 mc Microwave radio equipment is designed for "Long-Haul" application.

Uninterrupted Service

Brazos River Cooperative Cuts "Out" Time 90 Per Cent By Use of Mobile Radio

WHEN lightning, icing conditions or some other freak of weather tears wires down, an electric utility works at furious speed to restore service to the disabled area. Minutes are priceless when trying to get in touch with the nearest repair crew and when endeavoring to dispatch needed material to repair the trouble. *Immediate communication* is vital.

From his years of experience, Milton Sturdivant (See Fig. 1), Superintendent of Construction, Maintenance and Operation, reports: "Two-way radio saves 90 per cent of the time formerly required to handle emergencies and outages. Using it, the crew is on the job almost as fast as it formerly took us to reach a phone. Previously, distances of ten miles or more had to be covered back to the station before a crew could go on the emergency repair job.

"Routine jobs are also done faster. We can call line patrolmen immediately without waiting until they call in at the end of the day. At a moment's notice we can shift men where needed."

Chief dispatcher R. J. Sayger (See Fig. 2) has this to say about two-way radio:

Operations Superintendent calls office from his car



Chief Dispatcher relays call to Substation Foreman

"It's our principal form of communication. All our stations and substations are located at isolated points where nothing else would work. To us, radio is indispensable. We couldn't function without it."

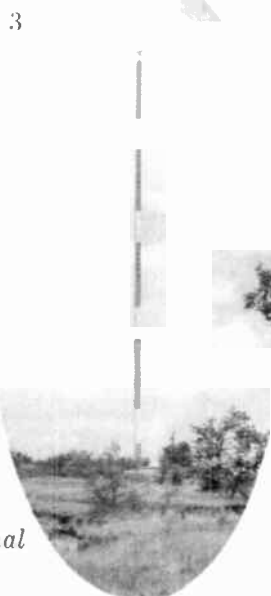
Substation foreman L. E. Perry (See Fig. 5), who uses radio in pick-up and work trucks, states:

"I used to spend all my time running up and down the line finding out what each crew was doing. Now, I can talk to all of them directly from my truck. With radio, I can coordinate two or three crews on construction of substations.

"Our business is out in the woods—not near phones or wire lines—and without communication we are lost.

"My men feel safer with radio, they know that if an accident happens help can be gotten at once."

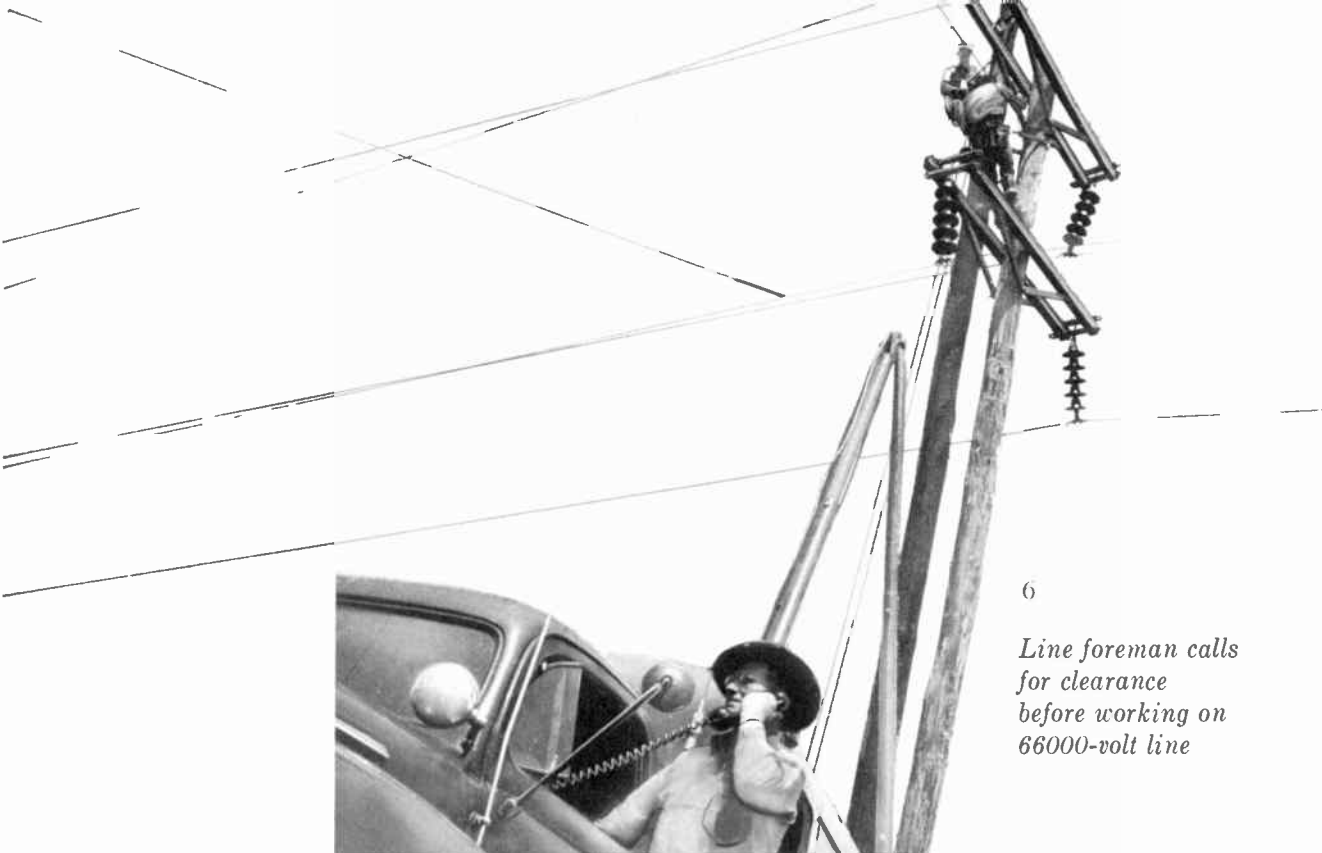
Substation Foreman receives Superintendent's message while out in the woods



260-foot transmission tower radiates radio signal



250-watt RCA transmitter employed for radio communication



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*Line foreman calls
for clearance
before working on
66000-volt line*

Line foreman Ira Carr and his maintenance crew trudged back to their mired "hot-stick" truck. Despite the difficulty of having to carry tools and material more than a mile down a muddy road, they had rapidly repaired the storm-damaged transmission lines. Now, they were ready for notifying the load dispatcher to switch power on in the line. But how to contact him? The nearest phone was miles away and there they were—stuck in the mud. Ira finally remarked, "may as well start walking."

"That day it took us hours to do what we now do in minutes with radio," Ira said when relating the story of this untoward incident. "However, we did have some good luck that day," Ira added, "because, just when it seemed that we had to walk to the nearest phone, who should happen to come along but a farmer driving a tractor. He pulled us out in no time at all and soon after we reached a phone and got in touch with the dispatcher." Summing it up, Ira concluded, "It took us all of four hours to do what we now do in ten minutes."

"Radio often saves a man's life, especially when a line goes out—because then, according to the rules, a circuit is automatically restored in five minutes, however with radio if he needs more time, a man can always get it.

"When a truck breaks down, the office knows almost immediately, and within a few minutes, help is on the way. Once a battery went dead in our 'hot-stick' truck, leaving me stranded out in the woods with a crew of men miles from nowhere. Although I couldn't get the truck started, I was able to go on the air long enough to be heard at the office. Soon, a new battery came along and we were ready to move.

"Another time one of our trucks dropped into a ditch and when the driver radioed for help, we asked him where he was. He replied, 'Just around the corner from the mail box.' That meant he was definitely lost and the only way we could find his location was to tell him to go back to the mailbox for the name!"

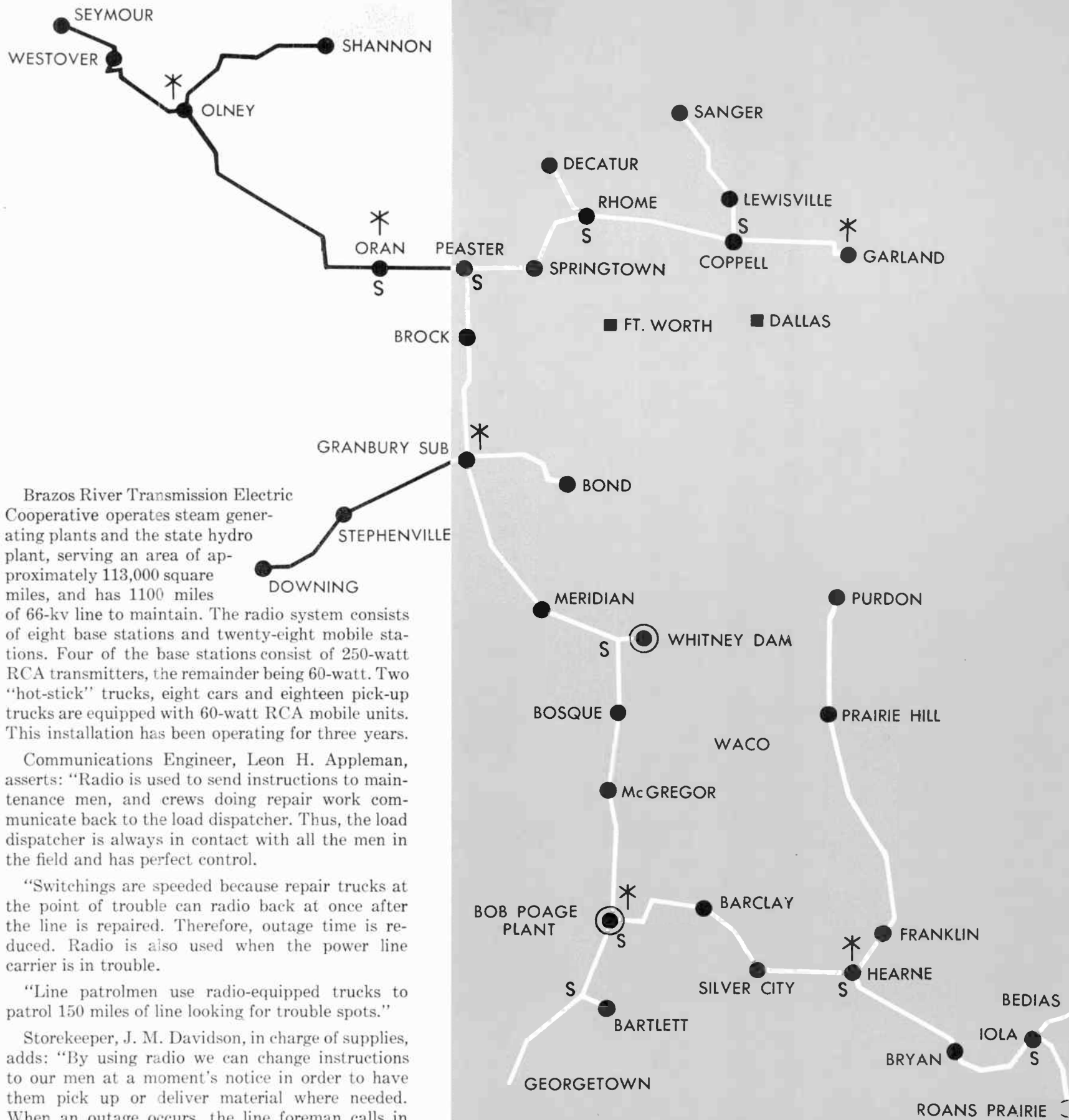


*Line patrol-
man's wife
relays messages
to and from
office*

*Substation Foreman
coordinates work of
several crews*



8



LEGEND:

- SUBSTATIONS
- S SWITCHING STATIONS
- GENERATING STATIONS
- TRANSMISSION LINES—66 K.V.
- * TWO-WAY RADIO STATIONS

Map of Brazos River System

TRAFICO Y TRANSPORTE, S.A., radio-equipped trucks, first in Latin America, are now familiar sights to the residents of Havana and throughout the entire Republic of Cuba, according to Meade Brunet, Vice President of RCA and Managing Director of the RCA International Division.

Cuba's million-and-a-half-dollar-a-year express trucking firm has completed the first installations of mobile radio "Fleetfone" units in eight of its trucks. An additional eight units are due for installation in the near future and eventual plans call for installation in nearly all of the company's 125 trucks.

"This project," Mr. Brunet states, "speeds vital transport necessary to the everyday economy of Cuba, and serves the republic's growing progress."

Amador Odio, President of the firm, founded the business more than twenty years ago, and with progressive planning and expert management has guided his firm to first place in its field. More than four

CA-1A non-directional VHF antenna was installed at the main office building atop a 100-foot mast. The antenna is cut for a frequency of 40.020 megacycles.

The transmitter in the main office, along with the control equipment, is operated by a dispatcher from her regular desk. No extra help was required, no extra equipment added. The transmitter fits in a corner less than three feet square, and operates without disturbing office workers or arrangement.

According to Sr. Odio: "Benefits resulting from the equipment installation were immediately apparent. Business efficiency rose, time lost due to telephoning for instructions was eliminated entirely, service was speeded, and customers amazed by the prompt pick-ups made possible by the inter-connecting radio between truck and main office. Most important, the firm now is in a position to service more customers; business is increasing rapidly."

Trafico drivers are as enthusiastic about the

6 CUBAN EXPRESS FIRM PIONEERS IN RADIO DISPATCHING

hundred fifty employees are on the company's payroll, plus 55 agents operating over the republic.

Trafico, as the organization is popularly known, is the first company transport to place mobile radio equipment in service in Latin America.

President Odio originated the idea—an indication of the type of aggressive executive planning that has made his firm so successful. Aware of the fact that time was being lost by drivers stopping to telephone for further instructions, he turned to RCA mobile radio equipment for the solution to his problem.

A call to the firm of Humara y Lastra, RCA Distributors for Cuba, brought a service engineer who discussed the situation with Sr. Odio. A mobile radio network was conceived that eventually will connect each of the company's trucks, wherever they may be in Cuba, to the firm's headquarters in Havana.

It was decided to install a "Fleetfone" 250-watt fixed station transmitter in the main office, which will be the key station of the network. Fleetfone mobile units were picked for the vehicles. An RCA

Mobile Radio as are the customers and company officers. To quote one such: "With the radio in my truck I save time and trouble. I no longer worry about finding parking space in crowded sections of town in order to telephone the office. What is more, I do not have to work overtime since the radio helps me do my job faster."

In addition to increased efficiency, Sr. Odio feels the advertising value of the installation is an outstanding feature of the equipment. The company letterhead carries reference to the radio, company advertising features it, all radio-equipped trucks carry the RCA monogram with the "Equipado con Radio" slogan emblazoned on their panels.

Trafico is convinced that its mobile radio is doing an impressive sales job for the company. It is too early yet to state its actual dollars and cents value, but President Odio is certain that when the final tabulation is recorded, his decision to equip his vehicles with radio will prove to be one of his most profitable investments.

***Announces Increased Efficiency,
Service, and Profits . . .***



Amador Odio, President of Trafico Y Transporte, inspects radio-equipped truck. At left is Antonio Zamorano, Service Engineer for Humara Y Lastra, RCA Distributors for Cuba



"Trafico Calling Truck 3!" Dispatcher can talk directly to trucks on the street



"Truck 3 Reporting" Trafico's express drivers contact the home office between pick-ups

"Fleetfone" radio transmitter occupies corner of office





Operator of dragline has two-way radio in cab to communicate with office

INDUSTRY FINDS A NEW TOOL

Whether your business is mining, warehousing, or water supply, here's a new way to up production and cut costs

*Better Communications for Open Pits**

MOBILE radio units are installed in trucks, tower cars, locomotives, and shovels to expedite open-cut mining operations. Foremen keep in touch with each other, learn of changes, and plan their moves on the spot. Transportation difficulties are thus ironed out. Maintenance crews are called to the scene of a breakdown promptly. Repair parts and tools are speeded to the job. In general, the installation of radio has helped reduce delays and made operation smoother. Savings resulting from increased production probably exceed those made in actual maintenance cost. Together they make it possible for a radio system to pay for itself very shortly.

The extent of coverage of two-way radio depends upon the terrain and location of transmitters. Generally, it covers the entire pit area plus all the dump area and many outlying points such as nearby towns, garages and office locations. The main or base station may be situated either at the pit or at the office.

*ENGINEERING AND MINING JOURNAL, Volume 151, No. 4, and Volume 152, No. 5.

Expedites Materials Handling

Radio control is "the most important materials-handling concept since the unit-load principle," according to James R. Bright, Editor of *Modern Materials Handling*.

"Dispatch orders, schedules, hand signals, buzzers, loud-speakers, and signal lights are adequate for certain situations, but each has drawbacks. With the exception of the loud-speaker, all are limited to getting the attention of the operator. None give him specific instructions. The best answer to this problem is a device that would:

- reach the operator instantly,
- enable detailed instructions to be given,
- allow two-way exchange of information, and
- not disturb other workers.

These characteristics describe a two-way radio communication system. Mobile radio offers a practical, efficient solution for dispatching, controlling, and directing the activities of materials handling equipment."



"Carfone" radio antenna is only 18 inches long but gives coverage of more than 300 square miles



Semi-portable "Carfone" on Fork Lift keeps operator in touch with dispatcher

*Regulates Rolling Equipment**

It's pretty hard to keep close watch on a string of locomotives, trucks or other rolling equipment working in a sprawling yard area. It's hard, that is, unless the mobile equipment is equipped with two-way radio.

For some large companies the total yard area includes over one hundred miles of railroad track. Trying to trace one particular locomotive to give its engineer orders would be quite a time-consuming job. With radio it can be done in a matter of seconds.

When decisions have to be made on the spot, radio is used to get in touch with the responsible person. Backtracking is a thing of the past when using immediate communication. Delays are avoided and handling proceeds at a rapid rate.

Stops Water Waste

You can never tell about water mains. For years they serve silently and faithfully with practically no maintenance, then without warning "old faithful" rips out and a problem is on your hands. Maybe the construction gang makes a slight error and, presto, a geyser erupts skyward. Sometimes, to add to the confusion, several mains let go at about the same time. In any case, you need a score of men in a tremendous hurry to shut off the big valves and stop the waste of water. Fast communication is needed to speed your men to the job.

A 10-inch main can lose more than 7000 gallons per minute, depending upon pressure, when completely ripped out. Usually, two men are needed for each of the numerous valves that have to be shut off. Locating the valves and getting the men to the valves often requires considerable time. On the other hand, if not shut off without delay, millions of gallons will be lost. Regardless of where your men may be, or what they may be doing, with radio communication, you can get in touch with them to dispatch them to the scene of trouble *immediately*. Maintenance men, material, and management can all be coordinated instantly with this modern means of communication.

*FLOW, August, 1951.

*Superintendent of Water
Works radios report
directly from his
car to headquarters*



9



Edgar P. Grim, Elec. Bureau Chief (left), shows
West Philadelphia radio control to city officials

World's Best Fire Radio Adds to City Protection

By JOHN M. McCULLOUGH

Philadelphia's Bureau of Fire now has the finest two-way radio communications system possessed by any city in the world.

As a result of installation of the system, which was completed on Feb. 14, every piece of apparatus in the department is now potentially in active service 24 hours a day.

The practical effect of the system installed at the modest cost of less than \$87,500 (as compared to New York's \$1,000,000) is that the fire department can now communicate with any fire engine in the city at any time.

Suspect Nabbed Purse Thief

Master control at City Hall.
Entire system can be
controlled from this console or
one at West Philadelphia

Billy Penn is Wired for Sound

REPORTERS covering the inauguration of Philadelphia's recently installed Fire Department radio system were impressed by the antenna atop the statue of William Penn. The write-up appearing in the Associated Press read, "William Penn Gets Modern Headgear"—and went on to say, "there's a feather in the hat that crowns the statue of William Penn atop Philadelphia's City Hall." The United Press reported, "William Penn Statue Is Wired for Sound . . . electronic science has turned Philadelphia's famed statue of William Penn into a 'fire-fighter' . . ." The story by the International News Service was headed, "Statue Helps Fire Fighters," and began, "William Penn has joined the ranks of the nation's radio broadcasters . . ." In contrast, the Philadelphia *Inquirer* took a more practical view, reporting "World's Best Fire Radio Adds to City's Protection."

The Mayor declared the new two-way radio system to be, "the finest fire alarm communications system in the United States. Not only will it further improve the present efficient operation of the Fire Bureau in normal times, but in the event of an enemy attack of any kind, this system will prove invaluable in dispatching fire equipment to the scene of disaster."

Philadelphia's new communication system had but a week to wait for a first-class test of its effectiveness in a city-wide emergency. Eight days after dedication ceremonies, the radio system was called upon to coordinate efforts to cope with a violent squall and driving rain storm which poured one-and-one-fifth inches of rain and hail on the city within a few minutes with gusts of wind ranging up to 82 miles an hour, leaving death and widespread



Station transmitters located in West Philadelphia. F. Schierff, at left, points out features to E. P. Grim, center, Bureau Chief, and Captain C. W. News

destruction in its wake. The Director of Public Safety declared that the system had virtually amortized itself in that one day by saving life and property. Edgar P. Grim, Chief of the Electrical Bureau, asserted "More emergency calls were serviced during the storm than in any like period of time in the years I have been associated with the Bureau."

The comprehensive Fire Bureau communication network places radio equipment on the city's fire apparatus for the first time. At least one radio transmitter and receiver is installed in every fire station in the city and is in direct contact with Station KGB-476, headquarters of the system, which is located in the Electrical Bureau at City Hall.

A duplicate communications headquarters is located in a newly constructed radio building in West Philadelphia approximately four miles from the heart of the city. In addition to serving as the auxiliary radio station, the new building also serves as the repair and maintenance headquarters for the city's motorized communications equipment. Duplicate master control facilities at this station and at City Hall make it possible to control the police and fire transmitters from either location by means of special remote-control switching equipment. Either station can be used to dispatch the city's motorized police and fire-fighting equipment and as a control center for civil defense and general emergencies. Either one of the two stations is always in contact with 150 Carfone radio units installed in fire engines, pumpers, fire boats, fire chiefs' cars and police and other mobile emergency units.

The new two-way radio communications system, according to the Director of Public Safety, is likely to become the city's most effective means of communications in case of an enemy attack of any kind, contributing to the safety of nearly three million persons living within metropolitan Philadelphia.

Pumper truck, one of 150 radio-equipped mobile units. Close-up shows RCA "Carfone"



Radio-equipped ambulance gets to emergencies faster



PUBLIC SERVANT

12



Pumper can request additional apparatus immediately

ALL police and fire departments of consequence employ two-way communication for their cars and apparatus. Small towns and volunteer fire companies take pride in having at their disposal this effective means of community service. Many are cooperating with each other to tie their radio systems into one comprehensive network. This serves for trapping criminals as they flee from one town to another and for fighting large fires through pooling of apparatus. Furthermore, such a network is one of the essential steps for effective civil defense.

Halts Crime in the Making

A story is told by one police department that illustrates just exactly what immediate communication can do. On a hot summer evening while airing herself by the open window of an upper-floor apartment, a woman was attracted by the actions of two men at a nearby pier on the water front. Although but mildly interested at first, it soon developed that the movements of the pair were suspicious. The information was phoned to the police, relayed by radio to



Ladder truck can be turned back when responding to false alarm



Firehouse is always in touch with all apparatus



All over the nation police and fire departments step up community service with the use of 2-way radio

NUMBER ONE

the nearest patrol car and within a few minutes the woman, from her window, saw the pair apprehended. In this case, an alert citizen plus radio resulted in preventing the looting of a pier warehouse.

Speeds Fire Apparatus Where Needed

"Experience has taught that fire has greater potential of damage to industry, human life, and property than any other hazard subject to physical control," reports Carl Gray of the Superior American Fire Alarm and Signal Company, in a paper presented before the IMSA. "The history of most of our large fires in recent years proves conclusively that lack of communication facilities was a contributing factor to the sacrifice of life, the painful price of injury, plus tremendous property damage.

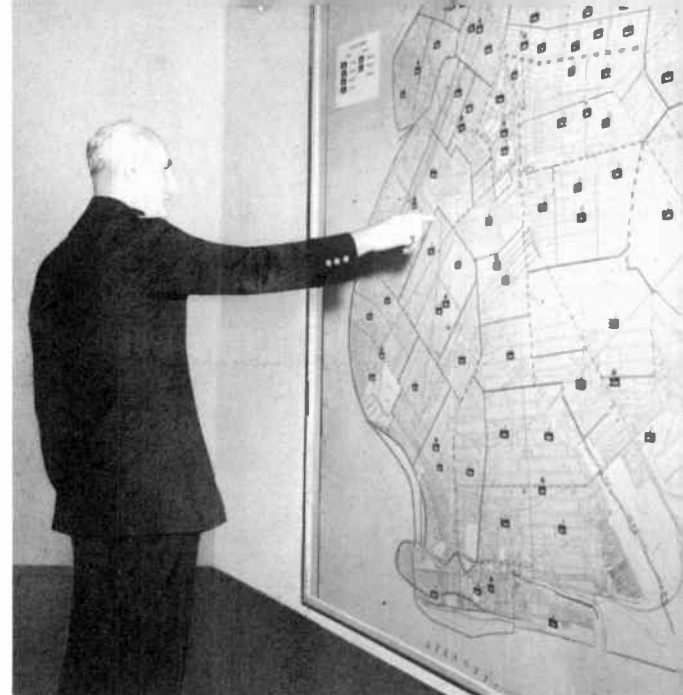
"Fire alarm boxes enable a citizen to notify headquarters so that fire apparatus is rapidly dispatched to the scene of the fire. Without radio, however, apparatus is lost just as soon as it leaves the firehouse.

"Much valuable time is often lost because it is

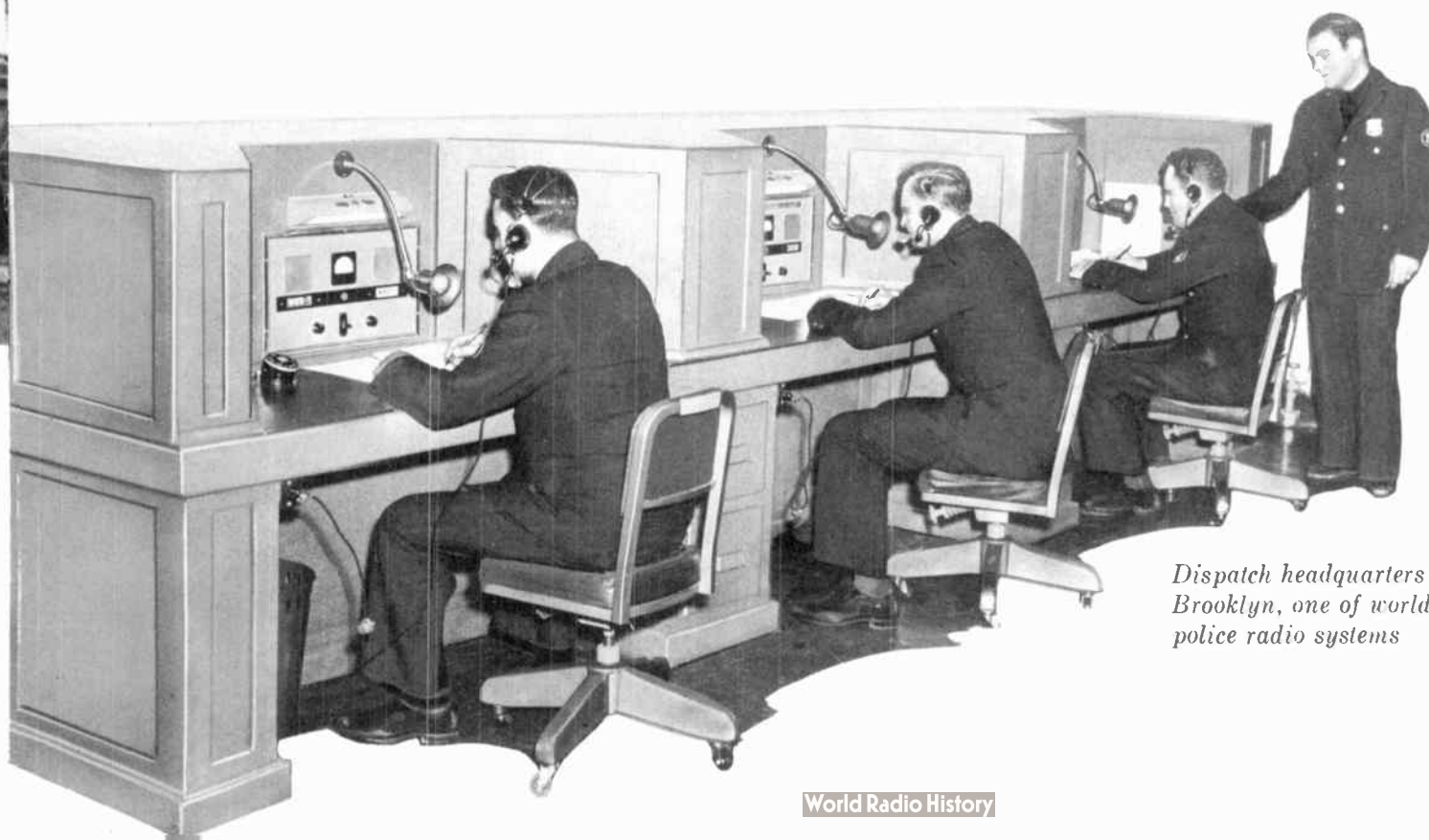
impossible to contact apparatus traveling to incorrect locations. In some of the larger cities it is not unusual to have more than one fire alarm box pulled for the same fire. If the apparatus is equipped with radio, it can be redirected quickly to the exact location. Also, in case of a false alarm the radio dispatcher can contact apparatus so the full run is not made, leaving the district exposed.

"A recent survey shows very few towns have adequate installation of fire alarm boxes for proper protection. In some instances it is necessary for a fireman to travel a half-mile or more to reach the nearest fire alarm box in order to request additional apparatus. When in radio contact with the control office, no time is lost.

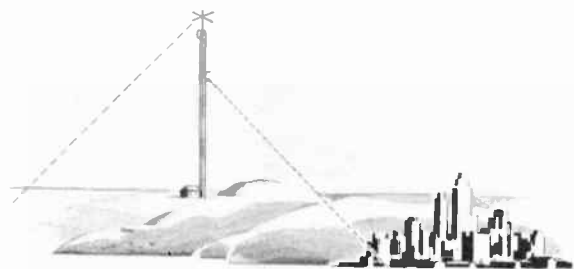
"If we do a real selling job, I believe we can prove to the citizens of our towns that we can save time, thousands of dollars as well as many lives if they back up their police and fire department officials and provide them with the latest equipment which they recommend."



Inspector Burns, in charge of communication for New York City Police, shows map of Brooklyn radio network



Dispatch headquarters at Brooklyn, one of world's largest police radio systems



T. A. McAmis, Executive Secretary, seated, and Gladman Upchurch, Chief Radio Engineer, relay report of illegal deer kill



OPEN SEASON ON POACHERS

Long arm of the law reaches deep into the woods

14 “RECENTLY,” reported T. A. McAmis, Executive Secretary of the Arkansas Game and Fish Commission, “we received word that some hunters were out at Faulkner Lake, near Little Rock, shooting ducks after the hour set by federal regulations. Our radio system made it possible to dispatch four wardens to the area within fifteen minutes and they were successful in apprehending fourteen men, all of whom were caught and convicted of violating federal code.”

During the height of the hunting season, radio-equipped patrol boats and airplanes are now used to close in on game violators. Radio has become a strong psychological deterrent for off-season hunters, teaching them to maintain a healthy respect for the law. But radio in the hands of game wardens is an important tool for more reasons than trapping game violators. It is vital for the welfare of hunters who are injured and need immediate medical attention. Aid can be summoned quickly and an ambulance dispatched to the nearest highway to rush the injured hunter to a hospital.

“Radio helps us report floods and fires faster,

reach hunters in distress, drive game violations to an all-time low.” Thus, T. A. McAmis describes the role of radio communications in the Arkansas installation, the largest to be established by any game and fish commission in the United States.

Gladman Upchurch, Chief Radio Engineer for the Commission, supervised the installation of the radio system. It was engineered in such a way that radio signals now blanket the entire State by six powerful station transmitters. Headquarters and master control for the state-wide system are in the State Capitol in Little Rock. The base station for the radio headquarters, located about fifteen air miles from the State Capitol on Chenault Mountain, is operated by remote control. By installing a 250-watt transmitter atop Chenault Mountain, 1300 feet high, Upchurch was able to achieve extensive coverage of the center of the state. How to get signals from the master control center in Little Rock to the mountain-top transmitter presented a difficult problem. After a thorough survey was completed, Upchurch decided that a microwave system would provide the least



Radio-equipped patrol fleet ready for action.

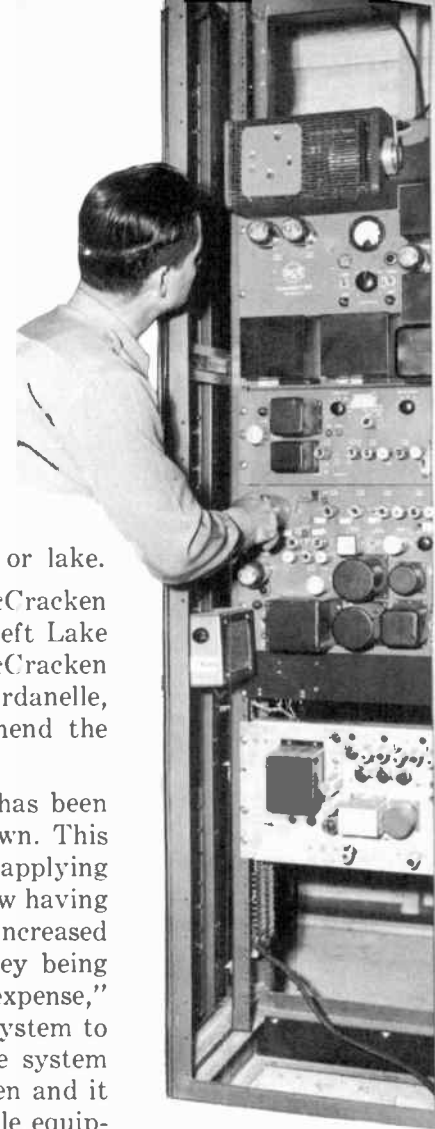
Warden out on patrol acknowledges radio call from his car





*Mobile "Fleetfone" unit
mounted in jeep truck*

*Gladman Upchurch checks
operation of station radio
equipment*



expensive and most effective method. By using microwave equipment instead of wire lines, approximately twenty-five miles of costly pole line construction were eliminated at a saving of about \$36,500. It eliminated the need for pole line maintenance, another costly item for the type of terrain it would have to traverse.

The Chenault Mountain transmitter is the hub of the system with five other 250-watt radio stations installed at equally spaced radii around the State. They are located at Magazine Mountain, Mt. View, Forest City, Star City, and Hope.

Fleetfone radios are installed in over 175 mobile units—in everything from passenger cars, jeeps, station wagons and trucks, to boats and airplanes. Dual frequency radio operation makes it possible to carry on car-to-car and car-to-station communications, greatly adding to the flexibility of the system. This makes it possible for a game warden to put through a general alarm or contact the wardens in his area for assistance in apprehending game violators who are beyond his physical reach

such as on the opposite bank of a river or lake.

A typical example: Supervisor Herman McCracken of Ozone was advised that a poacher had left Lake Nimrod with an illegal catch of fish. McCracken radioed ahead to Warden Campbell in Dardanelle, who was then alerted and able to apprehend the violator.

The fact that the long arm of the law has been extended by radio has become widely known. This makes itself evident by the flood of people applying for new licenses and the number of those now having their old licenses renewed. "Add to this increased revenue from licenses the amount of money being saved because of decreased operating expense," reports Secretary McAmis, "I expect the system to pay for itself, perhaps within a year. The system more than doubles the efficiency of our men and it will materially prolong the life of our mobile equipment. Most important of all is the fact that we are better able to serve the public, to keep our forests safer from fire and disease and to rush medical assistance to injured hunters and fishermen."

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Wardens speed to illegal kill



BIG AND LITTLE...TAXI OPERATIONS



Radio center contacts Yellow Cabs over 79-square-mile area. Handles up to 200 calls an hour

Yellow Cab repair truck is radio-equipped for fast dispatching from job to job



"THE primary mission of a taxicab company," according to Robert Freedman, President of the Baltimore Yellow Cab Company, "is to make every effort to provide faster and better service. The public appreciates service and it pays off in the end."

Mr. Freedman, a progressive, efficient businessman, is one of the leading figures in America's taxicab business. He pioneered with the use of two-way radio back in 1946,—very early he developed a technique for handling heavy telephone traffic. His system has handled as many as 600 two-way radio transmissions an hour. On the average, however, 195 calls an hour are completed during peak operation and 2800 calls are taken care of each day. "This," he feels, "is a record to be proud of and perhaps unmatched anywhere." Since installing radio, phone orders have mounted from 146,000 to 1,015,000 a year, representing a 595 per cent increase.

When two-way radio was first introduced in the cab fleet, many drivers looked at it with distrust "because the boss has a constant check on you." Now, they consider radio their best friend. They know that radio actually means a double chance at business either from pick-up or by radio call. They like radio, too, because it guarantees more income. The driver looks forward to \$15 a week more when he drives a radio-equipped cab. This amounts to approximately 22 per cent of his income. Drivers also find that while gratuities on calls completed with non-radio-equipped cabs are ten to fifteen cents, in calls answered by radio, the customers are so pleased with the prompt service that tips average twenty-five cents.

With radio in his cab, the driver is not afraid of being stranded because of engine trouble. He feels safer, not quite so fearful of being held up. There has been only one holdup of a radio cab since 1946. Mr. Freedman sums it all up this way: "Radio helps us provide better service. It also means that we are able to provide a maximum of service with a minimum of rolling stock."

"Phone orders increased our business 595% . . . all due to 2-way radio," says President Robert Freedman of Yellow Cab Company, Baltimore.



DRIVERS TURN TO TWO-WAY

TWO-WAY radio can do just as much for small taxi fleets as it can for large ones, according to James Camillone, owner of Vet's Cab Company. Operating three cabs, Jim enthusiastically exclaims. "Radio is the handiest thing a cab man can have. For me it's equivalent to having twice as many cabs."

Conneaut is a small city of about 15,000 population in northeast Ohio, bordering on Lake Erie. The terrain is generally level with no particularly bothersome radio obstructions. Jim's radio covers an area of approximately three hundred square miles.

Since he installed radio two years ago, Jim has been able to give his customers much better service. "I have handled as many as 112 calls in eight hours with two cabs," he states. "Before I had radio, it would have taken at least three cabs."

Customers like Jim's new, speedy service. Customer acceptance has steadily increased business to the point where gross revenue has increased 30 per cent. Take-home pay for drivers has gone up 15 per cent. Dead mileage and cruising have decreased, bringing substantial savings in gas and oil consumption.

Jim uses a 15-watt AC Carfone for his base station. It's compact and semi-portable, weighing only 44 pounds, and is easily carried from one location to another by hand. RCA 15-watt mobile units are installed behind the spare tire in the cabs, leaving the full capacity of the trunk available for baggage. The radio is easily reached for servicing.

No novice to the taxi business, Jim spent twelve years driving a cab before the war. During the war he served for three years in the U. S. Navy on troop ships, freighters, and landing craft in the Pacific theater of operations. On his return he started a taxi business in Girard, Pa.; after two years, longed to return to his home town. Because of competition, it took Jim 14 months to get his license. But once he had it, he went to work. He has since bought out his competitor.

*"My gross revenue
increased 30 per cent!
2-Way Radio cuts fuel costs . . .
gives customers better service."*



*James Camillone, owner of
Vet's Cab Co., Conneaut, Ohio*



"Carfone" mobile radio fits easily behind the spare tire

*Dispatcher uses portable "Carfone"
to communicate with cab driver*



MICROWAVE—MODERN MIRACLE OF COMMUNICATIONS AND CONTROL

Initial investment and maintenance costs are usually less than those required for a wireline system offering comparable facilities. Microwave is not subject to the physical limitations of wire, poles, and insulation, nor to the high cost of right-of-way and of traversing difficult terrain. Audio quality is at least equal to and usually better than anything offered by wire lines.

Microwave may be used for point-to-point communication or for remote control by Power Utilities, Water Systems, Pipelines, Railroads, Mining, Fishing, and Lumbering interests. Turnpike Authorities, Police Departments, Forestry Services, Fish and Game Commissions, and other government agencies having need for long-distance communications can employ Microwave.

Microwave functions reliably during bad weather. Storms that tear down wire lines cause excellent Microwave propagation conditions. Air turbulence actually improves Microwave performance. In wintry

weather it is not affected adversely since ice can't form on a radio beam. Excesses of temperature, dust and sandstorms likewise provide conditions in which Microwave excels in giving reliable performance.

A single RCA Microwave circuit affords as many facilities as a 24-channel wire-line system. These 24 channels may be used for phone communication or for control purposes. Each of the 24-voice channels may be subdivided into as many as 18 signal circuits; these may be utilized for telemetering, remote operation, supervisory and load control. Each voice channel may be subdivided into at least 8 teletype channels.

Microwaves resemble light waves in many respects. They may be focused in a narrow beam in the same manner as light is focused by a searchlight. In practice, the Microwave signal is beamed from one point to another by means of parabolic reflectors, which act as transmitting and receiving antenna. Like light, Microwaves travel in a straight line, and to

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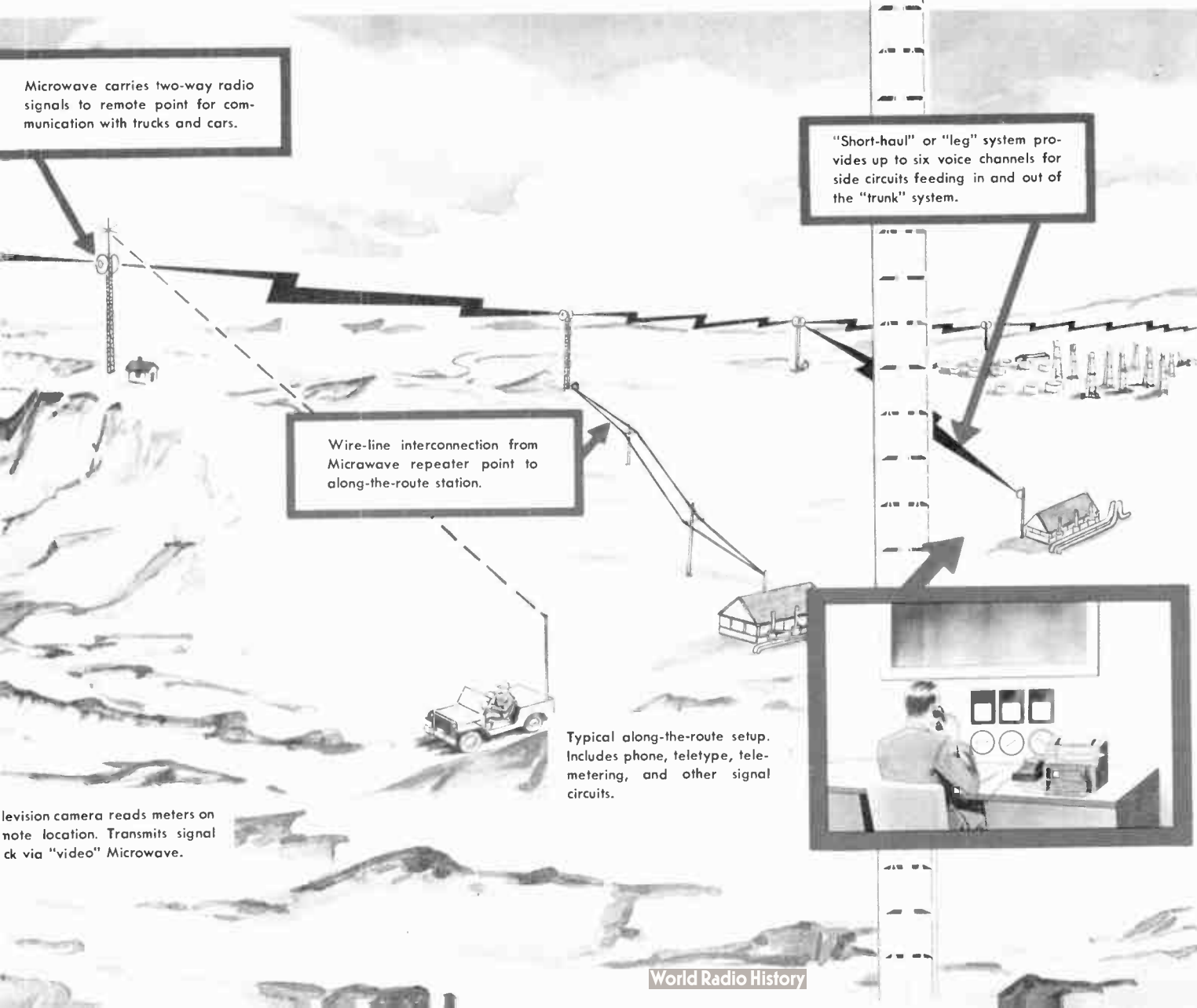


**Voice communication, telemetering, teletype, supervisory control,
and automatic operation**

cover distances of hundreds or thousands of miles, the signal is beamed from one repeater station to another along a predetermined path.

Repeater stations are usually located on high ground and are spaced up to fifty miles apart, as terrain and other conditions dictate. They are often located near an office or remote location where it is desired to have a phone or to make use of some of the various facilities offered by Microwave. Repeater stations operate automatically, functioning satisfactorily with relatively minor maintenance.

By means of Microwave, any function that can be converted to an electrical impulse such as pressure, temperature, engine speed, etc., can be transmitted from various places to a central location where recorders will give instantaneous indication of the various functions. Equipment in operation at unattended stations may be started, stopped, and regulated by means of impulses transmitted by Microwave.



CALAPCO STORY Operating Experiences of Supervisor

by T. A. Phillips, Chief Engineer and W. T. Quinsler, Jr.
Engineer, Central Arizona Light and Power Company



THERE are a great many facts that must be considered when a company selects equipment for supervisory control and telemetering. One of the biggest questions is whether to use carrier equipment or microwave radio to transmit indication and control pulses between the supervisory units.

Function and Location of Equipment

Telemetering and supervisory control were found necessary at this Company's Steam Electric Generating Station for satisfactory operation of a 69 kv transmission oil switch connecting the Central system to the Northern system; and in addition, four 69 kv feeder switches at a Western Division Substation. These two key stations requiring control are called Bell Switch Substation and Litchfield Substation, respectively (see Figure 1).

Selection of Equipment

After quite a complete investigation of the material alternatives and their respective economic considerations the rather interesting conclusion was reached that it would be considerably cheaper to install microwave. A carrier installation including labor would have cost somewhere near \$25,800 whereas the microwave radio equipment including labor cost about \$15,900, a difference of some \$10,000.†

This economic factor weighed heavily in the Company's decision to install microwave radio, but lower cost was not felt to be the only asset. Very good characteristics from the standpoint of noise and distortion; ability to combine relay station sites with VHF for use with fixed-to-mobile communications; channel reliability; relative ease of maintenance; availability of wide spectrum to support expansion; and reasonable freedom from interference are some of the experienced advantages of microwave radio.

†It should be brought out, however, that the results of our particular case are more the exception than the rule when comparing original costs of single channel installations.

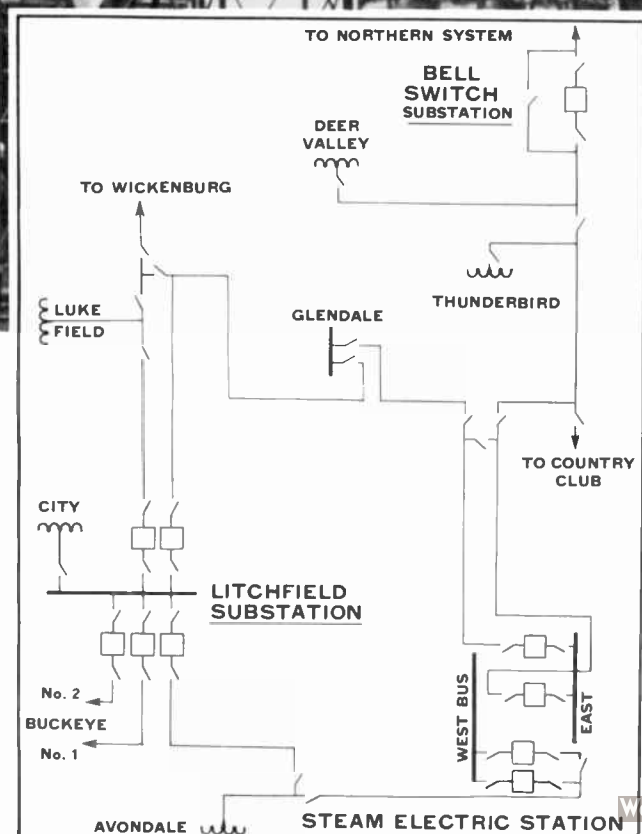


Fig. 1—One line diagram of a portion of Calapco 69 KV System.

Control and Telemetering

Fig. 3—Antenna arrangement on the roof of Steam Electric Generating Plant showing parabolic reflector placement to facilitate parallel signal paths.



Over a 960 Megacycle Link*

*Abstracted from paper prepared for the AIEE Pacific General Meeting, Portland, Oregon, August 20-23, 1951.

Installation

A twelve mile line of communications between Litchfield Substation and the Steam Electric Station forms an approximate right angle with the sixteen mile link between Bell Switch and the Steam Electric Station (see Fig. 2).

Simultaneous 956.75 megacycle signals can be received from both Litchfield and Bell Switch transmitters at the Steam Electric Station and by use of a coaxial type antenna relay a single three-watt output transmitter at 953.25 megacycles is switched from one 42" parabolic reflecting antenna aimed at Litchfield to a similar antenna aligned on Bell Switch.¹

The supervisory control and telemetering equipment employ four tone frequencies of 210, 310, 350 and 390 cycles, which are imposed on the microwave radio carrier signal (phase modulated) and transmitted in their proper sequence and time interval to the respective substations. The microwave receiver then demodulates, amplifies and channels these tone combinations into the supervisory and telemetering consoles which in turn energize relay combinations to perform the switching and telemetering functions.

Operation indications are set up by relay combinations in the supervisory equipment and tone signals of 3500 and 4500 cycles from Litchfield with

¹"Microwave Proves Dependable in Action," by T. A. Phillips, Electrical World, December 18, 1950, Vol. 134, Number 25, Page 87.

4000 and 5000 from Bell Switch are imposed on their respective microwave transmitter carrier signals and relayed back to the receiver at the Steam Electric Station to be demodulated, amplified and fed into the supervisory console, which in turn indicates to the dispatcher in the form of an alarm and/or designated light that his operating request has been completed, or in the case of a relayed breaker, that there has been an unrequested operation.

Transmitter—Through first an exciter unit and then the link-coupled transmitter proper, the crystal frequency is multiplied 972 times before output.²

Receiver—The receiver units are double super-heterodyne phase modulated and have available three different audio characteristics. Position "A"—Flat where distortion is approximately 0.15% and frequency response is good to 30 KC facilitating excellent multichannel service. Position "B"—For single channel service approximately 20 decibels more gain may be had with an accompanying 1% distortion and frequency response to only 3 KC.^{2,3} Position "C"—Will compensate for noise in the normal "studio to transmitter link" range of 3 KC to 15 KC, but will give relatively poor response to frequencies above and below this range.

Antenna Arrangement—Each switching station has a sending antenna and a receiving antenna mounted one above the other on the same pole approximately 69 feet and 75 feet respectively above the ground level. Both sending and receiving antennas are of the 42 inch parabolic reflector type. All four antennas at the common end of the two links are mounted in one group on the roof of the Steam Electric Generat-

²940-960 Megacycle Communication Relay Equipment Type CWT/R-5A Engineering Products Department RCA-Victor Division, Camden, New Jersey, U.S.A.

³"Video Handbook," Morton G. Scheraga & Joseph J. Roche, Wm. F. Boyce, Publisher. Section 3, Paragraph 117, Pages 272-274.



Fig. 4—Closeup of parabolic reflector antenna showing the polarization of the dipoles (top set vertical and bottom set horizontal). Note also the reflector dipoles at the outermost end of the focal support.

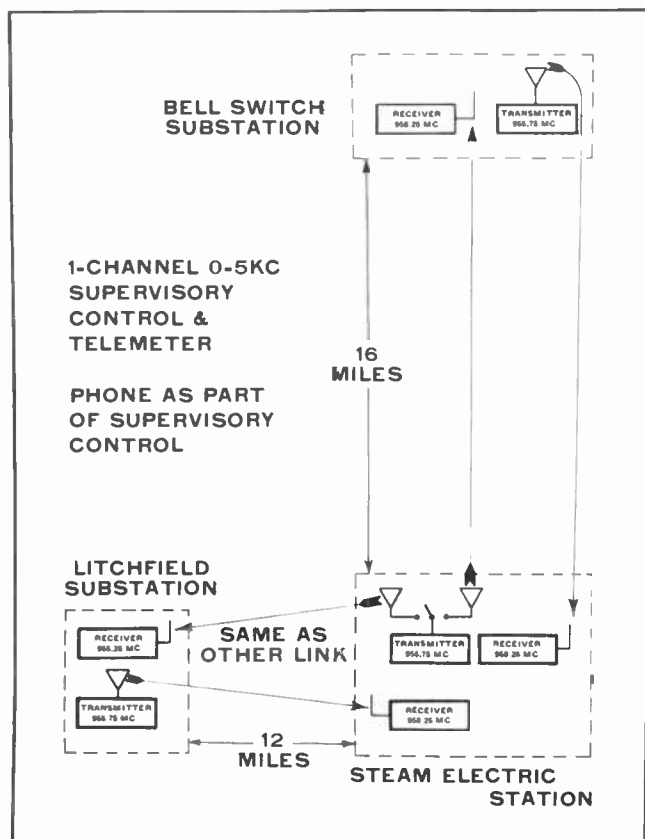


Fig. 2—Schematic diagram of Calapco Microwave 960-MC Links.

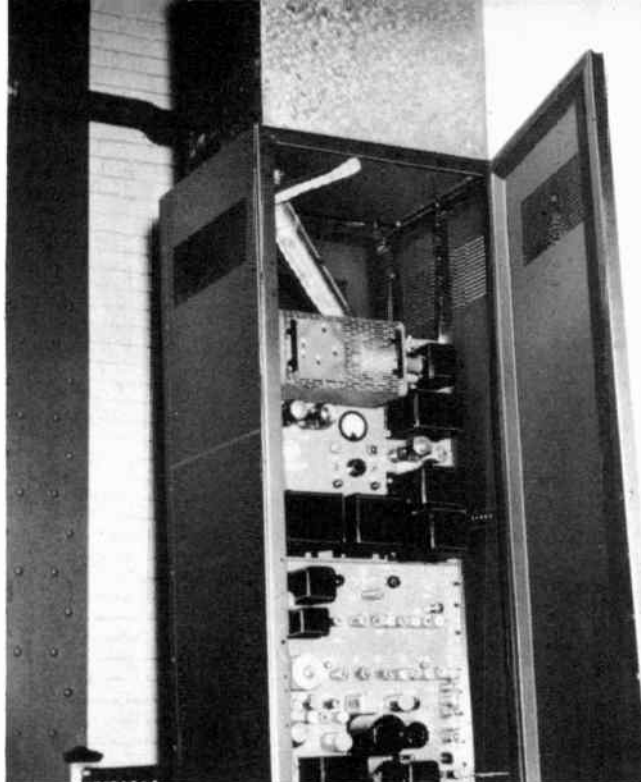


Fig. 6—View of Microwave equipment at Steam Electric Generating Plant showing auxiliary cooling at top. (Temporary setup).

ing Station (see Fig. 3). Both transmitting antennas on one mast are slightly higher than both receiving antennas on an adjoining projection so the arriving and departing signals will travel in parallel paths.^{4,5}

Polarization—In each link one set of antennas (sending and receiving at opposite ends of the link) has been horizontally polarized, the other vertically polarized to reduce feedback or interaction between the transmitter and receiver at each location (see Fig. 4). Note in Fig. 4 the vertical position of the top pair of quarter wave transmitting dipoles and the horizontal position of the lower receiving dipoles at the focal point of the parabolic reflectors.^{6,7}

Operation

The installations at Litchfield Substation and at the Steam Electric Station have both been installed some 15,330 hours to date. The former station has been out of service a total of 96 hours, giving a per cent outage of 0.626 per cent and the latter station has been out of service a total of 34½ hours, giving

“Field Testing a Microwave Channel for Voice Communication, Relaying Telemetry and Supervisory Control,” by D. R. Pattison, M. E. Regen, S. C. Leyland, and F. B. Gunter. A paper written for presentation at the 1950 Pacific General Meeting, Pasadena, California.

“Propagation of Short Radio Waves Over Desert Terrain,” by J. P. Day and L. G. Trolese. Proceedings of IRE, Vol. 38, No. 2, February 1950, Pages 165–175.

“Notes on Antennas”—Ronald W. P. King, Engineering 270 Page 126, a,b,c, Cruft Laboratory Harvard University.

“Arrays Using Reflecting Surfaces,” Paragraph 15, Chapter 20 Industrial Electronics Reference Book by Westinghouse Electric Corporation, John Wiley and Sons, Inc.

a per cent outage of 0.225 per cent. The Bell Switch installation has been in service for some 7300 hours; and in that time has been out of service a total of some 19 hours, giving a per cent outage of 0.267.

Nature and Common Causes of Trouble

Extremes in weather conditions are encountered, especially heat. Ambient temperatures of 140° are not uncommon within buildings in which equipment operates and in this range the heat is very hard on capacitors, polystyrene coil forms, and expansion and contraction tolerances of oscillating cavities. Needless to say tube lives are greatly shortened when the tubes are unable to dissipate their heat readily into surrounding air.^{10,11,12,13}

Terrific dust conditions are prevalent in desert localities, and are very damaging to relay operation as well as a cause for heating and detuning by lodging in cavity tuned circuits. Heating occurs when dust piles up on surfaces and prevents proper radiation.

Frequent violent summer storms are a source of damage from lightning and driving rain. More than

“Signal Officers Handbook,” The Signal School, Ft. Monmouth, N. J. 1 September 1948, Sec. 11, Paragraphs 13, 15, 16 and 22.

“Comparison of Measured and Calculated Microwave Signal Strengths, Phase and Index of Refraction,” A. W. Straiton, A. H. LaGrone, H. W. Smith. Proceedings of IRE Vol. 38, No. 1, Jan. 1950, Page 45–48.

“Care and Maintenance of Tubes,” by C. J. Madsen in Industrial Electronics Reference Book by Electronic Engineers of the Westinghouse Electric Corporation—John Wiley and Sons, Inc., publishers, Chapter 35, Paragraph 1 and 2, Pages 659–663.

“Fundamentals of Vacuum Tubes,” by Austin V. Eastman, McGraw-Hill Publishers, 1941 2nd Edition, II Impression Chapter IV, Pages 105–106.

“Factors Determining Industrial Tube Life,” by John F. Drgor, Jr. Electronic Industries, December 1945, Page 94.

“Rules of Prolonging Tube Life,” Hampton J. Dailey, Electronics April 1943, Pages 76–78.

Fig. 7—View of Bell Switch installation showing rigid antenna cable, dust filter and cooling unit thermostatically controlled.

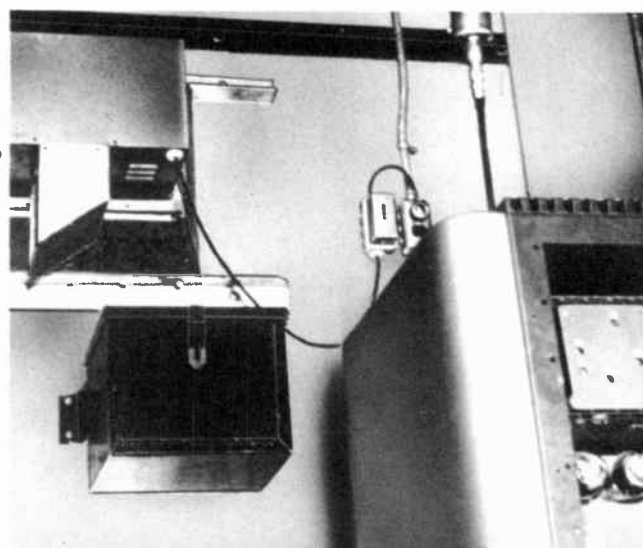


Fig. 5—View of antenna mast at Substation showing unhooded ¼-wave dipole antennas. Note metal extension on top of pole, and lightning rod.

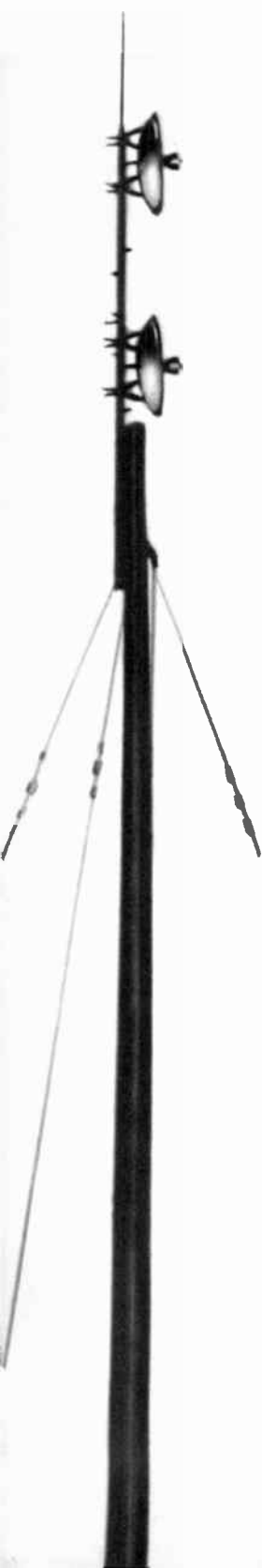




Fig. 8—View of RCA Microwave equipment showing the test switches and meter for voltage checks.

average precautions were found necessary to protect the equipment from these impediments to operation under desert conditions.

Of major importance is the trouble caused by a variety of desert insects crawling into the units and blocking cooling blower circulation or napping between sources of high potential and ground.

Corrective and Preventive Measures

Larger blower units were placed in the consoles to get greater cooling effect. In the unit located at the Steam Electric Station it was necessary to feed a source of pre-cooled air into the top of the cabinet. Dust filters combined with the cooling blower in the Bell Switch all-metal shack have reduced the trouble in relays considerably. Outages due to lightning have been cut to a minimum by installing arresters on the power supply lines, and of course, the antenna masts are topped by a ground rod. Measures were taken to seal openings and protect equipment from driving rains and insects. Due to the excessive heat it was found that a very great number of 6AQ5 tubes were failing; by replacing these tubes with the heavy duty service Model 5763, favorable results were obtained.

One preventive measure that has reduced outages considerably is the taking of voltage test readings each day by use of the built-in test switch and logging these readings for comparison trends. Roving substation attendants are responsible for this job. When a reading exceeds the tolerance assigned, a check is made to locate the point of failure (see Fig. 8).

Conclusion

This Company believes the general reliability of microwave to be very good. Our values of 0.626 per cent, 0.225 per cent and 0.267 per cent compare very favorably with an average outage figure of from 0.400–0.500 per cent for some microwave radio installations. We can expect even better results from

the equipment in the future for several reasons:

1. The improvements and experience that result from our experiment with microwave equipment will cut outages and speed service restoration;
2. The test readings, now taken daily, will afford a check on the beginning of component part failure in either the transmitter or receiver at all three installations; and
3. When copper coaxial cable will be used in lieu of some existing flexible coaxial the signal strength will increase.

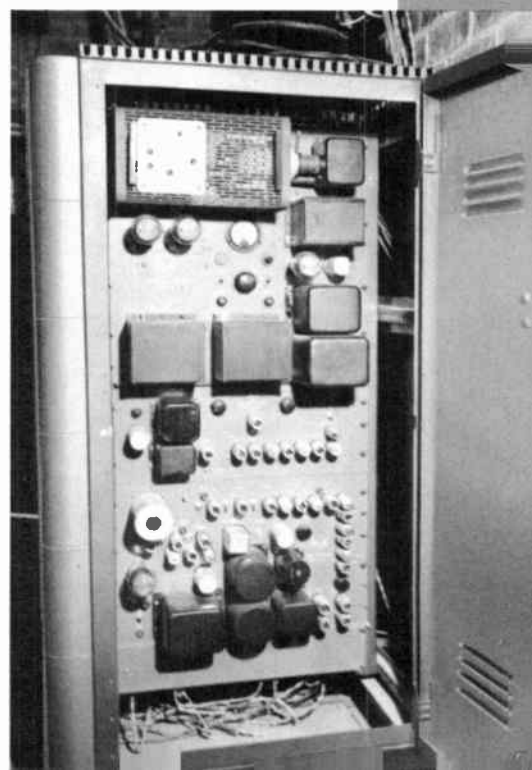
The Central Arizona Light and Power Company feels that its decision to experiment with this modern trend towards the use of microwave radio for supervisory control and telemeter indication to improve service and operation has been a practical one.

We made a careful study to determine the operational and economic advantages of the various types of equipment that would serve our need. We found for our particular case, microwave radio was theoretically the most suitable. We encountered some installation and functional difficulties, worked them out, and profited in experience by their existence. At times we were skeptical, probably because we were inexperienced and didn't understand this new tool, but now it is different. We know that our microwave system was not only theoretically the most suitable but actually and practically the most effective.

It is hoped that any companies contemplating the use of microwave radio for remote control will find some helpful pointers in this presentation and will feel free to request any additional data from us.

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Fig. 9—960-MC Microwave Equipment. Single unit construction for convenience in servicing.



Moorestown Terminal Station



SUPER COMMUNICATIONS SYSTEM PATROLS SUPER-HIGHWAY

*Mobile Radio and Microwave network
features directional VHF antennas, sensing
and lockout devices, voice and teletype circuits*

WITH the completion of its new multi-million-dollar turnpike, New Jersey may soon be better known as the Corridor State rather than the Garden State. Stretching from George Washington Bridge on the Hudson to Memorial Bridge on the Delaware, the new super-highway will provide a mile-a-minute express corridor through the State of New Jersey. Imagine, 118 miles of divided highway without a single grade crossing, no traffic lights, no bottlenecks . . . just a wide-open road through historic countryside! Indeed a motorist's dream of perfection, and a good enough reason for its being named the "finest highway in the world," by New Jersey's Governor, Alfred E. Driscoll.

"In 1949," the Governor said, "we determined to build in New Jersey the finest highway in the world, linking the interstate crossings of the Hudson River with the interstate crossings of the Delaware River for the convenience of the citizens of New Jersey and our sister states. The project was called the New Jersey Turnpike. Our Turnpike authority has substantially completed the project with incredible speed.

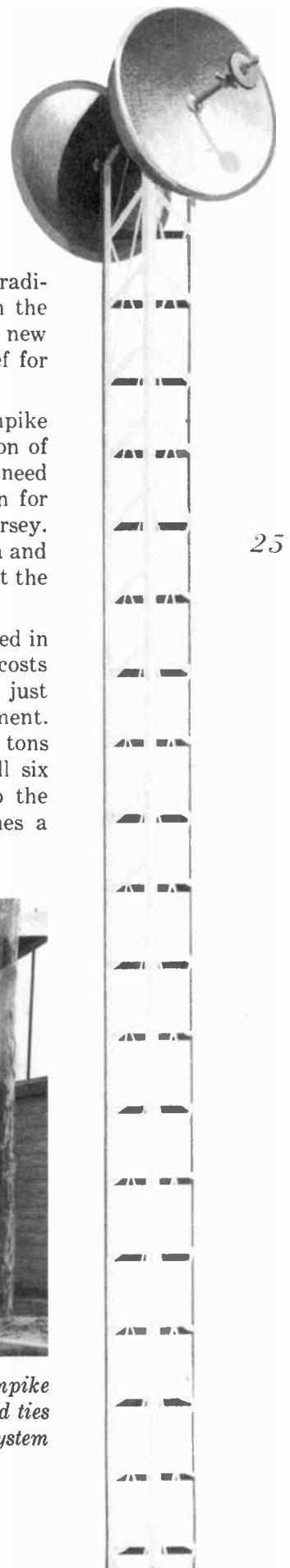
"Across New Jersey, a corridor state, has traditionally flowed the heaviest vehicular traffic in the country. The turnpike will not only provide a new facility for this traffic but will also afford relief for motorists who use our parallel highways."

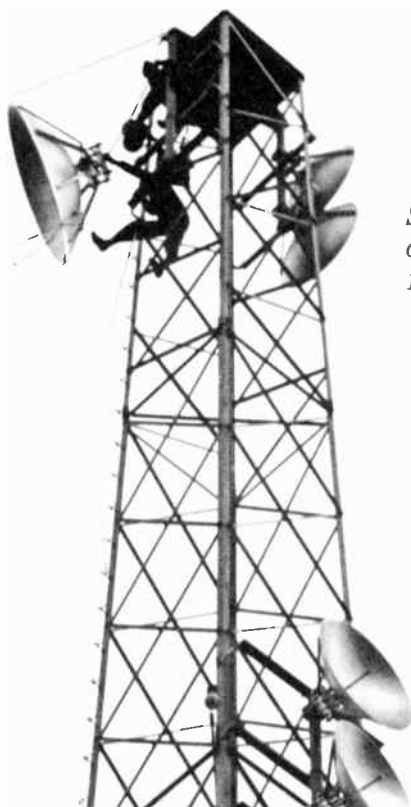
Many have hailed the completion of the turnpike as a strategic thoroughway for the transportation of troops, munitions, and matériel should that need arise. It is an important avenue of evacuation for the civilian population of New York and New Jersey. It links the ports of New York and Philadelphia and will serve many important industries throughout the State of New Jersey.

Construction of the new super-highway started in 1949, and will be completed early in 1952. It costs approximately 225 million dollars and includes just about every conceivable engineering development. The massive project consumed close to 190,000 tons of steel and enough earth was removed to fill six trainloads stretching from New York City to the Golden Gate. The total earth removed reaches a staggering amount of 51,000,000 cubic yards.



*Each tollgate on the turnpike
is radio-equipped and ties
into communications system*





Six-foot microwave "dish" antenna nears top of 150-foot Moorestown tower

Troopers' cars are radio-equipped for car-to-car and car-to-station communications



Description of New Jersey Turnpike Communication System

*by M. P. Pastel**

The turnpike includes a combined RCA microwave and two-way radio communications system. This system carries voice and teletype messages over the entire length of the turnpike, providing the most flexible and dependable means available today for controlling traffic, handling accidents, and administering road maintenance.

The microwave system operates at a frequency of 960 megacycles and takes the place of underground cables or overhead pole and wire lines which are vulnerable to various types of storms. Microwave assures a continuous flow of messages through sleet, snow, and windstorms. The microwave system includes a voice channel for monitoring the entire system, another for dial-phone administrative calls, two voice channels for communication with state police cars and maintenance trucks, and one party-line teletype. At five of the system's seven microwave

towers there are VHF radio transmitters which tie in to the microwave system and maintain contact with police cars and maintenance trucks all along the turnpike.

These radio facilities provide the Turnpike Administration at New Brunswick with a means of instant communication with all state troopers, maintenance trucks, and all tollgates along the road. The dial phones and radio-teletype, link the police divisions on the turnpike with one another and with the State Police Headquarters at Trenton.

Each police car on the turnpike is furnished with a two-way radio having two transmitting and one receiving channel, operating in the 152 to 174 megacycle band. The cars can transmit on either one of their dual frequencies while receiving on the station channel. The VHF station transmitters, located at the microwave towers, operate on frequencies reversed



*Microwave Communications, R. C. A.-Victor Division, Camden, N. J.

Road maintenance supervisor coordinates several turnpike projects with "Carfone" radio

to the transmitting frequencies of the mobile units. Hence, the normal path for a message transmitted from a car is as follows: The message is received by the nearest station and retransmitted to other local cars and tollgates; at the same time the message is also fed into the microwave system where in turn it is relayed up and down the line by microwave to the other stations for retransmission. Thus, this system provides two-way radio communication the full length of the turnpike.

A special sensing and lockout device was developed by RCA to prevent messages from being garbled. This new development selects the stronger of two or more signals from any car along the turnpike and automatically switches it to the microwave system for rebroadcasting. It also squelches the weaker signals so that they interfere in no way with the transmitted message.

If a state trooper wishes to talk directly to a nearby police car without having his message broadcast all along the turnpike, he may do so by switching

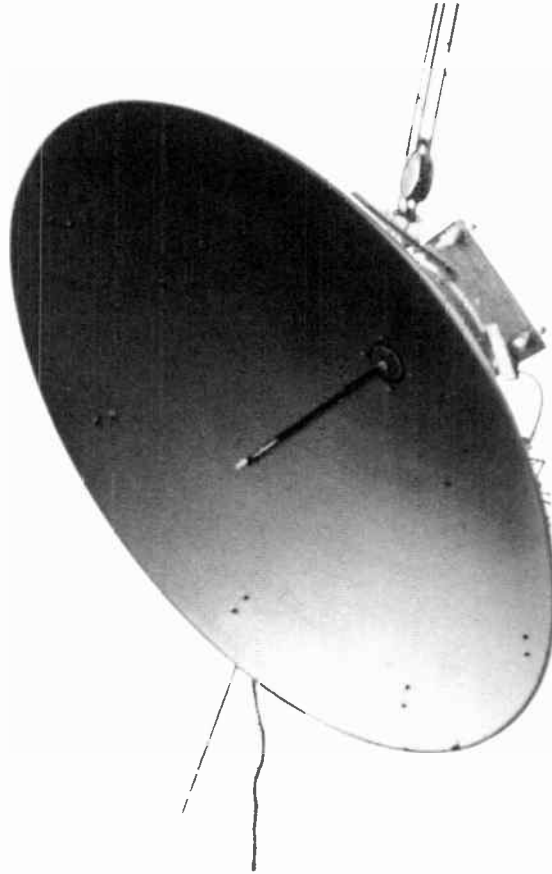
to his alternate channel. This added feature prevents local radio traffic from tying up the entire turnpike communication system. At the same time it keeps the patrol cars in contact with the system dispatcher.

Base station antennas are two-element arrays designed to have figure-eight radiation patterns, with the lobes oriented on the turnpike. This insures a strong signal on the turnpike with a minimum of possible interference to and from the adjacent communities.

This modern highway communications system was created through the joint efforts of the Paul Godley Company, which, as consultants, formulated the broad engineering requirements, and the Radio Corporation of America, which designed and manufactured the radio equipment. The system was installed by the RCA Service Company.

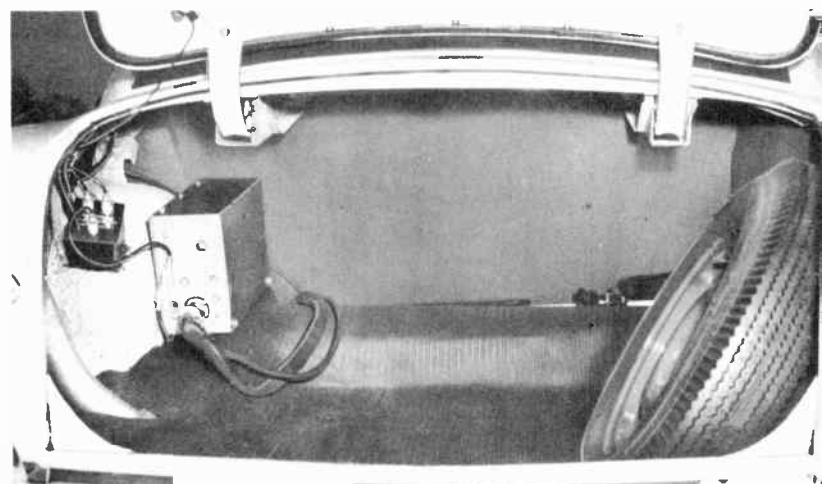
The Godley Company also developed the unique mobile VHF directional transmitting and receiving antennas which assure strong signals along the

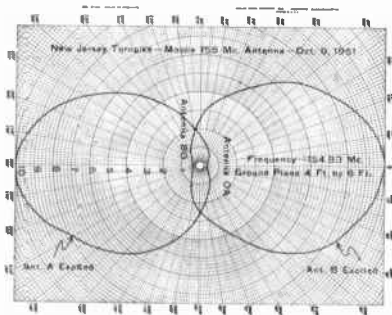
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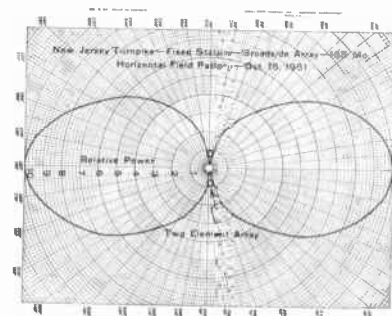
Riggers strain at tackle as huge microwave antenna and reflector go skyward

Two-frequency "Carfone" radios are installed in troopers' cars and in maintenance trucks





Directional antennas on mobile units and station towers provide effective coverage of turnpike with minimum "spill-over" into adjacent areas



highway with a minimum of "spill-over" into adjacent communities. These directional antennas also enable mobile units to choose the stronger of two signals coming from turnpike radio stations. With the flip of a switch, the operator can "focus" on either station for best reception in areas where signals overlap and would otherwise present a "hash zone" of difficult reception. (See figure at left top.)

At the turnpike headquarters a switching arrangement permits separation of the microwave radio system into two or three sections, thus increasing both flexibility and message capacity. When the microwave system is tied end to end, it is essentially one, large radio party line.

If serious traffic congestion develops in any one region, the New Brunswick headquarters can isolate that section of the communications system, leaving it free to handle its local affairs without tying up calls for the rest of the turnpike. However, headquarters is still in a position to monitor messages exchanged in the area, and can, by the flip of a switch, cut back into the over-all system when it seems advisable.

Antenna towers up to 175 feet in height have been erected in or near Swedesboro, Moorestown, Bordentown, Trenton, and New Brunswick. The base stations employ 60-watt RCA radio transmitter-receivers. Fifteen-watt radio transmitters are located at interchanges and maintenance buildings. Toll

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B. F. Wheeler and M. Pastel, RCA engineers at master control console installed at New Brunswick headquarters



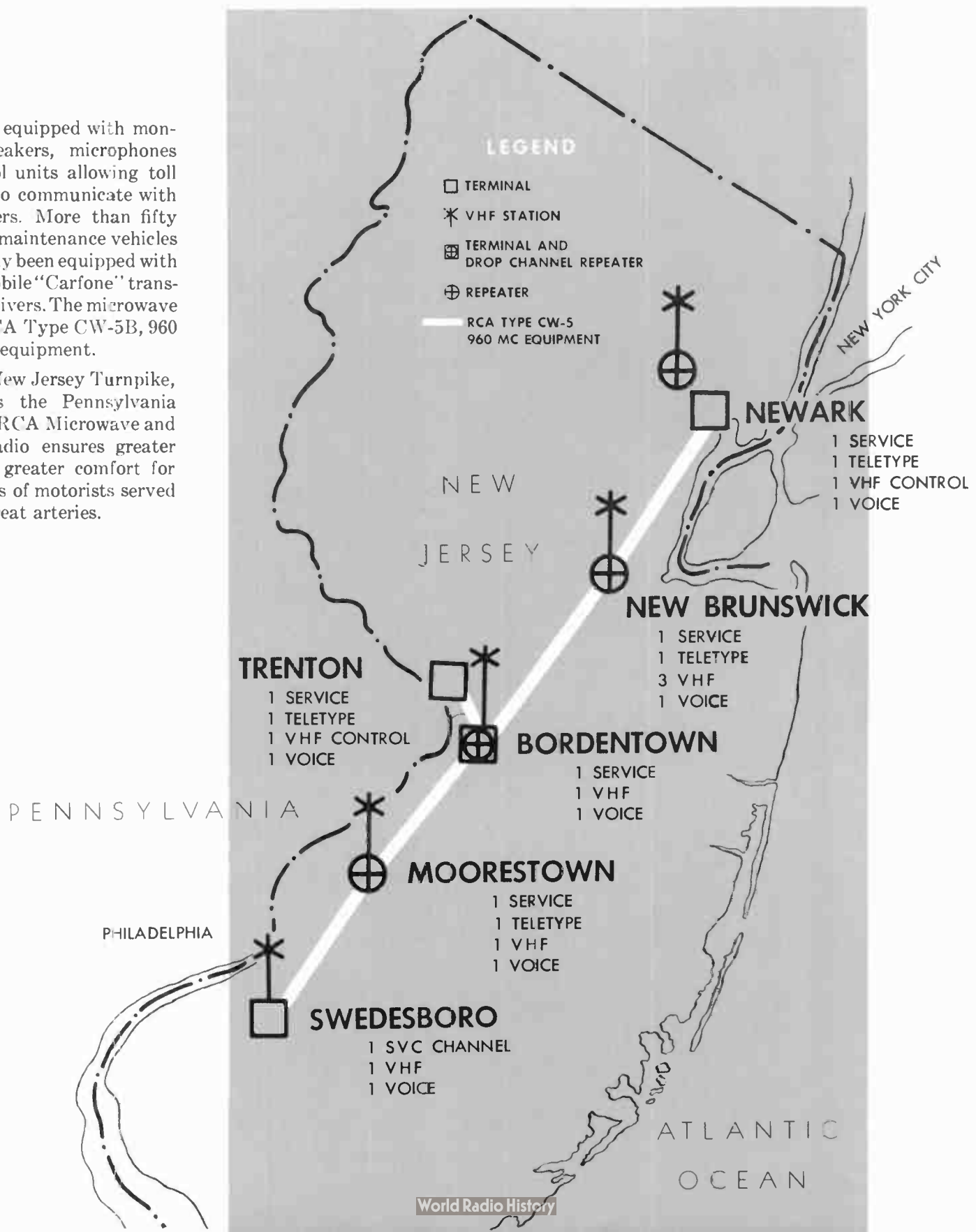
Paul Godley, Consultant for the turnpike (left), Earle Whitaker, RCA Service Company, examine "dish" reflector



Microwave radio provides end-to-end communications network along the New Jersey Turnpike

booths are equipped with monitoring speakers, microphones and control units allowing toll collectors to communicate with headquarters. More than fifty police and maintenance vehicles have already been equipped with 15-watt mobile "Carfone" transmitter-receivers. The microwave radio is RCA Type CW-5B, 960 megacycle equipment.

On the New Jersey Turnpike, as well as the Pennsylvania Turnpike, RCA Microwave and Mobile Radio ensures greater safety and greater comfort for the millions of motorists served by these great arteries.





*Front view of station console
equipped for three transmitting
and two receiving frequencies*

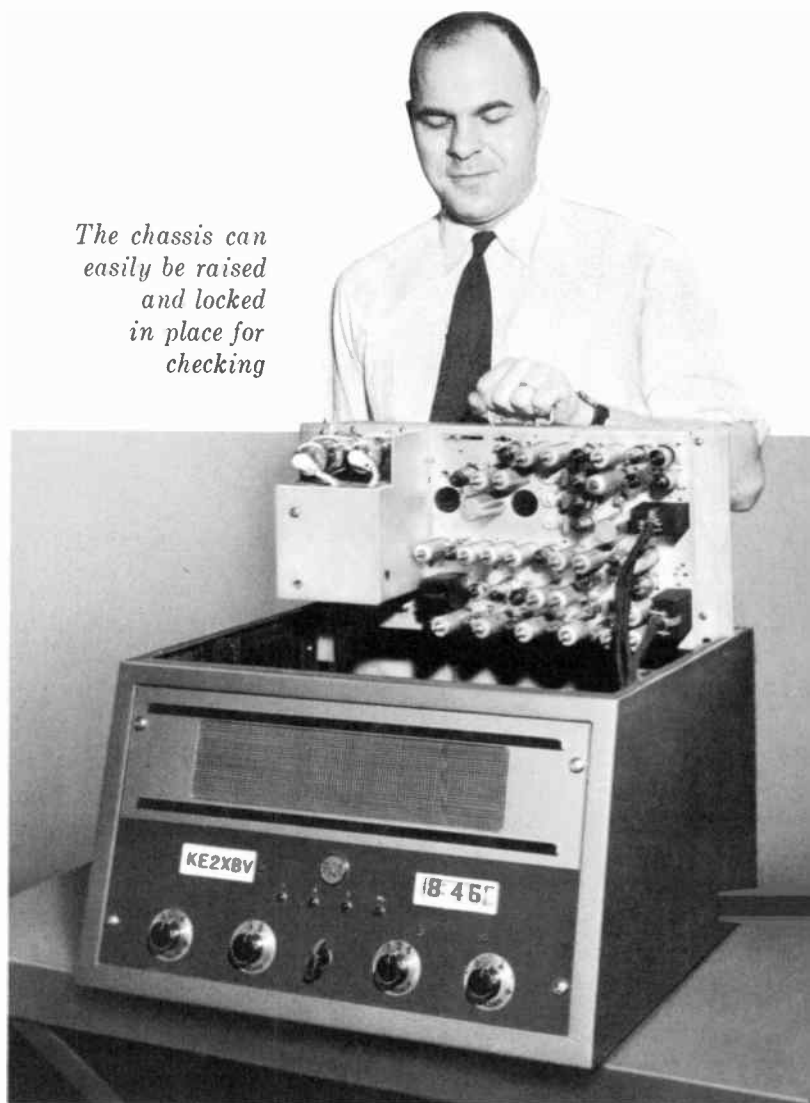
A COMPLETE two-way radio station, housed in a compact console, has been developed by RCA for desk-top operation. It simplifies installation, eliminating the need for extra floor space, and features an easy-to-get-at chassis. This station unit is applicable to such services as police, fire, trucking, public utility, and petroleum industry communications.

The new desk station combines a 60-watt transmitter, a receiver and a power supply in an attractively styled steel cabinet. Ample room in the cabinet is provided for mounting a line termination panel to permit remote operation. The sloping front panel incorporates an electric clock and the controls necessary to operate both transmitter and receiver.

The transmitter and highly selective adjacent-channel receiver are built on a single, rugged, formed-steel chassis. It is mounted in the cabinet in an upright position on tracks, and can easily be raised and locked in place for checking and tuning. The chassis can be installed in any standard 19-inch rack.

There is provision for remote control, two or three-channel transmitter operation, and dual-channel receiver operation. Self-contained or remote speakers may be employed. Dimensions are: 11⁷/₈ inches high, 22³/₄ inches wide, and 20³/₄ inches deep over-all. This "Fleetfone" desk station, Model CSF-60A, operates in the 30 to 50 megacycle band. A higher-frequency "Carfone" model for operation in the 152 to 174 megacycle band will be available shortly.

*The chassis can
easily be raised
and locked
in place for
checking*



NEW DESK-TYPE "FLEETFONE" RADIO TRANSMITTER-RECEIVER

*Designed for 30-50 MC Operation,
this 60-Watt Station is ready
for Immediate Delivery*



*All important circuits can be
serviced from front of chassis*



2-WAY RADIO FOR INDUSTRY



SPEEDY COMMUNICATION WITH ALL MEN AND EQUIPMENT

Tells in non-technical language what it is and how it works. Illustrates gas and electric utilities, pipelines, petroleum, logging, newspaper, construction, mining, materials handling, motion picture industry, business and industrial applications.



2-WAY RADIO FOR PUBLIC SAFETY



**POLICE • FIRE • FORESTRY
HIGHWAY MAINTENANCE
SPECIAL EMERGENCY**

RCA 2-WAY RADIO FOR EVERY MOBILE FLEET OPERATION

Describes municipal and state networks. Illustrates use in forestry conservation, flood control, game law enforcement, highway maintenance. Tells how it can be used by Civil Defense, physicians, veterinarians, ambulances, school buses, beach patrols and other public-safety services.

Twenty-page, 2-color brochure giving the most complete and up-to-date stories of this newest miracle tool of modern communication. Tells what it is and how it works, in non-technical language. Shows typical application by industry, government, service agencies.



2-WAY RADIO FOR THE TRANSPORTATION INDUSTRY



RCA RADIO COMMUNICATIONS FOR EVERY MOBILE FLEET OPERATION

Shows benefits of use by taxi and trucking companies, by inter-city and urban bus, and by trolley lines. Contains information on problems of applications, coverage, and obtaining an FCC permit.



These Free Booklets Give Full Details On HOW YOU CAN PROFITABLY USE RADIO COMMUNICATION



RCA Representatives are available for consultation from any of the following regional offices:

ATLANTA 3, GA.

522-533 Forsyth Building, Walnut 5946

BOSTON, MASS.

200 Berkeley Street

CAMDEN 2, N. J.

Front and Cooper Streets, Woodlawn 3-8000

CHICAGO 11, ILL.

666 N. Lake Shore Drive, Delaware 7-0700

CLEVELAND 15, OHIO

718 Keith Building, Cherry 1-3450

DALLAS 1, TEX.

1907-11 McKinney Avenue, R-1371, 1372, 1373

HOLLYWOOD 28, CAL.

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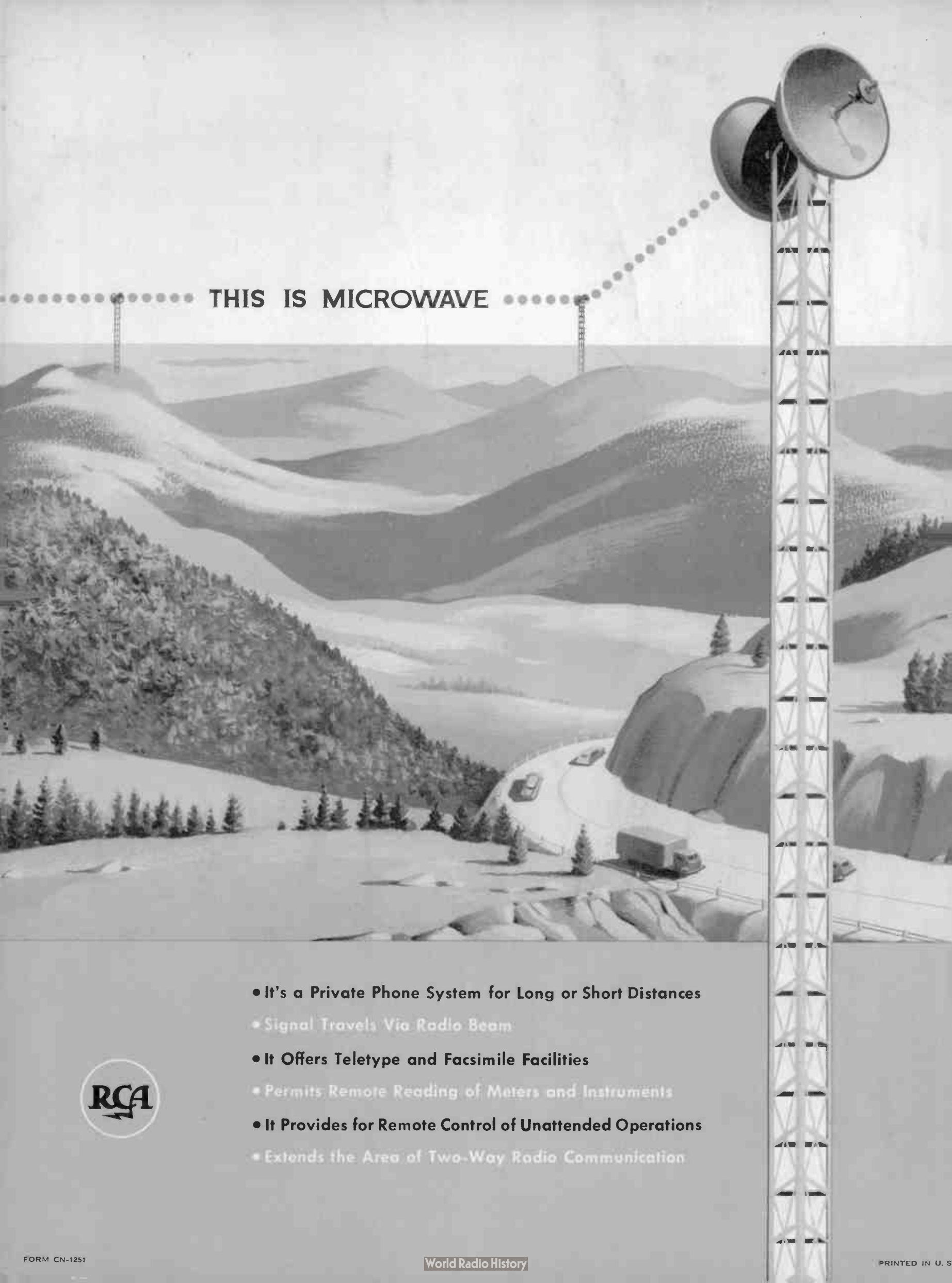
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