Two-way radio in chest harness lets crewman have hands free to work.

Individual radios carried by crewmen can aid yard work

Railroad managements are looking with renewed interest at yard radio. Heretofore it was considered sufficient to put a radio set on the locomotive. Hence, the yardmaster could keep in contact with the switch crew. But the award of Arbitration Board No. 282 providing for the elimination of firemen from freight and yard locomotives has changed operating conditions.

With only one man in the cab of a yard engine and the rest of the switch crew on the ground, there is concern that the engineer may not always be in a position to see hand or lantern signals. Poor weather, such as rain, fog, snow or haze, or even in good weather sharp curves on industrial tracks may make it difficult for the engineer to see signals from men on the ground. At some industries, for example, track curvature or close clearances along a building may put the engineer on the "blind" side where he is unable to see hand or lantern signals. In such a case one of the switch crew members would have to ride the engine.

One solution to this problem of passing signals is to provide pocket transmitter-receiver radios for the switch crew men on the ground. One railroad, the Chesapeake & Ohio has done just this at Elk yard, South Charleston, W. Va. One feature of the pocket transmitter-receiver (Motorola Universal HT series) is that it can be worn in a chest harness permitting the wearer to have his hands free to throw switches, climb on freight cars, etc. The antenna is the "dribble" type, a flexible wire that hangs down from the unit. Although the radio weighs only 37 oz, it has 1.4 watts of RF power and can work through a base station repeater to provide coverage over the entire yard.

Superintendent James M. Pitchford says the radios are expected to improve operations, cut down on loss and damage and help safety performances. "The crew will be in closer touch with each other," he explained. "The engineer and the conductor or the brakeman no longer have to communicate by hand signals."

Each train crew member can now be in immediate voice contact with every other member of the crew, including the engineer on the locomotive and even the yardmaster in the office. Four crews can use the radios in a yard at the same time without interferring with each other's communications because the radios have four separate frequencies. A man in one crew cannot speak directly to a man in another crew, but a message can be relayed through a central control unit operated by the yardmaster, who is in touch with all four crews.

Paul Flanagan, superintendent of communications, said the radios are "small (3½" x 9" x 1⅝") because they have transistors rather than conventional radio tubes. This has given us another plus. We can use the radios inside the gates of one of our South Charleston shippers, Union Carbide. We couldn't use radios with vacuum tubes because the higher voltages required for operation were not permitted in their property because of possible explosions. Gas sometimes can accumulate in pockets on the property and electrical sparking action could set off a blast. That's why we don't run our diesel-electric locomotives in there. Regular radios, you see, have higher voltage requirements and there is a greater possibility that sparking conditions might occur. The problem doesn't exist with the new radios."

The radios are recharged after eight hours on the job by placement in a charging rack for 14 to 16 hours. Similar units will be provided for crews' use at other yards soon, Mr. Flanagan said.

"There is no doubt in my mind that two-way radio is the optimum method of solving this problem of passing signals to the engineer," comments one road's communications engineer. "There is a drawback," he says, "in that you may not have enough frequencies available to equip all the crews that you would like to equip in a particular yard or industrial switching territory."

Some railroads have helped alleviate the frequency shortage by using tone

coding equipment. For example, the Elgin, Joliet & Eastern is operating radio systems in three yards on a single frequency. "The arrangement in effect gives us three separate radio systems while at the same time integrating all three yards on a single optimum channel utilization," says signal engineer W. K. Waltz.

The tone coding is achieved through the use of Motorola Private-Line radio equipment, which operates on 160.260 mc. The three yards in the system are South Chicago, Gary Mill and Whiting, Ind. Each yard has its own tone code so that a message transmitted from a base station or mobile unit is received by only the other units with the same code. The key to its operation is a subaudible tone, which is transmitted along with each message or voice transmission and "unlocks" all properly equipped receivers. Tone codes used are: South Chicago, 179.9 cps; Gary Mill, 114.8 cps; and Whiting, 91.5 cps.

One proponent for tone coding advocates fairly wide geographical separation between the separate systems. It has been suggested to make use of corner reflectors or other types of directional antennas to reduce or eliminate overlapping from the various base stations for each system.

Tone coding has been successfully used to remotely control a switching locomotive. If a locomotive can be remotely controlled via VHF radio, it should be relatively simple to light indicator lamps in the cab to instruct the engineer concerning engine movements. Switch crew members on the ground would carry portable VHF transmitters with pushbuttons or toggles for initiating action to transmit the various tone codes.

One proposed system would use a cab indicator panel with two vertical rows of lamps. One row of lamps would indicate a request for movement in the forward direction, the other in the reverse direction. Lamps, or their coverglasses, would be amber for Slow, Medium, Normal and Accelerate. A nameplate would identify each lamp. Accelerate would be used when "kicking" cars into a track. Stop indication would be displayed by a red lamp or coverglass. The man on the ground would carry a portable transmitter with a toggle for forward and reverse, and pushbuttons for each speed range desired. Loss of tones or carrier would automatically cause the red lamp to be lighted.

An advantage of the cab signal indicator system is that transmission of tones to light indication lamps would require a 0.1 sec or less. Thus, there would be less time "on the air" for a crew compared to a system using two-way voice transmission. No doubt several crews could use a single VHF frequency if they were equipped with this type of cab indicator system. It should be pointed out, however, that there is not as complete an information exchange as is possible with full two-way radio operation.

Related to the fireman-off situation is the size of crews in branch line and yard operations. Arbitration Board No. 282 set up guidelines for special boards of adjustment in making their decisions concerning crew consists. Guidelines (g), (j) and (k) are pertinent to this discussion:

"(g) Physical characteristics of the line to be traversed and in the areas where switching or industrial work is to be performed (including grade and general climatic conditions).

"(j) Availability and use of communication equipment (such as, but not limited to, end-to-end train radio, train to wayside radio and walkie-talkies).

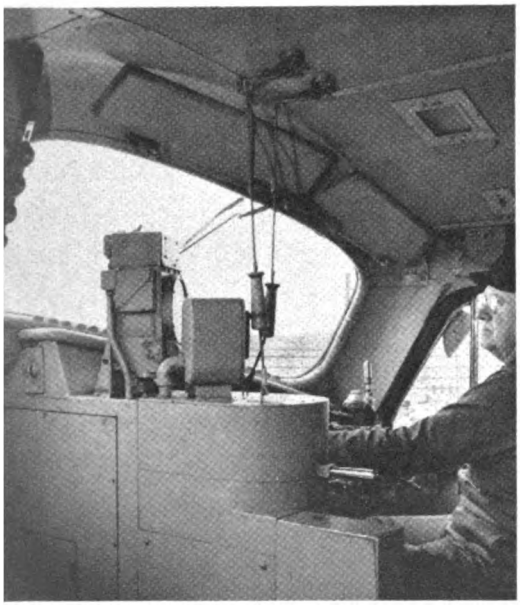
"(k) The presence or absence of a fireman in the engine service crew."

IMPORTANCE OF RADIO

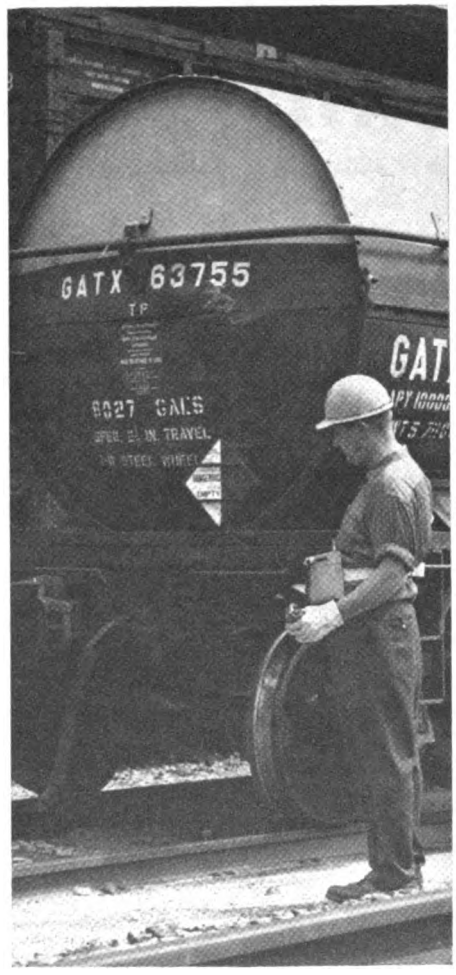
Thus it appears that the Arbitration Board was aware of the importance of radio communications. "Providing switch crews with radio or a cab indicator system might be a factor in reducing the size of such crews without a reduction in productivity," is one operating man's observation. Improved safety is also pointed out as one of the benefits resulting from this increased communications link (radio or cab indicator) between the man on the ground and the man in the engine cab. Such a system eliminates the need for switchmen to climb on top of moving freight cars to pass signals. Also they do not have to scramble up and down banks where the railroad is in a cut.

Undoubtedly railroads will select the system that best answers the need of a particular local condition, whether it be two-way radio or a cab indicator system. Where frequencies are available, opinion favors full two-way voice transmission because every member of the crew can be kept completely informed about the operation. Where frquencies are not available to equip each switch crew with its own two-way radio system, railroads will probably use the cab indicator system.

Whether a tone-coded two-way voice transmission or full use of the frequency for one crew, it has been suggested that crews may have to identify themselves to eliminate any confusion or misunderstandings. But, as in most such problems, the solution will depend upon local conditions. RS&C



Cab indicator system would have lights in cab similar to cab signals shown here, but would be actuated by . . .



. . . crewman on the ground using a portable radio transmitter. Coded tones would provide for several indications.