Train Talk

How New Jersey's Belvidere-Delaware Branch of the PRR Helped Modernize Rail Communication

Gordon Bond

Illustration adapted from *Railroad Magazine*, October 1944

How many ways can you think of to communicate with someone not nearby? You can call them on the ubiquitous cell phone that seems to hang from everyone's belt. You could text-message them on a Blackberry or iPhone. You could send an email or a "twitter." You could radio them or send them a fax. In short, there is a generation of Americans who will grow up having never known what it's like to *not* be connected by technology to the greater world.

But there was a time, not all that long ago, when it wasn't so easy—no phones, no radio and certainly no Internet. Now imagine you're the engineer of a steam locomotive. How would you communicate with the brakeman in the caboose or with the station master at the next station? If you could see each other, you could use hand signals, flags or lamps—all of which railroaders of old made use of. Indeed, they still do today. Watch the conductors on a passenger train when they're on the platform during a station stop. Once everyone is onboard, they will use hand or flashlight signals to let the engineer know it's safe to start moving again.

Perhaps the most charming mode of communication, however, is also that most quintessential sound of the rails—the train whistle. By combining long and short blasts from whistles on the engine and caboose, one end of the train could "talk" to the other, even when out direct sight, as on a curve or at night. It's also a good way to get the attention of anyone along the way. One long blast still warns people on the station platform that the train is approaching. Most people today will still recognize the two long, one short and one long as the warning that a train is approaching a road crossing.

Knowing how to "speak" in whistle blasts and other visual signals were skills every train crew needed to master, and they served the industry well into the early 20th century. Nevertheless, it was a limited vocabulary. If a train stopped unexpectedly, the brakeman in the service car (also known as the "caboose" or "crummy") would need to walk all the way to the engine to find out what the trouble was—and some freights could be miles long!

Clearly, as radio and telephone technology matured at the last turn of the century, there would be attempts at implementing them on the rails. Yet, they presented some serious technical and even political challenges that would need to be overcome first.

Phones & Radios

Before the era of the cell phone, telephone communications relied on both parties being connected by lengths of wire—often miles and miles worth—to carry the signal. Telephone

lines could certainly be strung from one end of a train to the other. Indeed, by the early 1940s, luxury passenger trains built by the Pullman company had boasted telephone communications. But these were "fixed-consist" trains, meaning that once the cars were strung together, they stayed that way for the duration of the trip.

Freight trains were a different matter. Even if the more than two-million freight cars throughout the United States in the first half of the 20th century could have been wired economically, the system only worked when the cars were coupled together so that the telephone lines could be connected. As a matter of course with freights, the "consist"—the make up of the cars—changed as parts of the train would be dropped off along the way or other cars picked up. The phone line connections would be broken during these decoupling and coupling maneuvers, making it useless.

If cars became decoupled by accident while the train was running, the phone communications would be down at the very time they could be most important! Indeed, as we shall see, it was this very situation that had jump started research into rail communications.

Further such an arrangement would not allow the moving train to communicate with stations and block controllers along the way.

The emerging technology of radio held out more promise. It was already being used for aviation—for aircraft to aircraft communications and and aircraft to ground. It was tougher, however, for the railroads.

As the commercial radio industry grew in the early 20th century, there was much competition for the available wave-bands. It was difficult for the Federal Communications Commission (FCC) authorities responsible for licensing and assigning frequencies to give suitable bands to the numerous railroads throughout the nation.

Further, radio waves are difficult to keep confined within the relatively short distances and narrow space from one end of a train to another or even within the bounds of a typical rail yard. There was an obvious issue with interference from other sources along the way. These were also the days before FM radio, so signals could fade out when the train passed under bridges or was inside of a tunnel. There were some experiments being conducted, but FM was not yet in widespread use by the Second World War. The war itself had diverted many research resources from the private sector to the pressing military needs.

According to an article appearing in the October 1944 issue of *Railroad Magazine*, "Train Talk. Carrier System for End-to-End Communication Speeds Up Freights on Pennsy Branch Line," M.S. Newman, described how "a number of the larger lines, Baltimore & Ohio, Burlington, D&RGW , Rock Island, and Santa Fe are conducting experiements with 'walkie-talkie' outfits, ultra-high-frequency sets, and the applicatins of the newly-developed frequence-modulation techniques." He noted that, "When wide-scale trials have been made, there's bound to be something new to add to the history of radio in train communication."

Wreck

While Newman doesn't mention it, the fact his article was appearing at the time it did hints at the broader political backstory involved. The Pennsylvania Railroad had been under fire resulting from a deadly wreck in North Carolina that had occurred in December of 1943.

According to an article by James Alexander, Jr. in the May 1995 issue of *Milepost*, journal of the Friends of the Railroad Museum of Pennsylvania, "A broken rail had derailed the last three cars of the *West Coast Champion*, traveling southbound at 85 mph.

Illustration adapted from *Railroad Magazine*, October 1944

Separated from the rest of the train, the derailed cars remained upright, fouling the northbound track, while the rest of the consist—three diesels and fifteen passenger cars—came to an emergency stop half a mile beyond. While passengers were being evacuated from the derailed cars (there were no serious injuries), a brakeman was sent to halt any following traffic."

Whenever a train came to an unexpected stop, the brakeman, fireman or conductor would walk down the tracks from the rear of the train with flags, laterns or flares in order to warn trains coming up from behind to stop.

The conductor up near the engine, however, wasn't aware of the decoupled cars. All he found was a minor damage to the coupling and air line between two cars near the front and assumed this was the reason they had to stop. He was unable to see that three of his cars were missing off the back end thanks to the dark of night and a blinding snowstorm. "Lantem signals from the rear were obscured and misinterpreted," explains Alexander. The engineer sent his fireman (the crew member who fed the coal into the furnace of the steam locomotives) to also help warn the train due behind them. As Alexander described it, "The fireman too was unaware of the derailed cars behind his train. He carried lanterns and one fusee [a type of flare], but in the excitement he neglected to take additional fusees...[s]ighting the headlight of the northbound train, the fireman attempted to light his only fusee, slipped on the icy ballast, and broke it. His efforts to flag down the fast-approaching express hurtling along at 85 mph with his flickering lanterns were to no avail...Roaring on by the halted southbound, the northbound slammed into the protruding derailed passenger cars, and the ensuing calamity became the next day's headlines."

Seventy people lost their lives in the wreck, including 47 servicemen. The subsequent investigations blamed human error. Nevertheless, *New York Times* columnist and radio commentator, Drew Pearson, assumed a new technology being developed, the radio-telephone, would have allowed the crews to communicate and avoid the tragedy. Why, he asked, hadn't the Pennsylvania Railroad—one of the most powerful railroads in the northeast—been making use of this technology? Their neglect of such advances, he asserted, as good as cost those people their lives. Rail historians, however, tend to discount that it would have made a difference, since each of the crews never knew the full extent of the damage to the train.

But once Pearson raged against the Pennsylvania Railroad for being so technologically backward, the thing took on a life of its own. Letters to the editor started appearing and politicians could smell a good cause to adopt.

Under pressure from the Senate Interstate Commerce Commission (ICC), the Federal Communications Commission (FCC) got into the act, working with the ICC to push radio use on the rails. According to Alexander, "Public pressure was still on. *Railway Age* [January 6, 1945] noted that 'after being practically dormant since 1930, intense interest in train communication burst forth in February, 1944, and has continued at white heat since that time.'"

The irony is that part of the PRR's backwardness had been imposed by the very government that was then forcing the issue. With the war raging, research resources were being channeled into the war effort. Radios were needed by the military and few were available for such civilian experimentations.

The human cost aside, the PRR was facing a public relations nightmare. Fair or not, they were being criticized on a systemic level for an accident that not only killed civilians, but servicemen during wartime—servicemen who were on leave just before Christmas, no less.

It was no coincidence, then, that Newman's piece in *Railroad Magazine* appeared when it did in October of 1944. It was, in effect, part of an overall campaign by the PRR and its federal overseers at damage control.

It could be argued, however, that regardless of the inspiration, it provided a needed catalyst in rail communication development. All they needed was a good rail line to test this all this new technology on. And they found it in New Jersey.

Journalist Drew Pearson, whose public criticism of the PRR—though perhaps unfair— had pushed them to develop their Trainphone communication system.

Bel-Del

When we consider the modern railroads around New Jersey, we may think of the New Jersey Transit lines that link up towns and regions throughout the state with each other and with the metropolises of New York and Philadelphia. We might also think of Amtrak's Northeast Corridor linking New Jersey to the eastern seaboard or lines that head up into Canada. The big freight carriers move goods across the whole of the country.

Yet, the early days of railroading was characterized by what's called "short line" companies. These were founded to serve very specific, local needs. The first railroad chartered in the United States, for example, was charged on February 6, 1815, to link the New Jersey cities of New Brunswick and Trenton. Called the New Jersey Railroad Company, it never actually laid any tracks, but at least it provided the model on which all future charters would be based.

The Camden and Amboy Rail Road and Transportation Company, however, was then chartered on February 4, 1830 and actually did provide the first rail transportation, linking Camden with South Amboy—and, via bridges and ferries, Philadelphia with New York, by extension. The Camden and Amboy (C&A) purchased one of the first practical steam locomotives from England, *The John Bull*, for use on this run. Amazingly, this engine was restored to running condition in 1981 by the Smithsonian Institution.

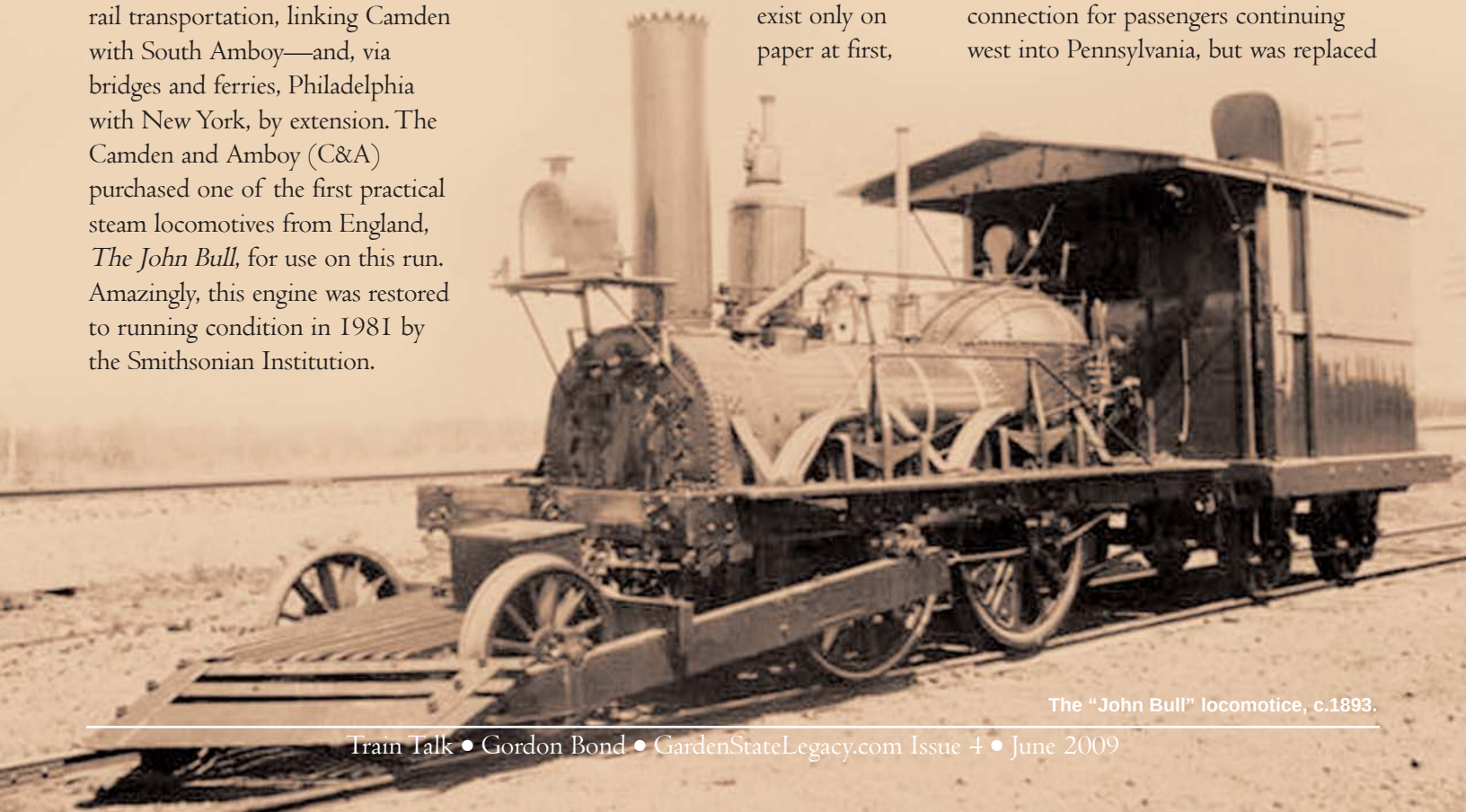
These were not the networks of rails we know today, but limited to linking two specific points. Other towns evolved along the way, specifically to exploit these transportation corridors. Along with canals (such as the Delaware Raritan Canal in New Jersey), the railroads helped to shape the devlopment of communities throughout the country in a way that wouldn't be seen again until the automobile.

The notion of connecting these short lines into a larger network was an obvious one. Smaller lines offered extended service by linking with other short line rails and it was only a matter of time before these collections of small, networked lines were combined into one larger entity.

A perfect example of such an evolution was New Jersey's Belvidere Delaware Rail Road, chartered on March 2, 1836. The impetus was to link Trenton with Belvidere, but also to connect with a planned railroad that would run west to the Susquehanna River in Pennsylvania.

The company would pretty much exist only on paper at first, though the idea was still considered sound enough that the Camden and Amboy Rail Road bought stock in what was nicknamed the "Bel-Del" on February 29, 1838. But it wasn't until February 6, 1851—fifteen years after its charter—that the first rails were opened from Trenton north to Labertville. A station was built at Trenton on April 25th at Warren Street. The line would be extended four times until finally linking with its namesake terminus of Belvidere on November 5, 1855.

Once established, the line was branched out over the years in various ways. In 1854, for example, Bel-Del agreed to operate the Flemington Railroad and Transportation Company, which added a branch from Lambertville northeast to Flemington. The Lehigh Valley Railroad coal trains started using the Bel-Del on January 17, 1856, linking with it at Phillipsburg. That summer, a stagecoach route was initiated linking the town of Belvidere with the Delaware, Lackawanna and Western Railroad at Delaware, New Jersey. This provided connection for passengers continuing west into Pennsylvania, but was replaced



The "John Bull" locomotice, c.1893.

on May 16, 1864 by an extension of the Bel-Del rails to the DL&W at Manunka Chunk. This made life a little easier for communters, though they would still need to transfer trains. The gage of the tracks—the space between rails and, therefore, between the wheels of the train—had not been standardized and the two railroads ran different gages. Once they became standardized, through-service was finally offered in 1876.

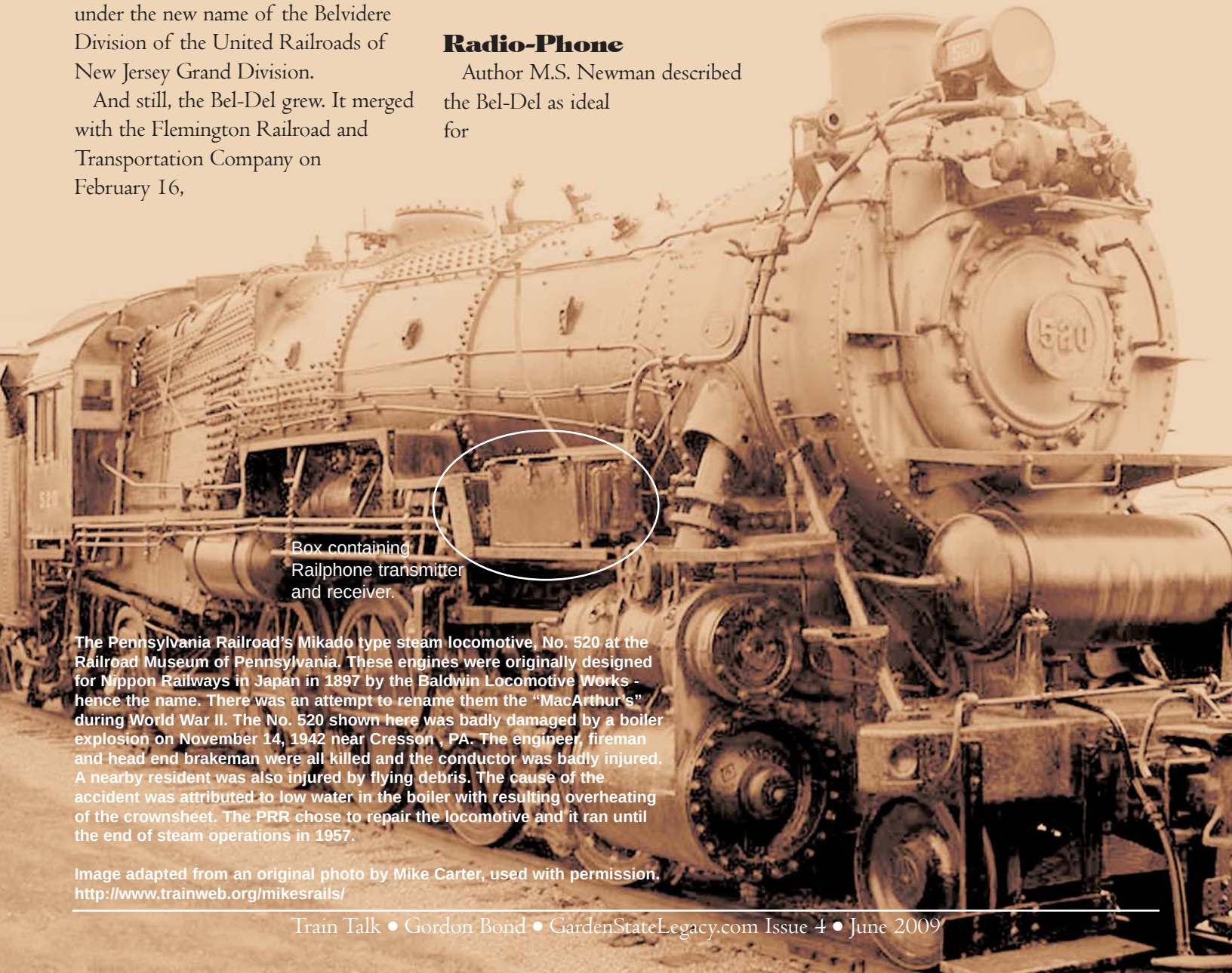
Passenger service was extended into Philadelphia in 1865 when they linked to the Philadelphia and Trenton Railroad. Connecting with Philadelphia was important for another reason. On April 1, 1872, the Pennsylvania Railroad began operating the Bel-Del under the new name of the Belvidere Division of the United Railroads of New Jersey Grand Division.

And still, the Bel-Del grew. It merged with the Flemington Railroad and Transportation Company on February 16, 1885, forming the Belvidere Delaware Railroad. On April 14, 1896, the Enterprise Railroad and Martins Creek Railroad were merged into the Bel-Del. The Lehigh and Hudson River Railway acquired trackage rights (the rights to run their trains on the Bel-Del tracks) on their line from Belvidere south to Phillipsburg in 1889. In 1908, the Pennsylvania Railroad added trackage rights over the Delaware, Lackawanna and Western Railroad from Manunka Chunk northwest to East Stroudsburg for trains serving the Pocono resorts.

It was on this matured Bel-Del branch that the Pennsylvania Railroad would test its technology—and attempt to deflect some of the criticism over the North Carolina tragedy.

Radio-Phone

Author M.S. Newman described the Bel-Del as ideal for the test. "With limited passenger service, and ten or twelve freights on schedule daily," he wrote, "this single-track branch... supplies service for local industries en route, connecting at Phillipsburg, N. J., with heavy-duty shipments from the large cement-manufacturing plants around Easton, Pa., just across the [Delaware] river...'Nothin' better'n the Bel-Del,' old heads will tell you when you go down to take a look at operations. Most of the railroaders there are veterans of this road up to the beautiful Delaware Water Gap country, and have put in a good part of their years of service there. And now that the Bel-Del boasts the most extensive train communication



Box containing Railphone transmitter and receiver.

The Pennsylvania Railroad's Mikado type steam locomotive, No. 520 at the Railroad Museum of Pennsylvania. These engines were originally designed for Nippon Railways in Japan in 1897 by the Baldwin Locomotive Works - hence the name. There was an attempt to rename them the "MacArthur's" during World War II. The No. 520 shown here was badly damaged by a boiler explosion on November 14, 1942 near Cresson , PA. The engineer, fireman and head end brakeman were all killed and the conductor was badly injured. A nearby resident was also injured by flying debris. The cause of the accident was attributed to low water in the boiler with resulting overheating of the crownsheet. The PRR chose to repair the locomotive and it ran until the end of steam operations in 1957.

Image adapted from an original photo by Mike Carter, used with permission. http://www.trainweb.org/mikesrails/

system in regular use on any line today, you'll have to admit that the old heads have a real point in their favor."

As an example of how it all worked, Newman looked at engine No. 3784, a Class L-1 Mikado type, which was hauling a string of boxcars. "Inside the cab," he wrote, "placed conveniently for the engineer, is a microphone of the kind used on ordinary telephones, mounted in a handset of the French type, with an ear-phone at the other end. It hangs from a hook at the side of small square control box, which contains the mechanism for controlling the volume of the voice current. A loudspeaker is suspended from the cab roof...[t]ransmitter and receiver, with the necessary tubes, filters, etc., are mounted in rubber and set in an oblong, all-steel box, which is placed on the running board."

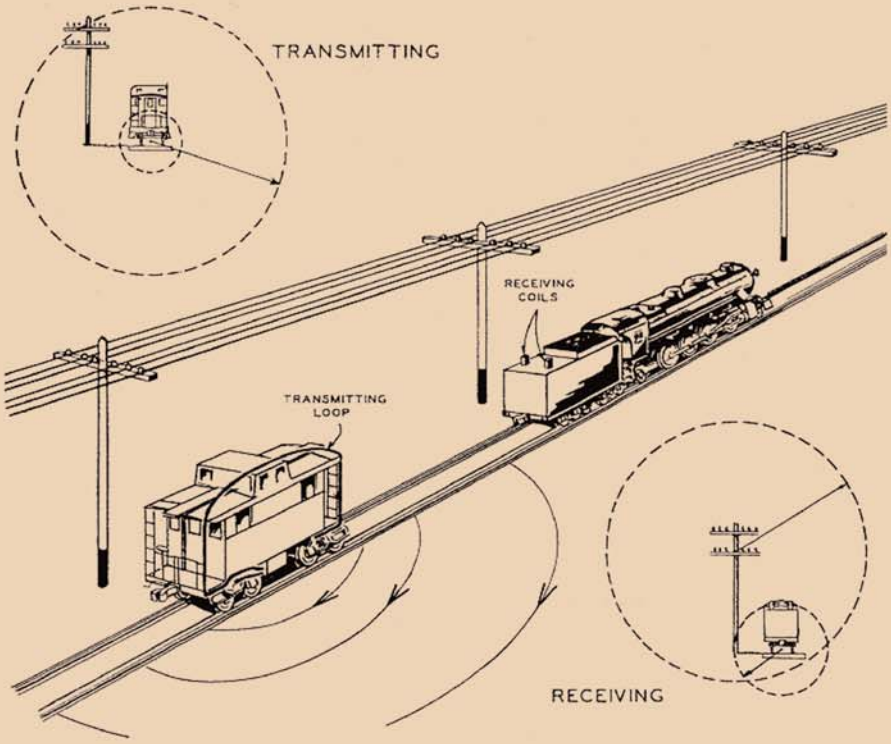


Illustration adapted from *Railroad Magazine*, October 1944.

A similar setup would be in the caboose. What this system did was to transmit the signal by using the rails as the wires! "[The] Receiving apparatus consists of coils mounted underneath the body of the vehicle, which pick up the current in the track by induction."

During the example trip, the train comes to an unexpected stop. The engineer, H.A. Scholl—"a tall, sparse vetran of the Bel-Del"—calls from the locomotive's cab to Conductor J.J. Schumacher in the service car. There are nineteen freight cars between them, but the engineer can let his conductor know, "[t[here's an automobile stalled on the grade crossing up ahead, and they're just getting it moved out of the way. We'll have about a five minutes' wait, I think."

"Saves me a trip," conductor Schumacher commented to the brakeman, V.M. Satterfield. "Used to be I'd have to walk up to the head end and find out what's going on. Nineteen cars isn't so far, but often we have three or four times this many, more than half a mile."

Telephone wires along side the tracks allow the train crews to also communicate with stations and the "block operators" responsible for clearing trains to enter or leave their section of track, or block. Previously, new orders for the train crews would need to be retrieved by hand—no small task when the train is moving! The written orders would be handed off using a stick shaped like a "Y" with string across the open forks at the top. The written orders would be tied to the string and someone would have to stand at the side of the track, holding the frame aloft. The engineer or conductor would snatch the stick out of his hand by getting an arm through the forks and under the string. If they missed, the train would need to be stopped and the orders delivered by hand, wasting valuable time. And, imagine doing this in the dark or during a storm or fog!

With the new technology, however, the engineer could speak directly to the station or block operator.

Another application was assisting with the various tests performed on each train before it left the yard. If a malfunction occurred in the middle between the engine and caboose, the train crews might not see it. An observer at a station, however, who notices a problem could then easily report it to the crew after they pass.

Proving the system could be of value in a crisis was of obvious importance. Newman was able to cite an example of just that. A freight heading south between Trenton and Phillipsburg came to an abrupt stop. There was smoke rising from a little bridge up ahead. The engineer was able to report it to the block operator in Frenchtown, who sent a nearby work train that had firefighting equipment. Another freight that had been in a siding also heard the report and was warned about the problem before proceeding. Thanks to the quick communications, the fire was put out before it could do any serious damage. "By means of train communication," Newman crowed, "between moving units and way stations, a minor emergency was handled in double-quick

time before it had any chance of tying up the line."

Clearly the New Jersey experiment was the proof of concept—and proof of action in response to a problem—that the PRR needed. It's likely that Newman's article was due in part to the media blitz undertaken in February of 1944 by the railroad's General Superintendent of Telegraph, W.R. Triem. Press releases were issued and he even went on a speaking tour. In an effort to allay the fears of the travelling public and quiet critics, he called the successful Bel-Del tests the "latest of a long list of improvements developed by the PRR and other railroads in cooperation with various electrical manufacturers to expedite train movements and afford better service to the public."

The Association of American Railroads (AAR) had supported the PRR's actions and defended it against its critics. It was the AAR who approached Washington about conducting tests and pointed out the difficulties the wartime restrictions had created. Together, the AAR and PRR kept a close watch on Drew Pearson's commentaries, trying to set him straight on the facts of the accident that had unleashed his wrath.

But now they could back it up with concrete improvements. It was announced that the Pennsylvania Railroad would install this new "Trainphone" on the 245 mile, four-track route between Harrisburg and Pittsburgh. Once World War II ended, the civilian world reaped the benefits of a host of technologies developed by the government, mostly in secret—radar, sonar, microwaves and more portable communications. This helped the rail communivations as well. By 1950, 1,613 miles of track on the PRR had Trainphone service. Managers of other branches visited the Bel-Del to see the equipment in action and soon were ordering it for their lines as well.

Transitions

Ironically, though the PRR could tout being ahead of the curve when it came to this induction carrier system in the 1940s, it was their adherence to it—perhaps due to having invested much in its development—that put it behind again in the 1950s.

"As a result of its public hearings, in May 1945," Alexander comments, "the FCC assigned 60 clear channels for railroad use, each channel 60 kilohertz wide, between 152 and 162 megahertz. (The number of channels and their width subsequently changed as a result of technological refinements and other needs.)"

Not all railroads had adopted the induction method and once the FCC started freeing up frequencies, they were quick to hop on the radio bandwagon.

According to Alexander, "[i]n the early 1950s, American railroads were installing over 2,300 radios a year, but the Pennsy installed only limited radio yard communications (such as at its Sunnyside yard) later in the decade. For some years the PRR continued to show its Trainphones in advertising, and it did serve a major purpose. By 1952, it had installed 1,268 Trainphones."

By the early 1960s, the PRR management was facing up to the reality that while their Trainphone induction-based system had worked well, it was fast becoming obsolete. Since they were the only major buyers for the equipment, no manufacturers had bothered to try to update it. Installation and maintenance would be cheaper for a new radio system than the existing Trainphone. Another major factor was that the induction system couldn't work on electrified rails. In short, the technology that had pushed them to the fore was now a deadend.

The transition to transistors began in 1966. With their General Order No. 2220, effective April 30, 1967, the PRR officially stopped using the induction system in favor of the radios. As Alexander put it, "[t]hus a useful but now outdated example of railroading progress came to an abrupt end."

By the end of 1966, even the Frenchtown way station that had been the scene of their success on the Bel-Del had been converted to radio.

These days, advances such as computers and satellite monitoring of trains help the railroads operate in ways the "old heads" could never have imagined. Such technologies have even made the caboose—and very need for the end-to-end communication—a thing of the past.

The Bel-Del itself has also gone through changes. Mother Nature dealt it a blow in August of 1955, when Hurricane Diane washed out the tracks north of Belvidere. In what was the beginning of the end, that stretch of tracks was abandoned and at the end of 1957, the Bel-Del was absorbed into the United New Jersey Railroad and Canal Company, though the Pennsylvania Railroad remained the parent company.

The real end came in April of 1976 when the once-mighty PRR went bankrupt and was turned into the federally funded Conrail. The line from Milford south to Trenton was converted into part of the Delaware and Raritan Canal State Park.

Large portions of Conrail were taken over by Norfolk Southern in the 1990s and now operate the line north to Belvidere.

In 1995, the tracks from Milford north to Phillipsburgh were taken over by the Belvidere and Delaware River Railway—a shortline railroad. The story of this interesting bit of New Jersey's railroad history had come full circle.