

# UNION PACIFIC'S FOURTH QUARTER 2017 Positive Train Control Update



Union Pacific continues to make strides implementing positive train control. The company anticipates it will make all required deadlines for installing PTC on its network. As allowed by federal law, Union Pacific will continue to test and refine the immature technologies comprising the system in 2019-2020.

Union Pacific's PTC footprint is the largest of all North American railroads, encompassing more than 17,000 route miles, roughly 45 percent more miles than the next largest railroad. Union Pacific is in regular contact with Federal Railroad Administration officials regarding its PTC progress.

Installing and implementing PTC across the U.S. rail network (passenger and freight) is costly and complex. One of the most complex parts of implementing PTC is ensuring system interoperability among all U.S. rail lines and locomotives. Given the various readiness levels of North American freight and passenger railroads, it will be important that all railroads continue working together to ensure smooth and safe transitions as PTC is implemented.

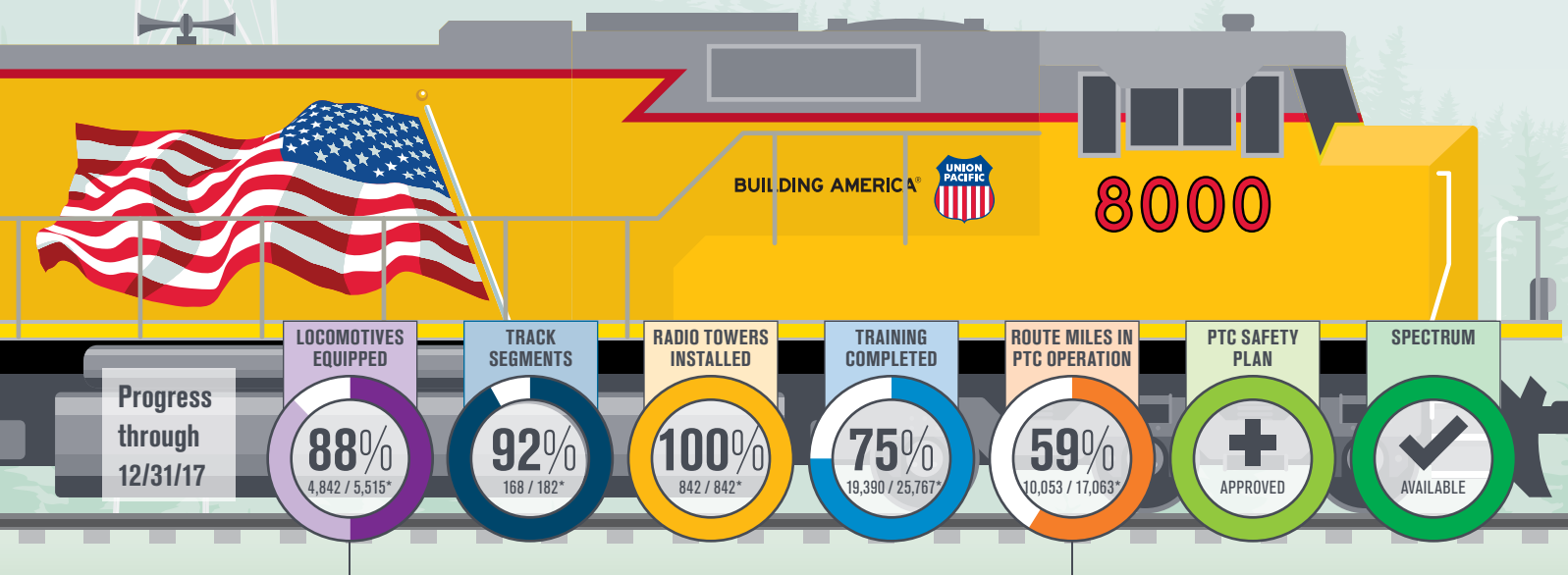
Union Pacific's fourth quarter 2017 accomplishments included:

- Preparing 33 additional track segments for PTC operations, bringing the total number of track segments to 168 (92 percent complete). These 33 track segments are equipped

with wayside devices (signals, switches and radios) and have defined GPS coordinates, which identify thousands of precise locations for system wide PTC coordination.

- Educating more than 2,700 additional employees on PTC operations, bringing the total number of employees trained to about 19,400 (75 percent). Training materials are tailored to a variety of employee roles, including engineer, conductor, dispatcher, maintenance of way/engineering, mechanical, signal, telecom and information technologies.
- Increasing by nearly 2,500 the number of route miles in PTC operation, bringing the total number of route miles in PTC operations to 10,053 (59 percent).

Union Pacific is testing the PTC system as we install the technology across our network and begin utilizing it in 200- to 300-mile sections. Trains are experiencing unintended stops, which are the result of a built-from-scratch technology in the hands of employees still becoming familiar with it. These unintended stops have an adverse impact on our system. On occasion, the communities we serve experience impacts to vehicular traffic. Customers also may be affected, on occasion, from the resulting system wide velocity impact. We are diligently working to reduce unintended stop situations to eventually eliminate these occurrences.



While the FRA notes only 2,849 (50%) UP locomotives are PTC equipped, nearly 4,850 are fully PTC equipped with the exception of a single component: the PTC-compatible, crash-hardened memory ("black box"). We have made significant locomotive installation progress in 2017 as the supplier-related black box issue has now been resolved. We expect this progress to continue in 2018.

With the FRA's conditional approval of our PTC safety plan, Union Pacific is running PTC operations on over 10,000 route miles in Arkansas, California, Colorado, Idaho, Illinois, Iowa, Louisiana, Minnesota, Missouri, Nebraska, Nevada, Oregon, Texas, Utah, Washington, Wisconsin and Wyoming.

\*Union Pacific submitted to the FRA a request for amendment to its PTC Implementation Plan. This request modifies the total requirement counts for each of these metrics. The numbers shown here reflect these updates and may vary from the FRA's quarterly industry status reports.

## FEBRUARY 2018 SYSTEM UPDATE

Developing and implementing a PTC system is a multi-dimensional process requiring a cross-functional, systemwide approach. Union Pacific's PTC system consists of multiple technologies functioning together to constantly monitor and manage train movements. These involve integrating signal and telecom elements; GPS; wayside, base station and locomotive radios; antennas and satellites – all to predict whether the train crew should be alerted to take action or if the technology should take control to slow or stop the train.

Through December 31, 2017, Union Pacific:

- Installed 99.7 percent, or over 17,000 miles, of required route miles with PTC signal hardware.
- Partially installed PTC hardware on over 98 percent of its 5,515 locomotives earmarked for the technology.
- Equipped and commissioned 4,220 locomotives with PTC hardware and software.
- Installed over 100 percent of the wayside antennas needed to support PTC along the company's right of way.

Union Pacific plans to spend about \$160 million on PTC in 2018 toward the current total estimated \$2.9 billion cost.

### SYSTEMWIDE PTC IMPLEMENTATION PROGRESS

Over 10,000 PTC-required miles were in operational status as of December 31, 2017, as shown in green. During the first quarter 2018, UP crews will work to cutover the additional track miles shown in blue. The remainder of PTC-required segments will be addressed later in 2018.



#### WHAT PTC DOES:

- ✔ Automatically stops a train before certain accidents caused by human error occur, including train-to-train collisions, derailments caused by excessive train speed, unauthorized train entry into work zones or movements through misaligned track switches.

#### WHAT PTC DOES NOT DO:

- ✘ Will not prevent vehicle-train accidents at railroad crossings, stop trains when pedestrians are on the tracks, or prevent incidents due to track or equipment malfunctions.