Telecommunications channels positive train control communications

Terms like "OPAC," "PTC 220" and "Slot 10" pepper Jim Barrett and Miles Francis' conversations. Barrett and Francis, both consulting systems engineers in Technology Services, are part of the BNSF Telecommunications team, led by Gary Grissum, assistant vice president, Telecommunications. Their team is responsible for designing and implementing the train-network communication functionality for BNSF's positive train control (PTC) system. And it's no small task.

The group is tackling multiple projects that will enable PTC technologies – including wayside units, base towers, locomotives and the Network Operations Center in Fort Worth – to communicate to one another and with other railroads, and creating back-up systems for each.

"The Telecommunications team must engineer the communication system, conduct radio acceptance testing and then deploy the system by the end of 2015," explains Jo-ann Olsovsky, vice president, Technology Services and BNSF's chief information officer. "It is a large undertaking."

PTC communications

The Rail Safety Improvement Act of 2008 stipulates that railroads' PTC systems must be "interoperable," or use common communication standards and processes so all PTC-equipped trains can operate with other railroads' PTC systems and vice versa.

To accomplish this, BNSF's PTC system will rely on wireless 220 megahertz (MHz) radio communications, a spectrum that has been approved by the Federal Communications Commission for PTC utilization. Other forms of communication technologies will be used, such as secure WiFi, cellular and GPS, but for very specific applications within the PTC environment.

"A concerted effort by the rail industry is under way to define system requirements, frequency allocation and channel planning, and complete radio development for the new 220 MHz technology," says Grissum. "We're anticipating a production radio design by the third quarter of 2011."

Designing the network

Two Telecommunications teams are partnering to design the PTC communications network, both supervised by Mike Lannan, director, Telecommunications.

Team 1: Dedicated to planning efforts. This team has already started:

- Conducting extensive coverage analysis studies
- Refining modeling tools, and
- Drafting engineering specifications to incorporate radio testing

Team 2: Constructing new base towers. This team's efforts include:

- Acquiring required permits
- Installing PTC antennas on towers and waysides, and
- Overseeing kit installations where PTC telecommunications components are bundled and delivered to designated bungalows, and are then installed and tested

Planning the network

Jim Barrett and the planning team have conducted extensive coverage analysis studies to ensure continuous communication coverage in the PTC 220 MHz environment. The team conducted these tests in four basic environments found across the BNSF system: rural, urban, dense urban and mountain.

Cellular tests on the Wichita Falls, Texas, Emporia, Kan., and Stockton, Calif., subdivisions also proved that cellular technology is a viable option for locomotive initialization downloads, which are critical to PTC interoperability. Initialization downloads occur at the start of each trip, when important trip information is downloaded to the locomotive's onboard computer system. Not only does cellular technology reduce installation costs on PTC-designated locomotives, it also reduces BNSF's reliance on more expensive WiFi networks.

Telecommunications Maintenance Maintainers Eric Allen (top) and Tim Mitchell (bottom) finish installing an 18-foot PTC antenna on the Ottawa, Kan., base tower.

To ensure that BNSF's 220 MHz radio meets federal requirements, the planning team will use a PTC test lab on the Fort Worth campus to simulate the wayside, base tower and locomotive components of the communication network and troubleshoot potential issues.

Constructing the network

After the planning team identifies where communication coverage is required for 220 MHz, Francis and the implementation team search for potential base tower sites. Once they identify a site, they conduct additional tests and, if appropriate, initiate the permitting process.

After gaining the proper permits, the team oversees base tower construction. Francis anticipates that BNSF will need about 36 new base towers to deploy PTC, with tower heights ranging from 120 to more than 250 feet.

The implementation team will also address communications in 16 of BNSF's tunnels and ensure that telecommunications components are installed and tested at bungalow sites.

In 2010, the implementation team will oversee delivery and testing of more than 900 kits for PTC-designated subdivisions. By the time that PTC is fully implemented in 2015, the team will have upgraded almost 10,000 waysides to the 220 MHz network.

"I am confident that the Telecommunications team will meet this challenge," says Olsovsky. "They're on schedule and will be ready for radio delivery."

PTC and Telecommunications by the numbers:

- Produce 118 coverage analysis models
- Retool and test more than 9,900 wayside units
- Retool approximately 750 existing base stations
- Construct more than 35 new base towers
- Test and accept about 4,000 radios

BNSF gears up for positive train control in California

In California, BNSF is already gearing up to meet mandated positive train control (PTC) requirements for both freight and commuter operations, as stipulated by the Rail Safety Improvement Act of 2008.

Those requirements mean that BNSF must install PTC on track that meets the following criteria:

- Movement of more than four passenger trains per day
- Movement of 15 million gross tons and any passenger traffic
- Movement of 5 million gross tons and any quantity of toxic-by-inhalation or poisonous-by-inhalation traffic.

For BNSF, those requirements could encompass approximately 700 miles of track in California, though the PTC team hasn't yet finalized system planning, according to Dave Galassi, assistant vice president, Network Control Systems (NCS), who heads BNSF's PTC program.

In 2010, BNSF is concentrating on the Bakersfield, San Bernardino and Stockton subdivisions. For these three subdivisions, Signal and Telecommunications work groups are responsible for:

- Completing 28 cutovers
- Installing 136 new signals
- Replacing or installing 63 bungalows
- Hanging 25 new PTC antennas on existing base towers

"The Engineering and Telecommunications teams are accomplishing a large amount of work and should be substantially complete with the field infrastructure needed for PTC on these three California subdivisions by the end of this year," Galassi says. "Additionally, the NCS Geographic Information Systems team has collected data on critical assets across these three territories."

For more information on BNSF's PTC progress, employees can check an interactive map on the team's PTC intranet site: Departments>>Operations>>Positive Train Control.