New braking technology taking hold

By William C. Vantuono, Editor

As the industry’s signal engineers attempt to get their arms around Positive Train Control, a technology required by federal law, their mechanical department colleagues are working diligently, albeit without a lot of the pressure, on Electronically Controlled Pneumatic braking—technology that has at least as much potential as PTC to significantly improve railroad operations. The Federal Railroad Administration’s timetable for ECP deployment throughout the approximately 1.3 million-unit North American freight car fleet, including cars in interchange service, is a guideline. The railroads are moving steadily ahead with ECP, not because they have to but because they want to, since the benefits are becoming increasingly quantifiable.

ECP programs have seen significant progress. Following Norfolk Southern’s successful pilot with Western Pennsylvania coal trains (RA, June 2008, p. 20), BNSF and now Union Pacific are working their way into ECP.

Utilizing New York Air Brake’s EP-60 technology, NS now has six ECP-equipped unit coal trains operating in three locations (pictured, above). Four use three head-end locomotives, the remaining two use three head-end units plus pushers. After going through nearly 500 coupling/uncoupling cycles involving nearly 54,000 carloads, NS has learned a lot from its ECP program. “For freight car reliability, we need ‘plug and play’ components,” NS Superintendent Air Brakes Jamie Williams reported at last month’s Air Brake Association technical sessions during RSI Global Expo 2009. “Cables must be properly coupled. We experienced some connector pin corrosion; NYAB addressed this problem immediately. Locomotive DBM (Dynamic Brake Monitoring) was causing some interference, resulting in communications failure and unintended train stops (ECP’s failsafe mode is an emergency air application); the FRA granted a waiver so we could turn DBM off. In terms of operational benefits, we’ve achieved consistent stopping-distance reductions of 40% to 70%, depending upon speed, terrain, and distance. We’ve been able to reduce dwell time by up to four hours.”

The next step, Williams said, is obtaining a 5,000-mile between-brake-inspection FRA waiver (the current limit under FRA waiver is 3,500 miles) to be able to operate through Powder River Basin coal trains jointly with BNSF. “Regulatory relief is key” to maximizing ECP’s benefits, BNSF Director, Locomotives and Air Brake Systems Dana Maryott added. “Let the technology do the inspecting.”

BNSF, which is using NYAB-equipped locomotives and Wabtec-equipped cars, has experienced similar results. Two ECP-equipped unit coal trains are operating on a 3,076-mile round-trip “business as usual,” Maryott said. “We’ve accumulated nearly 232,000 miles, and have had to bad-order and set
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out only two cars on line due to ECP problems. We’ve achieved a 10% improvement in train cycle time. These trains do not require special handling by our Network Operations Center [in Fort Worth]. The NOC Help Desk has become quite familiarized with ECP. So we’re seeing enough benefits to justify more widespread use of ECP.” The response from BNSF train crews has been favorable, with the majority of engineers involved in the test program asking when more ECP-equipped trains will be deployed. A possible next step, dependent upon an FRA 5,000-mile waiver, will be a Los Angeles-Chicago hotshot ECP intermodal train on the Transcon.

Union Pacific, reported Dave Tuma, is moving ahead with a Los Angeles-Chicago intermodal ECP test. So far, UP has equipped 10 ES44ACs and 50 DITX five-unit doublestack well cars with an equal split of NYAB and Wabtec equipment.

Don’t overlook the small stuff
Optimal braking performance depends to some extent on how other railcar suspension components interact. One example is the vertical isolation pad. Intended to cushion the interface between the truck side frame and roller bearing adapter, it was adopted in the late 1980s to address a chronic derailment problem on intermodal cars. “Its use was abandoned after a couple of years,” says Miner Enterprises Vice President-Engineering Bob Pokorski. “It provided a vertical suspension improvement, but allowed lateral motion that proved unacceptable.”

“Recently, we’ve been seeing some new or exaggerated conditions in the brake shoe and wheel tread areas,” Pokorski says. “Some coal trains are seeing brake shoe wear of around 50% in 1,500 miles with less than 20 minutes of brake application. Other trains, with tread-conditioning brake shoes, have seen little shoe wear but thermal damage to wheels, such that 25% of the wheelsets needed to be changed out. Diagonally opposite wear conditions on rod-through brake arrangements have been known to introduce accelerated wear of wheel flanges and heating in the throat of the flange. Increasing incidence and severity of this condition is being observed. Simple answers are not evident, and it is likely that a combination of factors has contributed to all of these problems.”

In the past ten years, revised freight car, truck, and brake system specifications have been developed with the intent to increase car weight capacity, improve performance, and reduce maintenance costs. These include the S-286 specification for unrestricted interchange of 286,000-pound cars; M-976 for truck performance in conjunction with S-286; changes to the brake ratio requirements of S-401; changes to the dimensional tolerances in the brake beam to side frame interface; and increased use of tread-conditioning brake shoes. “Clearly, there are real benefits to be gained from these and other changes. But it’s possible that one or a combination of them may be contributing to the problems we are now seeing,” Pokorski notes.

Task forces have been formed to study loaded-car truck
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hunting, braking ratios and premature brake shoe wear, thermal cracking in wheels, and brake beam lateral shift during brake application. While there will be some overlap in these studies, it’s hoped that there will be coordination, resulting in reports with complementary recommendations.

“In a perfect world, a steel wheel rolling on a steel rail will slowly wear away its tread,” says Pokorski. “But the world is not perfect, and wheels are subjected to events that cause small defects in the tread. Left unattended, these defects grow larger and can ultimately require premature wheel removal. Advances like tread-conditioning brake shoes are being sought and implemented to continuously erase small defects before they have a chance to grow into large ones. This involves a tradeoff: Wheel tread life is intentionally shortened by a small amount to prevent the possibility of major defects developing that will drastically shorten the wheel’s life.”

Another variable that affects braking performance is moisture. Contaminants in a locomotive’s compressed air system can cause failures in a number of downstream components: inoperable reservoir drain valves, contaminated desiccant dryer media, triple valve failure, and even seizure of the air brake cylinder. Failure can result in costly brake servicing, compromised braking efficiency, and even catastrophic failure.

Oil and ambient moisture in the airstream causes these problems. “Over the life of a compressor, piston wear allows oil to be drawn into the compression area,” according to Norgren, Inc., Littleton, Colo. “Exposed to heat in the chamber, the oil forms an aerosol and, in some cases, hard carbon particulates. This residue mixed with water creates a sticky sludge that finds its way to the bottom of air reservoirs. It also creates a lighter emulsion that is carried farther into the braking system. This contamination impedes reservoir drain valves, ruins desiccant dryer media, and flushes lubricant from triple valves and brake cylinders. While oil carryover is the major concern, water condensation and particulates in the airstream also reduce overall locomotive brake efficiency and accelerate wear of downstream components.”

A multi-stage air filtration system can help solve these problems. Norgren has developed one specifically for the railway industry that uses specialized filters placed at critical stages of the air supply to remove oil, water, and particulates from the airstream. “This filter system can pay for itself in as little as six months, based on cost savings in desiccant dryer media replacement alone,” says Norgren. “Additional savings can come from a prolonged service life of original installed components, less frequent compressor service, and elimination of the need to flush reservoirs and clean contaminants from the triple valve and air cylinder. The cost of unscheduled downtime and labor to check freight car brake cylinders for contamination from the locomotive’s braking system is eliminated. Plus, maintaining optimal air storage capacity reduces the energy required to operate the compressor, and allows brakes to perform at full capacity.”