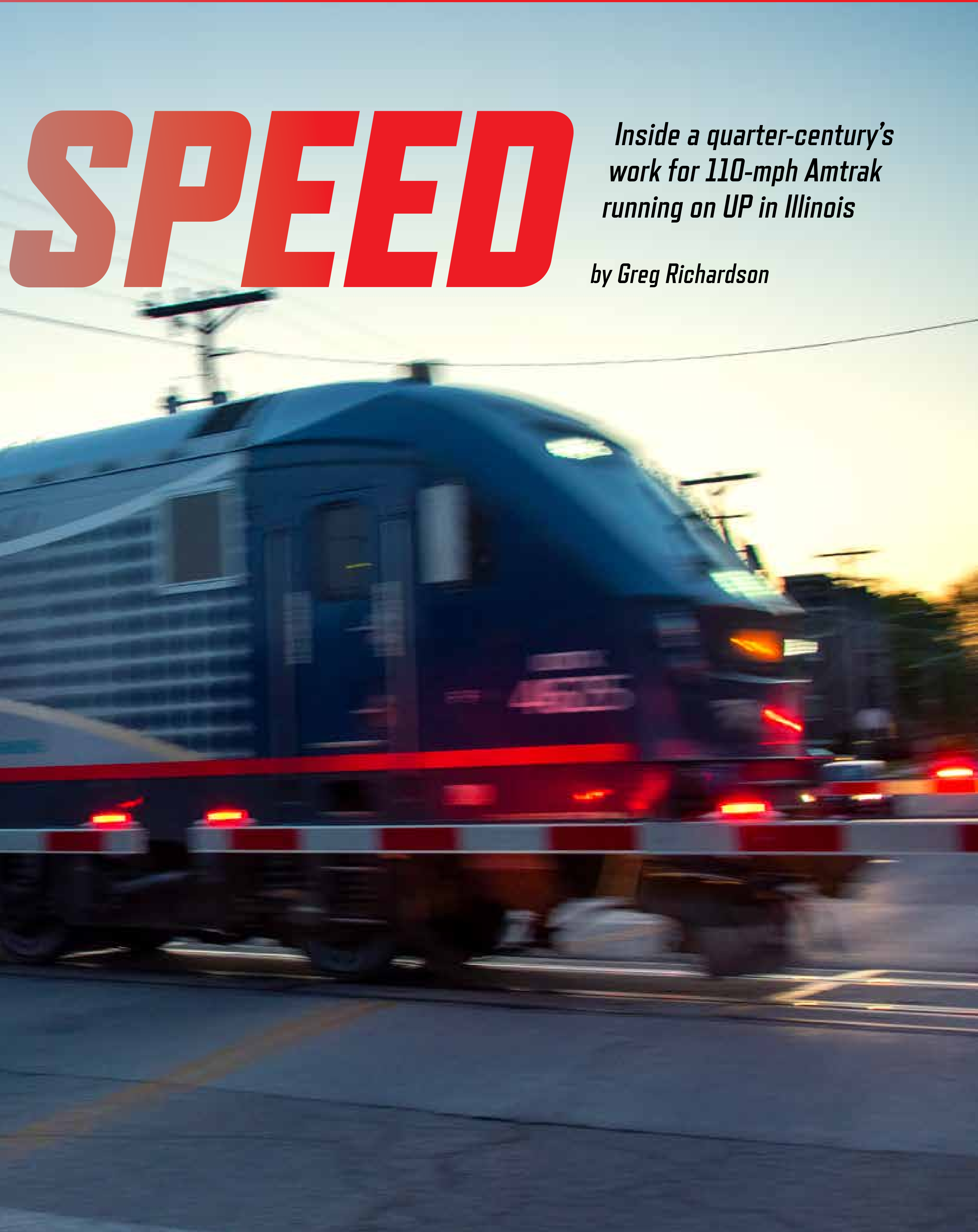
A SLOW PATH TO HIGHER

Siemens SC44 Charger No. 4625 powers Amtrak *Lincoln Service* train No. 304 across Race Street in Atlanta, Ill., on April 30, 2023, three days before the May 3 start of 110-mph operation. Steve Smedley

SPEED

Inside a quarter-century's work for 110-mph Amtrak running on UP in Illinois

by Greg Richardson



A small ceremony at Chicago Union Station on June 26, 2023, marked Amtrak's change to schedules incorporating 110-mph speed limits on portions of its Chicago-St. Louis route. The ceremony, led by Illinois Gov. JB Pritzker, included current and former politicians, and representatives from Amtrak, the Federal Railroad Administration, Illinois Department of Transportation, and Union Pacific.

Those on hand were likely unaware of the long journey to the event, but for me, it was the culmination of 25 years of professional involvement in the effort to bring the line 110-mph operations, primarily related to signal and train control implementation.

PHASE 1 THE NORTH AMERICAN JOINT POSITIVE TRAIN CONTROL PROJECT

In April 1998, I joined Arinc, Inc., as a member of an engineering team consulting with railroads on communications, dispatching systems, and train control. In fall 1998, my boss said what turned out to be the most significant words of my career: *"I see positive train control in your future!"*

I was assigned to two projects. One was sponsored by Norfolk Southern, CSX, and Conrail to evaluate how different positive train control systems developed by each railroad could be utilized on the others' lines — an initial foray into "interoperability."

Then there was the "North American Joint Positive Train Control" project. This ambitiously named effort of the Association of American Railroads, FRA, and Illinois DOT sought to develop and implement PTC technology on a portion of UP's newly acquired Chicago-St. Louis route via Springfield, Ill. Each stakeholder contributed to a total budget of $60 million. A committee with representatives from each of the Class I railroads, Amtrak, FRA, and IDOT was formed to guide program policy. The engineering team to which I was assigned was to develop system specifications and oversee all technical aspects.

Several safety objectives traditionally associated with PTC were in the scope of the project: prevention of train-to-train collisions; prevention of overspeed derailments by enforcement of speed restrictions, including civil speed limits and temporary slow orders; and protection for roadway workers and their equipment within the limits of specific authorities. Additionally, the system was to provide for communications-based advance activation of highway crossing warning systems, and to demonstrate a "flexible" or "moving-block" operation. This allows train movement without the constraint of traditional fixed signal blocks, theoretically increasing line capacity.

The system was to be designed around a "PTC Office Server" which served as its centralized "brain." This processed inputs from UP's dispatching system, wayside signals, and PTC-equipped locomotives, tracking the location and operational state of each train. It then was supposed to compute and communicate non-overlapping authority and speed limits back to the PTC-equipped locomotives. The test territory for the system was between Mazonia and Ridgely tower, just north of Springfield.

Another objective was to achieve FRA approval for the new PTC system through a regulatory protocol then under development. Signal and train control regulations, largely codified in Title 49 Part 236 of the Code of Federal Regulations, subparts A through G, were generally prescriptive and written around legacy relay and electromechanical systems. They did not apply well to "new and novel" processor-based train control technology, and it would have been difficult or even impossible to certify such technology. This system was to be the first through this new wringer, performance-based regulations ultimately published in 2005 as subpart H.

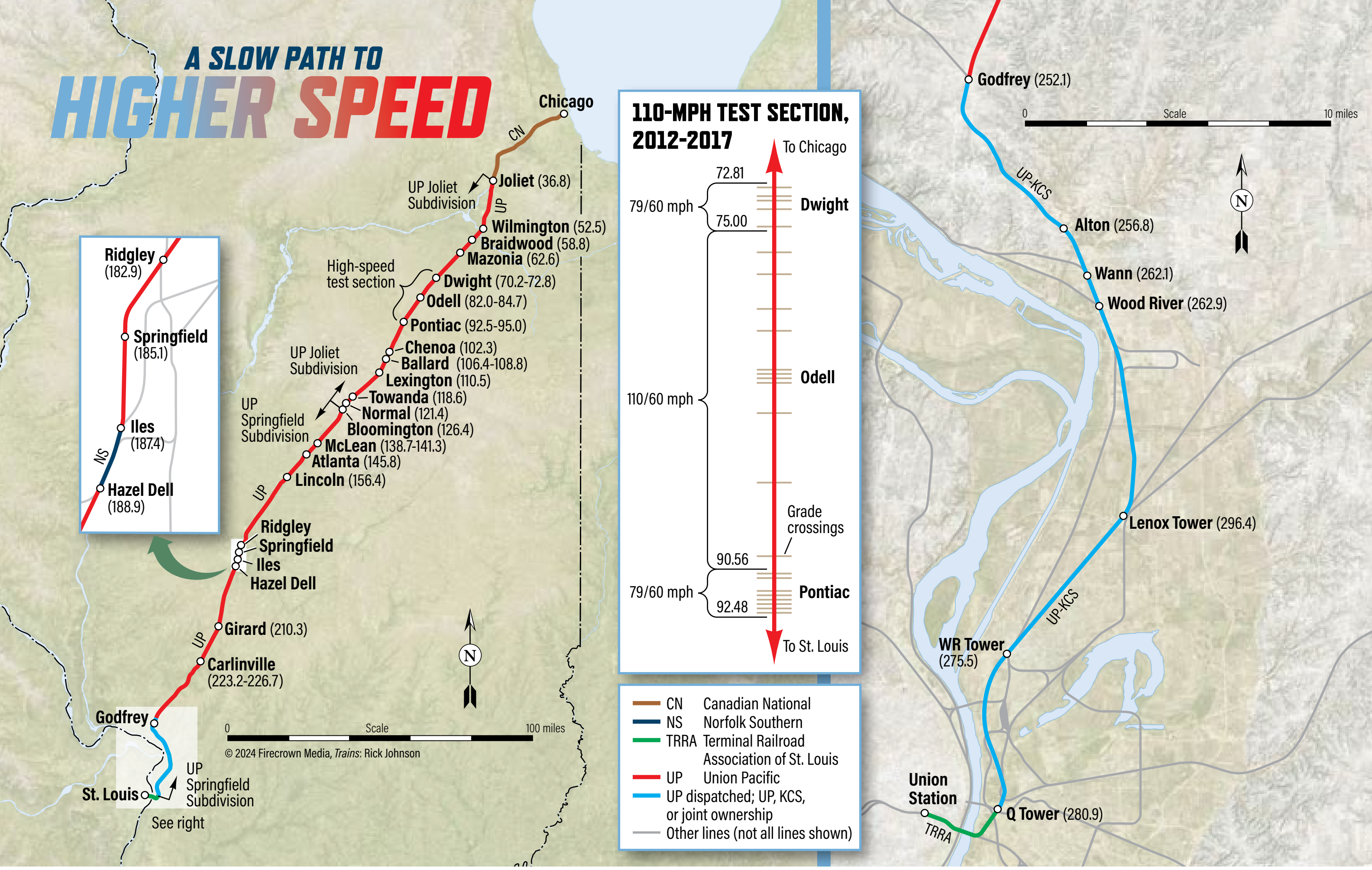
Amtrak and Union Pacific personnel look over a switch at Ballard, Ill., during test runs of equipment involved in the 110-mph program in July 2002. Steve Smedley

In early 2000, the program issued its Request for Proposals. Submissions came from several traditional railroad signal suppliers, as well as defense industry supplier Lockheed-Martin. The traditional suppliers focused on what they perceived as the technical and regulatory challenges and uncertainties, while Lockheed-Martin confidently described how these challenges would be overcome by the will and capability of its team, and its defense-industry credentials.

During the selection process, management committee members were split between the "devils we know" (the traditional suppliers) and the "one we don't." In the end, Lockheed — which enlisted two experienced rail industry suppliers, Wabtec Railway Electronics and Union Switch & Signal, as part of its team — was selected by virtue of its superior technical and financial proposals (i.e., lower price), which overcame most of the concerns about its lack of railroad-industry experience.

Development and testing, and the attendant management and technical meetings, began immediately. This division of

Illinois Secretary of Transportation Kirk Brown (left), FRA Administrator Jolene Molitoris, and U.S. Transportation Secretary Rodney Slater hold a $6.5 million check representing federal funding to Illinois for the North American Joint Positive Train Control project on June 21, 2000. Bob Johnston



Lockheed had specialized in submarine fire suppression systems, so the engineers were generally unfamiliar with railroad operations. Members of the systems engineering and UP teams spent significant time at Lockheed's Mitchel Field (Long Island), N.Y., location, trying to bring as much understanding as possible.

During early design and engineering, the UP signal team pointed out that interfacing PTC with the 1968-vintage General Railway Signal relay-based signal system would be difficult, expensive, and likely unreliable. Their case was compelling. As a result, a new Union Switch & Signal Microlok II processor-based signal system was installed between Mazonia and Ridgely. The B&O-style color position-light signals and pole-line circuits were replaced by color-light signals, coded track circuits, and radio-based CTC communications.

After approximately two years of development, the system was ready for field tests in late October 2002. Amtrak supplied a test train, including P42 locomotives Nos. 51 and 52. A battery of tests, primarily designed to exercise the system's navigation and communications capabilities, were conducted over a 2-week period. Most results were favorable, but at times the office server was not able to track train locations in an accurate, timely manner. In one example, the server inexplicably believed an Amtrak train from the previous day was still on the running track at Bloomington because of a phantom track occupancy indication. Unfortunately, this proved to be one of the most significant technical hurdles and was never safely overcome [see "What is a flashing green?" at right].

At the culmination of this first test session, a small demonstration of 110-mph operation was held for stakeholders and other invited guests. A series of short, speedy runs was made between Normal, Ill., and the passing track at Ballard, Ill., over two days. Law enforcement officers and flaggers were stationed at each crossing as the test train shot back and forth several times. A highway radar speed trailer was positioned at Towanda, Ill., and we train riders delighted in observing the speed readout as the train passed. I was aboard to brief officials and the press on how the system worked — or was supposed to.

System development, as well as the cycle of testing, problem identification, and resolution, continued for three years. Extensive field tests of 10 to 14 days occurred about once per year [see "A unique 'dampening device,'" page 24]. Each morning, the train would leave Bloomington and tests would be conducted until it needed to clear for the passage of an Amtrak or UP local train. (The Global 4 intermodal facility in Joliet had not yet been constructed, so

WHAT IS A "FLASHING GREEN?"

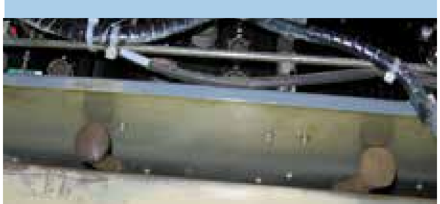
THE DESIGN OF the Lockheed PTC system included use of a high flashing green signal aspect (dubbed the "PTC aspect"), indicating that the train's movement was governed by its in-cab PTC display. This was to be utilized for future demonstration of "moving block" operations and was displayed upon receipt of a request from the office server to do so. The office server would send this request to a signal when it was to be displayed to a PTC-equipped train in a moving block operation, based upon its tracking of the train's location. On the first day of testing, though, the PTC aspect was mistakenly displayed to a UP local that happened to be operating near the test train. Its crew was not familiar with this aspect; it was to them, by rule, an improperly displayed aspect. Much confusion and consternation resulted. Testing was paused immediately and, since FRA test monitors were on board the train, an impromptu inquiry was held. The outcome was that this feature was immediately disabled and, in fact, never utilized again. — *Greg Richardson*

A UNIQUE "DAMPENING DEVICE"

DURING ONE FIELD TESTING session utilizing Union Pacific No. 1399, one of two GP40-2 locomotives equipped for testing, its location determination system was performing poorly. This was a component of the overall system that pinpoints the locomotive's location, speed, and direction of movement by processing Global Positioning Satellite signals, wheel tachometer signals, and other measurements of speed and acceleration. The Lockheed engineers analyzed data and speculated that the accelerometers in the subsystem hardware enclosure were malfunctioning.

A short time later, the test train was routed into the Odell, Ill., siding for an Amtrak passenger train. The UP project manager headed to the offending locomotive. A short time later, he returned and announced he had inspected the equipment, observed that it might be subjected to excessive vibration, and procured two "Union Pacific Standard Vibration Dampeners" trackside and applied them, possibly remediating the situation. The Lockheed engineers were intrigued and began asking questions about the design, schematics, and availability of such "standard dampening devices." The UP manager then escorted them to the locomotive so that they could inspect the "field modification."

Their intrigue turned to surprise and skepticism when they observed two rusty spikes, installed with an air hose wrench, wedged between a bulkhead and the floating end of a cantilevered shelf on which the location determination system enclosure was mounted. That surprise turned to satisfaction as No. 1399 performed well in subsequent tests. A more elegant "engineering change" to the shelf installation ultimately followed. So the low-tech forged railroad spike was able to save the day, if only temporarily, in an age of fiber-optic ring gyroscopes. — *Greg Richardson*



Two spikes inserted below Lockheed Martin's Location Determination System reduced vibration. Daniel L. Steinhoff

there was little freight traffic to dodge.) The test train would often pause midday at Braidwood, Ill., for the crew to descend upon the Polk-A-Dot Drive In, a trackside Route 66-themed diner.

By late 2005, progress slowed on technical matters such as the problems with accurate train tracking by the office server. Lockheed contract change orders and project scope reductions, presumably typical of the defense and aerospace industries, began to exhaust stakeholder patience and the program budget. No material progress on flexible block operation or advance activation of crossing warning systems was made, and no field tests of either were ever conducted.

Concurrently, little progress was made in exercising the new FRA regulatory approval protocol. In late 2006, these headwinds resulted in a "stop work" order, effectively shutting down the program's technical portion.

Why did the project fail? From my perspective, there were three primary reasons. The first was the centralized "brain" office server architecture; operation of the signal and communications system and the logic to handle all the inputs for safety-critical train tracking proved to be more complicated than expected and just wasn't improving. The second was budget: $60 million was nowhere near the real cost of initial development, testing, and certification of a PTC system, whether for 100 or 10,000 miles of railroad. The last was the lack of significant railroad operating expertise in the development process; too much of that burden was placed on the Lockheed team, new to the railroad industry. A silver lining is that these became significant lessons learned and were fresh in the minds of many when the industry embarked on mandated PTC development just over two years later.

Union Pacific itself remained committed to research and development of PTC, and for the next 2½ years at Arinc, I worked with UP on its PTC research. The September 2008 collision between a Metrolink passenger train and UP freight at Chatsworth, Calif., prompted the passage of the Railway Safety Improvement Act in October 2008, which mandated industry-wide interoperable PTC. This profoundly altered the industry's PTC research and development trajectory — and my own.

PHASE 2 THE DEMONSTRATION SEGMENT

On Feb. 1, 2009, I reported to Union Pacific headquarters at 1400 Douglas St., Omaha, Neb., transitioning from consultant to UP employee: general director, train control systems. My charge was to be a leader of UP's technical effort to meet the PTC mandate (a story unto itself).

Shortly after starting, I was informed

An Amtrak test train, seen from the Hudson Stuckey Road overpass near Towanda, Ill., hit a reported 109 mph on its second test run on Oct. 31, 2002. Steve Smedley

we were inking new agreements with IDOT to implement 110-mph operations on UP's portion of the Chicago-St. Louis line. Just over two years after the NAJPTC project concluded, its train control and crossing aspects were back on my plate and within the PTC statutory mandate. Long-term 110-mph operation ceased to be a stand-alone effort and became fully entangled with overall PTC development.

Uncertainty about the PTC timeline was discouraging for stakeholders in Illinois; UP was asked if some sort of interim demonstration was possible. This would build and maintain enthusiasm for high-speed operation while PTC development plodded on.

I proposed the use of UP's four-aspect automatic cab signals to meet regulatory train control requirements for operation above 79 mph, and a variant of the Incremental Train Control System (ITCS) to meet "guidelines" from the Illinois Commerce Commission for operation of highway crossing warning systems at higher speeds. Amtrak had achieved success with ITCS crossing operation as part of overall

Author Greg Richardson displays a box containing the Lockheed Martin Location Determination System for the benefit of TV news crews during the Oct. 31, 2002, 110-mph demonstration run. The media also viewed a live video image from the locomotive cab.

PTC function on its Michigan line; since some Amtrak locomotives were already equipped, logistics could be minimized.

A significant difference: only the crossing-related functions of ITCS would be utilized in Illinois; this was dubbed "XITCS". Functions include the ability for a train to activate the crossing warning system by radio communication independent of the conventional track circuits, which remain arranged for operation at 79 mph or less. Additionally, XITCS

Four-quadrant gates, closed-corridor fencing, and additional signage warning of "longer gate times" protect a grade crossing in downtown Odell as *Lincoln Service* train No. 302 passes on Nov. 16, 2016. Two photos, Bob Johnston

provides a mechanism to communicate the presence of certain hazards at the crossing, so an approaching train can be slowed or stopped. These hazards include:

• Failure of the warning system to activate;
• A highway vehicle occupying the crossing during the warning system activation cycle;
• Failure of the highway vehicle detection system;
• Failure of the crossing gates to lower or raise properly;
• Extended activation of the warning system;
• Insufficient backup battery voltage.

The proposed use of automatic cab signals and XITCS was not compliant with PTC regulations, so the demonstration operation would eventually sunset as PTC implementation occurred. The demonstration section was between Dwight and Pontiac, Ill., with a 110-mph speed limit for 15 miles between approximately MP 75.0 and MP 90.5. There was one 100-mph curve speed restriction within those limits; a total

The crew on a demonstration-segment test run in 2012. From left: Greg Richardson; Butch Hayes, Amtrak conductor; Steve Fleming, Amtrak engineer; and David Blackmore, FRA test monitor.
Greg Richardson collection

of 14 highway crossings were equipped with four-quadrant gates and XITCS equipment.

The Illinois Commerce Commission proposed that XITCS crossing warning time be sufficient for engineer reaction and deceleration in the event of a detected crossing hazard. This resulted in warning times of approximately 85 seconds, compared to 30-35 seconds for freight trains and at conventional crossings in the area.

Furthermore, the Commission proposed

FIGHTING WITH FLIPS

ONE LAST ATTEMPT was made to diagnose and resolve the cab-signal problem just south of Odell prior to the start of revenue 110-mph operations in the demonstration segment. A prominent theory was that high-voltage power lines paralleling the right-of-way were causing the induction of stray electrical currents into the rails, which then interfered with the cab signal operation. Arrangements were made with the local power utility and a large grain facility north of Pontiac to de-energize the power lines during their lunch break for the operation of a test train. The test train was positioned at Dwight, Ill., and at the stroke of noon, the power switch was thrown. The train highballed south to Pontiac and returned northward to Dwight. Alas, the cab-signal flips remained, and a 90-mph speed restriction was placed just south of Odell to avoid problems.

Although the restriction was a minor operational nuisance, it stuck in my craw as a matter of principle. In late spring 2014, I retained the services of a railroad signal engineering consultant to further investigate. An Amtrak test train was assembled in Chicago and outfitted with various instruments to monitor the onboard cab-signal systems, and UP facilitated the instrumentation of wayside signal components in the problem area. The test train operated back and forth for a couple of days and, as predicted, electrical signal anomalies received on board the locomotive were observed, although their cause was not clear. Adjustments to the onboard and wayside signal systems were made, but to no avail.

During one afternoon debrief, an engineering consultant presented graphs that indicated that the electrical anomalies appeared to occur at evenly-spaced intervals of 78 to 80 feet on each rail. The number "78" immediately rang a bell — that is the length of rails welded together at the factory to form quarter-mile sections of continuously welded rail. The cause of the signal anomalies was thought to be residual magnetism induced by the factory welding process. At speeds above 90 mph, the cab signal pickup bars encountered the magnetized areas at a rate which interfered with the 180 pulses per minute of the CLEAR cab signal indication. Further tests supported this theory. However, identified solutions were costly and/or impractical. No action was taken, and the problem went away when the demonstration segment's cab signals were retired in 2017. — *Greg Richardson*

During the period when cab signals allowed 110-mph operation through the area on a demonstration segment, southbound Lincoln Service train No. 301 flies through Odell, Ill., leaving traffic on Interstate 55 in its dust, on May 22, 2014. Bruce Bird

novel operation for warning systems at private "field-to-field" crossings: the gates would normally be in the lowered position, and would raise only when a button was pushed at the crossing, if no train was approaching. Both UP and FRA expressed concern about this proposal, and the FRA ultimately denied a waiver petition, but the 85-second warning time for passenger trains remained, albeit with the condition that a motorist behavioral study be conducted after operations commenced. An informational filing describing in detail the proposed technical and operational approaches was submitted to FRA in June 2012, and in late August, FRA gave conditional approval. Union Pacific then completed track upgrades in the segment to the Class 6 standard allowing 110-mph maximum speed, as well as installing cab signals and XITCS crossing and communications equipment.

Beginning in summer 2012, extensive tests were conducted at each of the 14 XITCS crossings utilizing a hi-rail truck equipped with the XITCS onboard apparatus, checking communications with each crossing and the ability to detect the various hazards. It was then time to bring in the test train. On days it operated, contract flaggers would camp out at each of the 14 crossings while protecting the test train's passage in case of some failure. The test train made passes through the demonstration territory at ever-increasing speeds; proper operation and warning times were verified after each pass. Testing went well, and speed was quickly increased to 110 mph.

However, one recurring problem emerged just south of the Odell siding. At more than 90 mph, the cab signal would repeatedly "flip" between "CLEAR" and "RESTRICTING" aspects. Because the cab signal speed control was engaged on the Amtrak locomotives (thus providing Automatic Train Control functionality), this induced an overspeed penalty brake application each time the cab signal dropped to RESTRICTING. Little progress was made in resolving the issue before the start of revenue service operations, so the decision was made to impose a 90-mph speed restriction in the problem area [see "Fighting with flips" at left].

A special train on Oct. 19, 2012, allowed dignitaries and their entourages to sample and take credit for 110-mph operation. There were nervous moments among signal technicians and the operating crew as the train raced through the Dwight-Pontiac segment. But the train achieved its intended goal, with some difficulty [see "VIP Run Drama," page 28], proceeding southward through the demonstration section and on to ceremonies at the new Bloomington station in Normal, Ill.

Revenue operations commenced as planned on Nov. 12, 2012, and continued for almost five years. [See "How Illinois ramped up to 110 mph," "Passenger," June 2013]. Most passengers probably did not notice the short burst of high-speed running, which did not materially impact schedules or on-time performance. However, motorists on parallel Interstate 55 near Odell often raised their eyebrows when they were unable to keep up with a train.

Overall, the combination of cab signals and XITCS technology proved extremely reliable. Ultimately, on Oct. 30, 2017 — shortly after the implementation of PTC on the Joliet Subdivision for UP freight trains and on the eve of Amtrak's ability to operate PTC on UP lines — passenger train speeds reverted to a 79-mph maximum, the cab signals were retired, and XITCS operation ceased, at least temporarily.

PHASE 3 *THE FINAL PTC PUSH*

In late 2008, UP and other Class I freight railroads formed the Interoperable Train Control committee to collaborate on fast-track development of interoperable PTC. The aim to was to meet the tight statutory deadline for full PTC implementation — at that time, Dec. 31, 2015. (This was later extended to 2018 or, conditionally, to 2020).

Two Union Pacific business cars trail *Lincoln Service* train No. 302 near Odell, Ill., on Sept. 15, 2012, as executives view a presentation on the cab signal/XITCS project by the author. Two photos, Bob Johnston

The XITCS display, at left, and UP cab signal display as they were installed in the cab of Amtrak P42 No. 66 during the Dwight-Pontiac 110-mph demonstration. Compare this with the current system shown at right.

A Siemens Charger shows IETMS positive train control and XITCS displays during current 110-mph operation. XITCS status information is in the gray block at the left center of the PTC screen. Greg Richardson

One major regulatory hurdle was the requirement that each railroad obtain a PTC System Certification, achieved by FRA's approval of its PTC Safety Plan submission. The FRA could provide certification at several different levels, based on what was requested in and supported by technical material in the railroad's safety plan.

The lowest level of certification allowed for a maximum train speed of 90 mph; other levels specified higher speed limits or none at all. No Class I railroad other than UP had any higher-speed project in the works, and all were generally apathetic toward the need to seek a PTC certification which allowed operation above 90 mph. I lobbied the other Class I railroads to pursue a higher certification level that would permit 110-mph operation specifically because that was UP's Illinois high-speed corridor objective. Eventually, I prevailed, and it was agreed to set our mutual sights on a certification level that would allow (at least) 110-mph operations.

In late 2015, the first safety plan submission — by BNSF — describing the industry's consensus PTC technology was approved by the FRA, but at only the lowest certification level. Similar approvals followed for the other Class I railroads. While the balance of the industry was excited about receipt of their respective certifications, my enthusiasm was tempered by the fact that it fell short. On several occasions, I met with IDOT, its consultants, FRA program managers, and other disappointed stakeholders to explain the technicalities of safety and certification levels, what our next steps were, and what the delay to the program might be.

On the crossing front, UP and Amtrak decided XITCS would remain the technical solution. Crossing-related functions were not mandated by the PTC statute, and it was not feasible to develop them anew as a direct part of the PTC system with the given deadline. The XITCS would operate independent of PTC (although it is able to place some textual status information on the PTC display). Union Pacific installed a new underground fiber-optic cable along the route to support XITCS communications between trains and crossings, as well as elaborate messaging systems in its Omaha data centers, which allowed XITCS to utilize the interoperable PTC communications network.

In 2017, there were discussions between the Illinois Commerce Commission and project stakeholders to modify the XITCS capabilities to detect crossing hazards. Each modification required a new cycle of safety-critical design review and development, followed by installation of modified software and testing at all affected crossings. This added many months and some complexity to the project.

Fortunately, the other Class I railroads' interest in seeking upgraded PTC certification was steadily increasing, albeit due to

VIP RUN DRAMA

AS THE OCT. 19, 2012, demonstration run approached, I discussed with Amtrak's mechanical department staff the possibility of cutting out the speed-control feature of the cab signals on the P42 locomotive to prevent the penalty brake application resulting from the intermittent cab signal flip south of Odell. The cab signals would be otherwise operative. Amtrak was agreeable; so was the FRA supervisor on the run. The appropriate steps were taken and we departed for Joliet, where the VIPs boarded, and then proceeded south. As we passed Dwight and entered 110-mph territory, the Amtrak engineer notched out on the throttle: 80 … 81 … 82 mph.

Suddenly, the cab was filled with the sound of escaping air. Bewildered looks filled the cab; a penalty brake application had occurred. We shrugged, the engineer recovered the air, and notched out again. But at 82 mph, the sequence of events repeated. After a quick debate, we concluded (and later confirmed) that the cut-out of the cab-signal speed control had the unintended side effect of reducing the locomotive overspeed feature from 112 to 82 mph.

Illinois Gov. Pat Quinn points to the speed of 111 mph as the test train runs between Dwight and Pontiac, Ill., on Oct. 19, 2012. U.S. Transportation Secretary Ray LaHood, Senator Dick Durbin and Joseph C. Szabo of the FRA beam in approval. Steve Smedley

I jumped up and made my way back through the body of the P42 locomotive, opening and slamming bulkhead doors as I went, to the air compressor room at the rear, where Amtrak mechanical employees were riding. They asked why we hadn't yet accelerated; I explained the problem, our theory, and beckoned them forward immediately. We returned to the cab and saw we were almost to Odell, having exhausted half of the demonstration territory and still operating at 79 mph. One of the Amtrak technicians reached into the nose of the locomotive, manipulated something with a screwdriver, and reported the cab signal speed control was now restored.

By this time, the train was on the approach to the crossings at Odell, and a feature of XITCS, which limits train acceleration when approaching crossings to ensure constant warning time, prevented us from immediately attempting to accelerate. Finally, we cleared the crossings and the engineer notched out again past 83 mph and no penalty! Success was declared as we accelerated to 111 mph before passing the south siding switch at Odell. We highballed along for another mile until, right on cue, the cab signal flips and resultant cab signal overspeed penalty started. The engineer made a valiant effort to power the train through the penalty application until the cab signal stabilized, but, alas, we were quickly approaching Pontiac and the end of 110-mph territory. We decelerated and then cruised along at 79 mph to Normal, where the VIPs disembarked for another ceremony.

I remained in the locomotive cab for a while catching my breath, until I was summoned to meet the UP delegation on the platform to discuss what had happened. I provided a quick explanation; there seemed to be no significant heartburn and I gathered my career at UP was probably not impaired significantly. On the deadhead move north after the ceremonies, the Amtrak engineer and I pondered our fates had the train never surpassed 79 mph.

Later, I found a *Chicago Tribune* article which stated, "There was a momentary glitch in the data communications link between the trackside signaling system and the Amtrak train that slightly delayed the acceleration from 79 mph toward 110 mph, according to railroad officials monitoring the test run." That explanation, while not accurate, best protected the dignity of all involved, so it worked for me. — *Greg Richardson*

A northbound test train approaches the Airport Road grade crossing north of Springfield, Ill., at 90 mph on June 25, 2020. Technicians in the bungalow are monitoring track circuit and IETMS/XITCS data; flaggers (not visible) protect the crossing. Bob Johnston

reasons other than high-speed passenger train operation. An upgraded certification level not including the specific 90-mph limit was targeted. Technical changes to the system, each improving its reliability, performance, and safety, had been accruing since the railroads first placed it into operation (UP began revenue service operation of PTC in December 2015). Railroads were also able to supplement the safety plan analysis with several years of data accumulated through hundreds of millions of train-miles of operation. A new safety plan was developed, which primarily included a re-work of the system safety analysis.

Union Pacific and Amtrak then made the decision to move forward with an interim speed increase from 79 to 90 mph under the existing certification. While not particularly impactful to schedules and operations, it was to be a significant technical milestone, since XITCS would be placed in daily revenue service operation at all crossings and for the first time since the demonstration operation ceased in 2017. Tests were ran at each of the 180-plus equipped crossings, followed by a small number of test-train runs in 2021, all of which were successful. A "soft launch" of 90-mph operation for *Lincoln Service* and *Texas Eagle* trains began July 7, 2021. Public schedules were not immediately updated, so trains arriving early at intermediate stations simply dwelled until the existing scheduled departure time. Run-time data was collected and used to develop the new schedules, implemented some weeks later.

On Sept. 17, 2021, the FRA approved the revised safety plan submission by UP, Amtrak, and several other railroads, which provided the upgraded PTC certification necessary to remove the 90-mph limit. Union Pacific and Amtrak also began to collect data and perform analysis to demonstrate that the combined PTC/XITCS operation could safely support 110-mph operations. In October 2022, UP submitted

yet another safety plan petitioning for 110-mph operation, followed by a revision in February 2023. On March 20, FRA provided its approval — the first to utilize a freight railroad's PTC system for operation above 90 mph. All regulatory and technical hurdles had now been cleared!

Since the move from 90-mph to 110-mph operations did not involve any technical changes to the PTC system or XITCS, there was little to do other than establish new timetable speed limits and make a couple of test runs. On May 3, 2023, the UP Joliet and Springfield Subdivision timetables were updated to reflect 110-mph maximum authorized speed for Amtrak passenger trains (100 mph for trains with Superliner equipment), constituting (again) a silent launch of operations at that speed. During subsequent weeks, operations were monitored closely and train performance data was gathered, which served as input for the revised public schedule changes and celebration of June 26, 2023.

Author Greg Richardson, on the eve of his retirement from Union Pacific, prepares to board the head end of *Lincoln Service* train No. 304 at St. Louis for what proved to be a routine display of PTC and XITCS performance. Greg Richardson

EPILOGUE

In September 2023, on the eve of my retirement from Union Pacific, I rode the head end of Amtrak trains Nos. 301 and 304 on a Chicago-St. Louis round trip. The trip felt routine and the PTC and XITCS systems performed without exception, as they regularly do. These systems' reliability is impressive given all that goes on "under the covers".

Many outside observers have opined that the benefit of the new schedules do not justify the time and costs to achieve them, and that they compare unfavorably with those maintained by GM&O or even Chicago & Alton. In those "good old days," such passenger operations largely required only the will of the operating railroad; the entire operation was under a single managerial umbrella. It is a different world today with the mesh of funding, regulatory, operating, and local governmental organizations who all have a stake and say, and not a relevant comparison given contemporary realities. That the entire project got caught up in the industry PTC upheaval was a twist of fate rather than a case of mismanagement or incompetence.

I witnessed first-hand the waves of technological, regulatory, and financial fatigue experienced by various stakeholders (including me and my employers) during such a long endeavor. I consider the delivery of a reliable operation and the perseverance in the face of these obstacles to be career-level accomplishments by the people in each of the organizations involved. **I**