Trains SPECIAL

SPECIAL 10TH ANNIVERSARY ISSUE

LOCOMOTIVE 2015

Annual 2015

GE takes the Sunshine State

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Steinheimer's Tehachapi revisited p. 50

Where coal and crude converge p. 66

Spend a week in an Alco heaven p. 76

Motive Power Review, then and now p. 12

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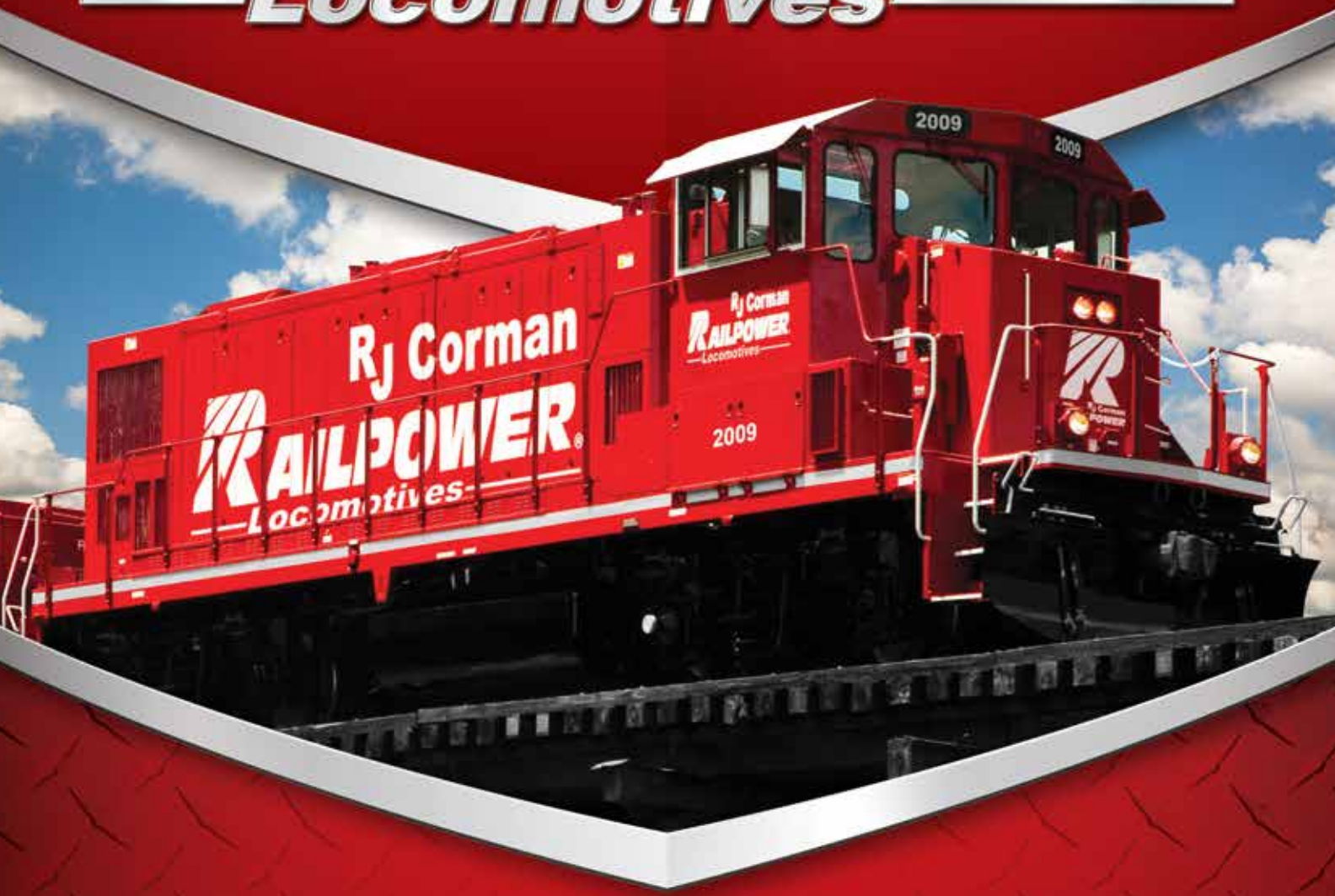

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LOCOMOTIVE 2015

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Trains SPECIAL

KALMBACH PUBLISHING CO.

On the cover: Florida East Coast Railway train 107 southbound on the FEC main at St. Augustine, Fla., on March 10, 2015. Scott Harris
This page: FEC 808 rests beneath the palms at Bowden Yard in Jacksonville, Fla. See page 40. Drew Halverson

LOCOMOTIVE X
ANNIVERSARY SPECIAL

Tehachapi! BNSF trains meet on a mountain railroad as spectacular now as ever. See page 50. Greg McDonnell

LOCOMOTIVE 2015

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A long way from California, Modesto & Empire Traction Co. No. 602 has a new home. See page 48. David Styffe

Oregon Pacific GMD1 No. 1413 leads a mixed train along the East Portland riverfront. See page 88. Kyle Weismann-Yee

>> On the Web

Delaware-Lackawanna diesels
See video footage of D-L RS3s at work and a D-L locomotive roster.

Bloomer Line extras
For more on Bloomer's fleet of classic EMD Geeps, see a complete roster.

We're havin' a party
Check out a roster and gallery of classic EMD cabs expected to take part in Streamliners 2016 in Goulburn, New South Wales, Australia.

Visit www.TrainsMag.com/Locomotives

"Alco doc" Don Colangelo and RS3 No. 4103 at the D-L shop in Scranton, Pa. See page 76. Greg McDonnell

It comes with the territory

Boston-bound *Acela* No. 2124 rips through Princeton Junction, N.J., on May 6, 2015. Hang onto your hat!

It's pure coincidence that two of the biggest motive power stories of 2015 lead straight back to the cover story of the first issue of this magazine. It's no coincidence that in this 10th anniversary edition of LOCOMOTIVE we've followed those leads to the assembly lines of GE Transportation's factory in Erie, Pa., and to the tidewater swamps and polished-steel "speedway to sunshine" on Florida's east coast. From its inception, this magazine's mandate has been to provide informative, in-depth, and imaginative coverage of the motive power scene.

GE's Evolution Series locomotive line was in its infancy when we first reported on the "Evolution Revolution" in the premiere issue of LOCOMOTIVE in 2006. We've kept pace with the Evolution story ever since, documenting the construction of a Union Pacific ES44AC ("Birth of a Locomotive," LOCOMOTIVE 2008), testing a new BNSF ES44C4 ("Test Drive a GE ES44C4," LOCOMOTIVE 2010), and following the development and introduction of the Tier 4 prototypes and test beds in recent issues.

Drew Halverson's exquisite treatment on Florida East Coast Railway's new *Champion* liveried ES44C4s, "GE takes the Sunshine State" (see page 40), and the new power profile of production-model Tier 4 ET44AC and ET44C4 locomotives (see page 34) take the Evolution story to the next level.

It's an exciting beat covering the locomotive scene. In doing so, we've been privileged to showcase the work of some of the most talented writers and photographers in our midst to document the drama of battling gravity on the east slope of the Alleghenies and over the legendary Elkhorn Mountain grade; to explore the erecting halls and assembly lines in Erie and Fort Worth, Texas; London, Ontario, and Muncie, Ind.; and go backstage in shops from Altoona, Pa., to Albany, Ore., and Livingston, Mont. We've tracked vintage diesels from upstate New York to the vineyards of California, the mountains of Slovenia and the wilds of Australia, and celebrated the

RS3s approach Nay Aug tunnel on Miss Phoebe's main. Two photos, Greg McDonnell

rescue and restoration of the last Alco PAs.

"The railroad business in particular — and railroading in general — is as exciting as it's ever been." A decade down the road, I'll stand by the words taken from this magazine's first editorial. And offer this proof: On a perfectly pleasant May evening, Paul Cordingley and I stood on the platform at Princeton Junction, N.J., and watched as a twinkle on the horizon rapidly materialized into the sleek silver-and-blue form of a speeding Amtrak *Acela*. In a flash, the train was upon us; headlights glinting off the polished steel of the quadruple-track main, catenary singing, electric-blue flashes from an extended pantograph. *Acela*! A blur of logos and windows and metallic sheen, and with a hang-onto-your-hat rush of wind, it was gone.

Just hours earlier, we'd ripped through Princeton Junction on a New York-bound *Acela* making every bit of 100 mph, having topped out at 135 mph on the fast track. A little more than 12 hours later (and a world away) we were holding down seats in the cab of Delaware-Lackawanna No. 4068, one of two 63-year-old RS3s muscling grain empties over Miss Phoebe's Pocono Mountain main (see "Still Rockin'," page 76).

In sensory overload from the experiences of the past 24 hours, I climbed down from the RS3 in Scranton, recalling the words of Kevin Keefe, the creative mind behind this magazine. When he pitched the concept more than a decade ago, Kevin included a simple stipulation: make it exciting, and make it fun. It comes with the territory, Kevin. It comes with the territory.

Greg McDonnell, editor

GE Evolution revolution goes global

Worldwide Evo sales top 7,500 and counting ■ by Greg McDonnell

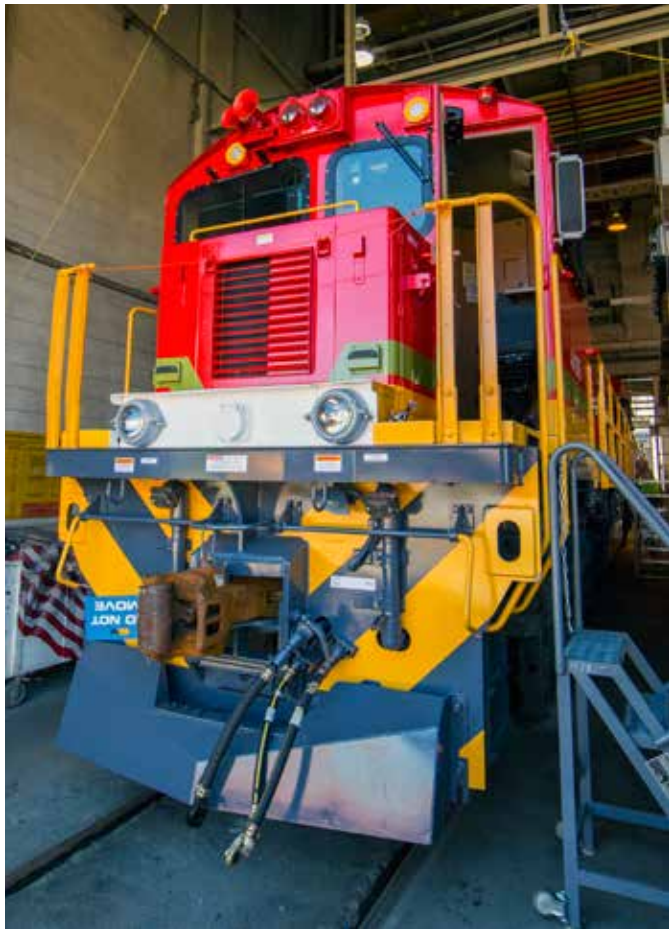
GE Transportation has a rich history of building locomotives for the global market. Indeed, the "U" in GE's legendary U-series locomotive line had nothing to do with the popular "U boat" moniker and everything to do with the builder's ambitions. "U," GE will tell you, stood for universal. GE has been building locomotives for the world market for almost as long as it's been building locomotives, from 42-ton electrics built in 1912 for a Manchurian colliery in China, through generations of U-series, Dash 7, Dash 8, and Dash 9 models in every configuration and gauge, to new Evolution Series locomotives.

It's estimated that there are more than 20,000 GE locomotives in service worldwide. For the past decade, many international customers have stuck with models powered by the traditional FDL engine. The latest Tier 4 locomotives under construction for North American customers share space on the Erie erecting floor with such exotics as dual-cab, narrow gauge Indonesian CM20-EMPs powered by eight-cylinder FDLs and B+B-B+B Dash 9-40BBWs for South America. But the Evolution revolution is catching on around the globe.

China became one of the first international Evolution Series customers with an order for 650 6,000-hp ES59ACis. GE has also developed dual-cab, wide-body EVOs for Kazakhstan and neighboring CIS Region (former Soviet, Commonwealth of Independent States) countries, and is supplying GEVO engines for new Russian TE116 locomotives. South Africa has signed on for 233 4,000-hp ES40ACis, descendants of the FDL-based C30ACi. In South America, the transition from Dash 9 to Evolution technology is gaining, with orders on the books for the first eight-axle EVO model: B+B-B+B ES43BBi locomotives for Brazil.

"Our International Evolution series has become a cornerstone of our locomotive-product portfolio globally, due to the life-cycle-cost advantage it carries," notes Gary Lada, executive product manager, Global Locomotives. "It takes advantage of our most fuel-efficient engine while maintaining global emissions flexibility."

GE is in the world market for the long haul. ↥



New for Transnet Freight Rail in South Africa are 233 narrow gauge 4,000-hp ES40ACi EVOs, descendants of the successful FDL-based C30ACi. Greg McDonnell

NORTH AMERICA

Canadian National 250
125 ES44DC
201 ES44AC

Canadian Pacific 291
291 ES44AC

CSX Transportation 852
302 ES44DC
550 ES44AC

Norfolk Southern 386
220 ES44DC
166 ES44AC

Union Pacific 1209
1209 ES44AC

BNSF 2589
715 ES44AC
1153 ES44C4
721 ES44DC

Kansas City Southern/ Kansas City Southern de Mexico 220
245 ES44AC

Ferromex/Ferrosur 123
123 ES44AC

North American regionals 171:
126 ES44AC
24 ES44C4
20 ET44AC
1 ES44DC

Citicorp
100 ES44AC

Florida East Coast
24 ES44C4

Iowa Interstate
17 ES44AC

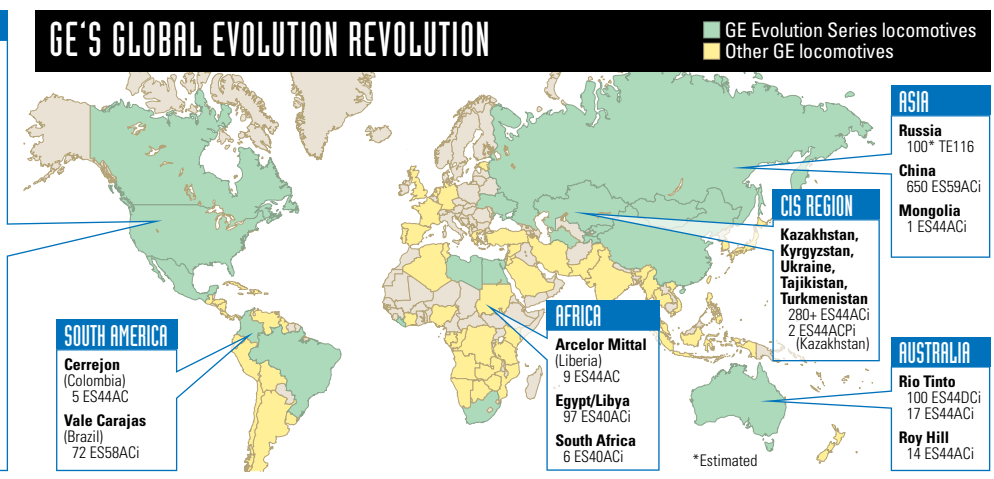
Savatran
3 ES44AC

Arcelor Mittal
2 ES44AC

Cemex
1 ES44AC

GE
27 ET44AC

GE'S GLOBAL EVOLUTION REVOLUTION

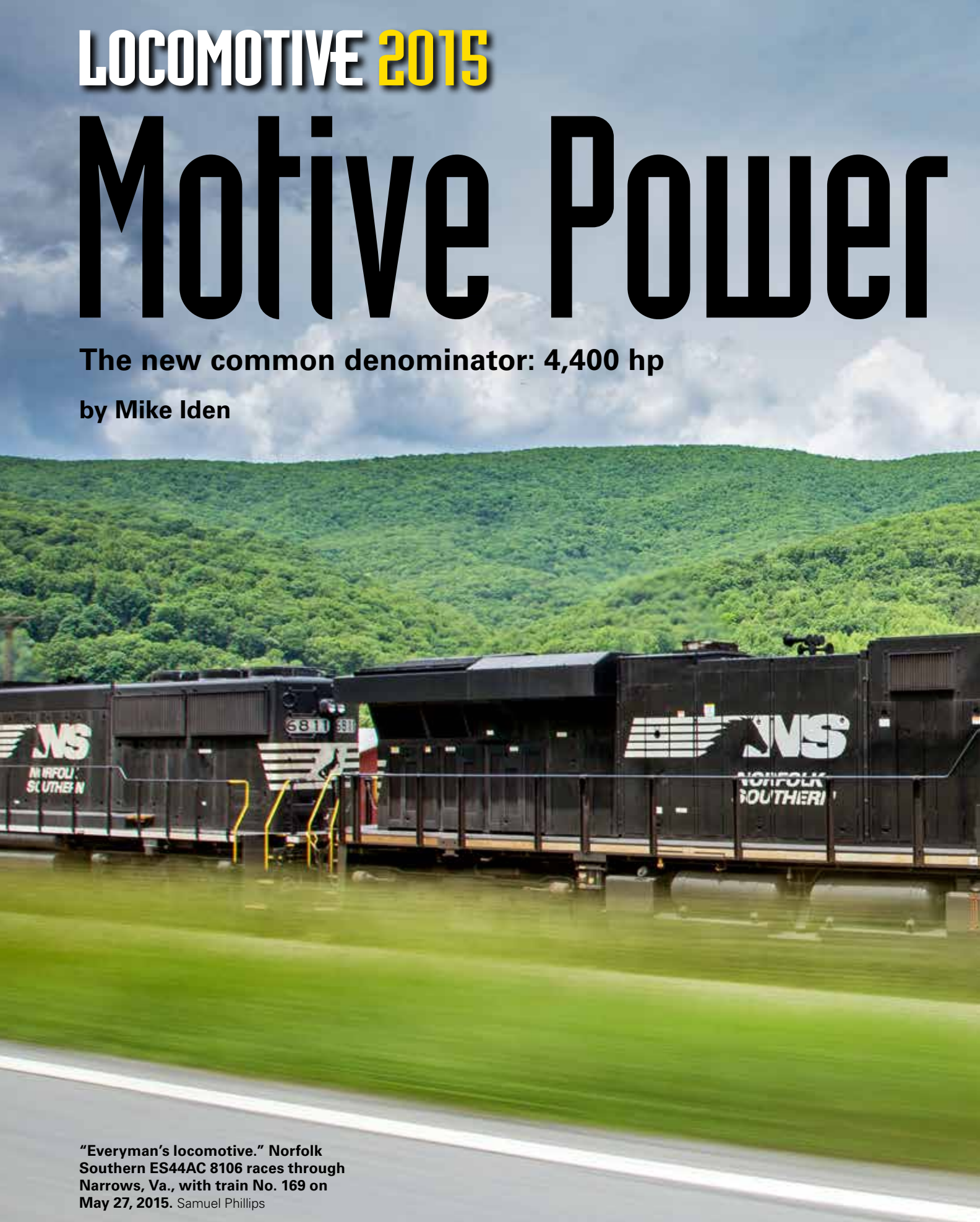


LOCOMOTIVE 2015

Motive Power

The new common denominator: 4,400 hp

by Mike Iden



"Everyman's locomotive." Norfolk Southern ES44AC 8106 races through Narrows, Va., with train No. 169 on May 27, 2015. Samuel Phillips

Review

LOCOMOTIVE X
ANNIVERSARY SPECIAL

"Everyman's locomotive." In the 17th annual motive power survey in the August 1965 issue of TRAINS, Editor David P. Morgan declared 2,500 hp as the common denominator that defined "everyman's locomotive," further noting, "seldom if ever had there been such singularity of choice in the market as was displayed in 1964." A half-century later, 4,400 hp is the new common denominator, and everyman's locomotive is a six-axle, A.C.-traction machine, packed with microprocessors and technology that was the stuff of science fiction when the GP35 was the best seller and Alco's C628 was the "most powerful single-engine unit" on rails.

How does the motive power of 2015 stack up against Morgan's everyman's locomotive of 1965? What's changed, how did we get there, and why?

TRAINS published its annual motive power survey for 44 years, from 1949 to 1992. After I became a subscriber about 1962, the issues that I consistently awaited the most as a young reader were those containing the annual review of all things locomotive, especially diesels. I usually ignored the remainder of the magazine until I had read and re-read the survey. I look back now and think about those issues, and how they contributed to the development of my own calling in the railroad industry. Those articles by Morgan — and Jerry Pinkepank, J. Parker Lamb, Louis Marre, J. David Ingles and others — enabled me to be backstage, so to speak, with diesel locomotive operations, maintenance, manufacturing, and design.

Get the full story: Read David P. Morgan's complete 1965 motive power survey beginning on page 84.

I recently looked back at all 44 TRAINS surveys. Morgan authored the first 20 (1949-1968); Pinkepank did three (1969-1971); Ingles took up the mantle with the next 15 (1972-1986). Tom Yagerhofer did one (1987), followed by Greg McDonnell with three (1988-1990). Paul Schneider delivered the final pair in 1991 and 1992. LOCOMOTIVE revived the tradition and has carried the torch for a decade.

In re-reading the original surveys, I was struck by the historical timeliness of the first, "The Shift From Steam," published in April 1949. This was the year in which Baldwin, America's oldest and most famous locomotive builder, delivered its final domestic steam locomotive: Chesapeake & Ohio No. 1309, a 2-6-6-2 articulated. The next year was Baldwin's 125th in the business, and its first without any domestic steam production. Morgan's first survey heralded the beginning of the end for

An eastbound UP coal train snakes through Red Gorge, west of Radium, Colo., with three midtrain DPUs and a lone rear DPU to keep the train in check on the mountain grades of the Moffat Tunnel Sub. Mike Danneman

steam. A year later, in the 1950 survey, he wrote that the big U.S. railroads "almost forgot steam," and within a decade, steam power had all but vanished.

By midcentury, dieselization was unstoppable, driven by economics and overturning a century-plus relationship between railroads and the steam locomotive builders. In the steam era, many railroad mechanical staffs designed or detailed their locomotives, which the builders would then manufacture and assemble. Locomotives with a common wheel arrangement on different roads frequently had nothing else in common. "Here are the design details for my connecting rods, boiler and tender: build me this 4-8-4." Commercially successful diesel locomotives such as the FT were being assembled for different railroads in quantities using standardized parts. Practically the only option given to the purchaser was, "What color do you want it painted?" More importantly, financial and accounting managers were often making final purchasing decisions.

"Disruptive innovation." Electro-Motive's pioneering FT road locomotive presented steam locomotion with its greatest challenge, and ultimately changed railroading for good. Greg McDonnell

Prior to World War II, steam locomotives were relatively cheap to acquire, but were more maintenance-intensive and effectively used only about 5 percent of their fuel's energy content. Diesel locomotives were more expensive to acquire but could be four-to-five times more efficient in using fuel, and they eliminated the need for an entire infrastructure of coaling towers, water tanks, ash pits, and boiler shops.

In today's technology-driven world, the steam-versus-diesel battle can qualify as an example of what is now called "disruptive innovation," a theory developed by Harvard business professor Clayton Christensen in 1995. Steam locomotives had matured greatly, becoming what is known today as a "sustaining technology." They met the needs of even the largest railroads, and technological changes were modest and small. Diesel locomotives in the early 20th century were too small and not powerful enough for most railroads, had immature features and posed little threat to steam. During the 1930s diesel locomotives jumped the gap — thanks largely to Electro-Motive's pioneering FT road locomotive — to become steam's great challenge, establishing diesel locomotives as a "disruptive technology."

In 1968, Morgan wrote his 20th and last motive power survey, "The Iron-Horse Opera." Subtitled "Confessions of a Middle-Aged Locomotive

"Everyman's locomotive," 1965 version. EMD's 2,500-hp, B-B GP35 debuted in 1963, outsold its GP30 predecessor, and more than doubled the sales of the competition. EMD

Union Pacific SD59MX No. 9922 ambles through American Canyon, Calif., on Genesee & Wyoming's California Northern Railroad. Drew Halverson

Reporter," the feature opened with a retrospective commentary on the previous two decades: "A lot of diesels have gone over the dam in the past 20 years. And I've been watching them go by as I've reread 104 pages' worth of earlier TRAINS annual motive power surveys by way of homework for this 20th edition. In retrospect, I can see that these add up to a sort of mechanical soap opera." He added: "As the premier survey wistfully noted, my lot was to document a marriage, not a romance."

Let's take a look at 11 key points in Morgan's 1965 survey and consider how they relate to today's railroading. My comments will focus on over-the-road, high-horsepower freight locomotives; not yard, passenger, or commuter power. Also, in discussing locomotive builders, we will limit the discussion to those that have been producing quantities of large high-horsepower freight locomotives.

1 Singularity of choice in acquiring new locomotives

Morgan discussed singularity of choice in 1965 in terms of the increasing commonality of locomotive features. Singularity today means more of the same and also the temporary shrinkage of the U.S. road locomotive manufacturing base to a single builder.

In 1965, new high-horsepower diesel freight locomotives were singularly similar with four or six direct-current traction motors in B-B or C-C configuration with a turbocharged V-16 diesel engine rated at 2,500 hp for traction. (In the mid-1960s, engine horsepower was considered the most important element of locomotive performance.) A railroad could choose between EMD, GE, or Alco models available in any color with available optional features.

The engine itself was the greatest difference. EMD was using the second generation of the two-stroke-cycle technology it pioneered in the 1930s, and Alco and GE were using four-stroke-cycle engines. As Morgan described it, the 1,600/1,750 hp B-B units so common in the mid-1950s were being eclipsed by 2,500 hp B-Bs.

Freight trains were not only getting longer, the cars themselves were getting heavier. Atlantic Coast Line had blown away the four-motor ceiling, sampling 2,500-2,750 hp C-Cs from all three builders. Freight cars were growing too: from 50-ton capacity to 70 or more tons per car, and Southern Railway was introducing the lightweight, aluminum-bodied, 100-ton capacity "Big John" covered hoppers.

In 2015, the choice of new freight locomotives in the U.S. is simple. Everyman's new high-horsepower locomotive — at least temporarily — is manufactured by GE Transportation. This is the first year since 1924 when only one U.S. builder has offered new diesel locomotives for over-the-road service, and the first year since 1934 for the absence of new domestic locomotives bearing the Electro-Motive name. More on that later.

GE's Tier 4 freight locomotives are the newest version of the Evolution Series built since 2005 under Environmental Protection Agency locomotive emission Tiers 2 and 3. The Tier 4 Evolution includes exhaust gas recirculation (EGR), and the largest cooling system ever installed on a single-engine GE locomotive. EGR is an emissions-reducing technology, first used on automotive gasoline engines in 1973, which re-circulates ("re-breathes") about 10 percent of an engine's exhaust gases, which are cleaned and cooled before returning to the engine, reducing emissions out the exhaust stack. A distinguishing feature of all Tier 4 locomotives will likely be cooling systems that are physically larger than their engines.

The first U.S. locomotives to have EGR were 10 repowered "SD59MX" units delivered by EMD to Union Pacific in 2010-11. These were a joint effort by UP and Caterpillar-EMD to investigate the use of EGR on EMD 710-series engines. In order to provide space for the EGR technology, UP chose to have donor SD60Ms repowered with a smaller V-12 710 engine to replace the original V-16 prime mover. All 10 units are in service in California.

"Singularity of choice." EMD's pre-Tier 4 offering has been the 4,300-hp, A.C.-traction SD70ACe. Greg McDonnell

GE's Tier 4 locomotive will retain the 4,400-traction-horsepower rating offered since the first Dash 9 locomotives were built for Chicago & North Western in 1993. EMD had been producing domestic 4,300-

"Raising the bar." C&NW's drive for an "enhanced" Dash 8 to speed up Powder River coal trains inspired the GE Dash 9-44CW and established the 4,400-hp threshold. Five of them head trains at Bill, Wyo. Mike Danneman

hp locomotives under EPA Tiers 2 and 3 through 2014.

Cat-EMD's absence from the U.S. market for new locomotives starting this year was publicly announced in July 2014 as being temporary until as late as 2017 to allow completion of the design and validation of new freight locomotives that meet the Tier 4 standard. (Tier 4 became effective for newly manufactured locomotives at midnight on Jan. 1, 2015.) This is the 16th year that the EPA has been regulating the exhaust emissions of newly manufactured and overhauled locomotives in the U.S. The specifics of Cat-EMD's Tier 4 engine and locomotive could be considered this summer's suspense in the ongoing "mechanical soap opera."

2 The grand debate: four traction motors versus six

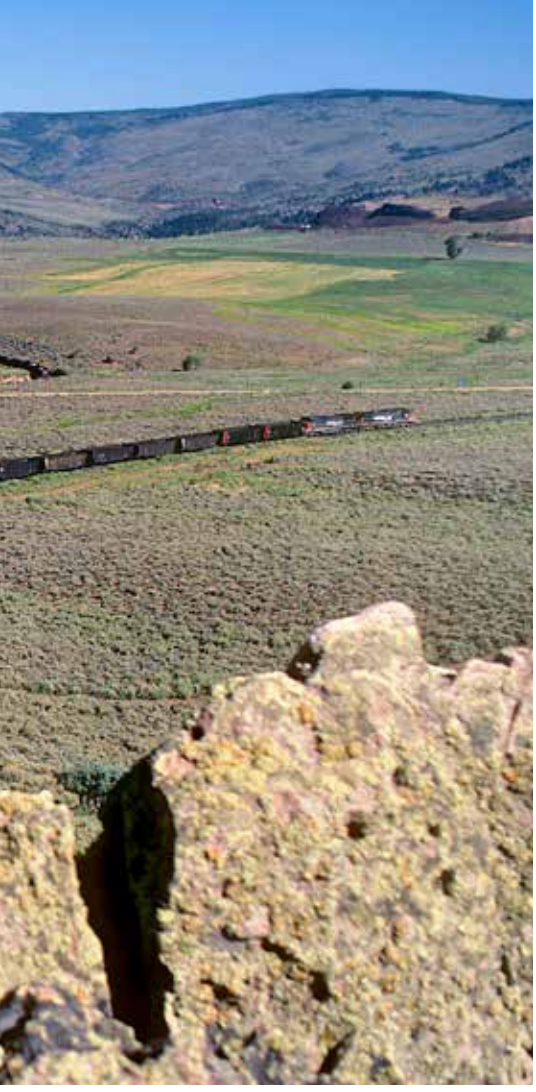
The debate has (almost) ended. The mainstream transition from four to six D.C. traction motors began in 1963 when the Atlantic Coast Line received its EMD SD35s, GE U25Cs, and Alco C628s. Fairbanks Morse's six-motor 2,400-horsepower Train Master of the early-1950s should have been a landmark locomotive design, but 1950s railroads lacked an effective understanding of the relationship between horsepower, number of motors, tonnage ratings, and speed capabilities. The Train Master was too much locomotive too soon.

It has been 21 years since Southern Pacific became the last major U.S. railroad to purchase four-axle, four-motor units when EMD's London, Ontario, plant delivered the last GP60s in February 1994. With the exception of BNSF and Florida East Coast acquisitions of GE's unique six-axle, four-A.C. motor ES44C4 units (rated as equiva-

What's in a name?

The "EMD" label requires some historical clarification. Electro-Motive Engineering Corp. began business as a passenger railcar-engineering firm in 1922. It was purchased by General Motors in 1930 and rebranded as Electro-Motive Corp., or "EMC." It became the Electro-Motive Division of General Motors (the historic "GM-EMD") on Jan. 1, 1941. GM sold the Division in 2005 to a private investment group, which on Aug. 2, 2010, resold the business to Progress Rail Services Corp., a subsidiary of Caterpillar Inc. Today's EMD is legally known as Electro-Motive Diesel Inc. To avoid confusion with "GM-EMD" in 1965, this article will refer to today's EMD as "Cat-EMD."

Greg McDonnell



"Bigger trains plus more horsepower will make midtrain power mandatory." Two AC4400CWs up front, two midtrain, and one on the rear work an SP coal train through the Crater Loops near Crater, Colo. Mike Danneman

Three EMD models bring a coal train up Nebraska's Crawford Hill, on May 21, 2006. The train has two SD70MACs up front with another in DPU mode. The SD75I/SD60M/SD60M trio is a manned helper set. Tom Danneman

After being banner tested at the foot of the grade, UP SD70ACe No. 8923 leads a Wash, Utah, to Midwest City, Okla., crude-oil train down the 2-percent grade in Coal Creek Canyon west of Denver on Jan. 15, 2015. John Crisanti

lent to six-motor Dash 9s or ES44DCs), the pure four-axle, four-motor freight locomotive appears to be a dead design.

Why? Because engineers simply cannot package what the large railroads want — large fuel tanks for long operating range, high tractive effort for low-speed performance, and high engine horsepower for speed — onto a shorter, lighter, four-axle platform. Throw in mandatory compliance with EPA emission standards, too: Remember the discussion about ever-larger cooling systems?

The practical weight limit for a six-axle locomotive is 432,000 pounds (which includes allowance for the weight of a locomotive's variable supplies such as diesel fuel and traction sand), or 72,000 pounds per axle. Older readers may remember Western Pacific's four-axle U30Bs from the 1960s, weighing 288,000 pounds each and also averaging 72,000 pounds per axle.

A four-axle GP60 can carry up to 3,600 gallons of fuel. Today's six-axle units come with 5,000-gallon tanks, achieving a 39-percent increase in fuel capacity. Larger fuel tanks give railroads flexibility in where and how often they refuel locomotives. For a transportation manager, a locomotive that has run out of fuel can be the ultimate failure.

The liquid supplies on a diesel locomotive weigh a lot. A 5,000-gallon tank will hold 35,500 pounds of fuel. The 450 gallons of engine lubricating oil weigh about 3,300 pounds, and 450 gallons of radiator water add another 3,700 pounds of weight. That adds up to 21¼ tons of operating fluids per unit. Include the weight of the fuel tanks, the super-large radiator packages, the D.C.-to-A.C. power inverters for A.C. traction motors, and stronger front noses for crashworthiness, and you have a locomotive that's simply too heavy for four axles.

The ultimate expression of UP's two-units-in-one philosophy was the DDA40X. In July 1984, UP 6913 and three NS C39-8s roll an eastbound intermodal train through Hermosa, Wyo. Mike Danneman

GE Dash 9s are BNSF's second most prolific locomotives. On Sept. 12, 2010, a BNSF westbound holds in the siding at Austin, Mont., as an eastbound approaches. Both trains are headed up by Dash 9s. Tom Danneman

Class I statistics 1964 vs. 2014

Horsepower sold 1964 vs. 2014:
EMD 1964: 2,400,000 hp
EMD 2014: 2,445,950 hp
GE 1964: 532,500 hp
GE 2014: 3,069,650 hp
Alco 1964: 406,900 hp
Alco 2014: n/a

3 Goliaths and two-in-one units: high-horsepower plateaus

Today's railroads want big power in a practical size and standard configuration. In 1965, DPM noted that UP was all but alone pursuing its "two-units-in-one" philosophy. Between 1963 and 1965, UP acquired 71 5,000-5,500-hp double-engine units from EMD, GE, and Alco. Another 40 5,000-hp GEs and 46 6,600-hp DDA40X "Centennials" from EMD followed in 1969-71. Southern Pacific was the only other railroad to sample double-engine locomotives, taking three U50s from GE and three DD35Bs from EMD in 1964. Yes, the experimental 1960s Krauss-Maffei and Alco diesel-hydraulics built for the Rio Grande and SP had twin engines, but the diesel-hydraulic episode was a two-road technical experiment, albeit with important repercussions for the entire industry.

UP's passion for double-engine locomotives can be distilled to the need for speed over long distances. Only one thing buys speed in railroading: horsepower. Power is defined as the time-rate of doing work; thus, as power increases, so does the ability to generate ton-miles, the traditional measure of freight transportation work.

When UP dieselized after World War II, it often had to assign five or six units totaling 8,750 to 10,500 hp on every train. By comparison, most other U.S. roads found two or three locomotives and 3,000 to 4,500 total horsepower adequate. Beginning in 1955, UP even created "Omaha GP20s" — modified GP9s with four small turbochargers — to get an additional 250 hp per locomotive. Four years later, EMD introduced the turbocharged 567-series diesel engine in the GP20.

In midcentury, UP also became the only U.S. railroad to embrace gas turbines. UP purchased 25 4,500-hp, single-unit gas-turbine-electrics in 1952 and 1954, followed by 30 8,500-hp, two-unit-plus-fuel-tender "Big Blow" locomotives, built between 1958 and 1961. All of the GTELs came from GE. The 8,500-hp turbines were true goliath locomotives, with the B unit containing the gas turbine itself (a derivative of GE jet engine designs) and four large D.C. generators, mounted on a single, monstrous, speed-reducing gearbox, connected to the turbine shaft. In 1965, during Morgan's 20th survey, the turbines were operating at the pinnacle of their careers. The ultimate downfall of the turbine units was fuel: They had a prodigious thirst, and they were eventually retired in favor of newer, more fuel-efficient diesels. Gas turbines are also most efficient at full power, and even in UP's wide-open spaces, locomotives don't always operate in notch 8.

Having two diesel engines in one carbody did satisfy UP's horsepower needs, however. A single 6,600-hp DDA40X technically had the same high-speed capability as a pair of 3,000-hp SD40-2s or U30Cs, and UP ran the wheels off of them. The DDA40Xs at one time were accumulating 220,000 miles annually, achieving an average of more than 600 miles per day, a figure more common among well-utilized passenger locomotives than freight power. The downside was maintenance. When a double-engine unit had to be shopped, the entire 5,000-6,600-hp package was out of service. By the late 1970s, UP had attempted to extend life of the DDA40Xs by overhauling them, but corporately it had shed the double-engine philosophy, which involved super-large custom locomotives, in favor of smaller and simpler "everyman units" equipped with UP accessories.

However, the concept of "big locomotives" returned temporarily in the early 1990s when UP pursued 6,000-hp, single-engine designs from EMD and GE. This was a valid attempt to achieve a two-for-

"Piling more and more on the front drawbar pushes railroading nearer and nearer to the point of no return on coupler strength, which will make midtrain power mandatory." Two photos, Greg McDonnell

three replacement ratio (targeted at SD60s and Dash 8s) which resulted in the acquisition of 61 GM-EMD and 80 GE 6,000-hp A.C. locomotives. As with the twin-engine episode, only two other roads sampled the 6,000-hp units: CP acquired four EMDs and CSX acquired 117 GEs. None of the EMDs survive today, and almost all of the GEs have been re-engined with 4,400-hp power plants.

Just as the U.S. railroad industry settled into the era of 2,500-hp, four-motor units in 1965 and then 3,000-hp, six-motor units in the 1970s and 1980s, today's long-distance locomotive fleet is centered around 4,300-4,400-hp locomotives. Was there a catalyst in making 4,400 hp the new "everyman's" standard?

In the early 1990s, the industry's heavy-haul, six-motor, D.C. locomotives were GM-EMD's SD60 and GE's Dash 8-40C, rated at 3,800 and 4,000 hp, respectively. After acquiring its first Dash 8s in 1989, C&NW shifted from four units on coal trains in the southern Powder River Basin to three units, focused around Dash 8s. The Burlington Northern-C&NW Joint Line in eastern Wyoming was dispatched by BN, which was operating trains with four- or five-unit consists, usually a mix of 3,000-hp EMD/GE and 3,800-hp EMD SD60s leased from Oakway Inc., a subsidiary of Connell Rice & Sugar Co. BN dispatchers looked unkindly upon C&NW's loaded trains, which would operate uphill at speeds several miles per hour slower than their own.

In 1990, C&NW asked GE for an "enhanced" Dash 8 locomotive with 10-percent-more traction power — 4,400 instead

of 4,000 hp — to boost train speed in the Basin. Over the next several years, GE's Erie plant developed an "enhanced Dash 8" that ultimately became the "Dash 9" with an engine rated 4,400 hp. In late 1993, C&NW was the launch customer for the highly successful Dash 9-44CW. By 1994, GE began offering the AC4400CW, an A.C.-traction equivalent of the D.C. Dash 9. CSX was the first Eastern road to order AC44s in quantity; C&NW was first quantity buyer in the West. EMD, of course, made landmark sales of the pioneering, 4,000-hp SD70MAC to Burlington Northern, but by 1996 had upgraded to 4,300-hp SD70M-2 and SD70ACe locomotives. By 2005, the industry had established 4,300-4,400 hp as the new common denominator.

"Streamlining is dead." Today, locomotives are utilitarian machines that define function over form. All the same, they're impressive machines, as illustrated by UP SD70ACe No. 8962 at Mojave, Calif., in April 2015.

4 Coupler strength will always limit the length of freight trains

Engineers can design only so much strength into couplers and knuckles; when couplers break, you no longer have a train.

Couplers and knuckles have always been an important part of railroad technology, giving us the ability to connect individual locomotives and cars to make a train. "Piling more and more on the front drawbar," Morgan wrote, "pushes railroading nearer and nearer to the point of no return on coupler strength, which will make midtrain power mandatory." Morgan was right, and he was much ahead of his time.

Since 1965, improved steel and casting technologies have produced stronger couplers and knuckles, but individual freight-car weights have also increased. Freight trains are longer and heavier, and more-powerful locomotives (think A.C. motors) are now common. All of these changes come into play in various ways, depending on a railroad's operating practices and ter-

With over 700 produced for Burlington Northern and later BNSF, the A.C.-traction SD70MAC is a staple on coal trains. Three BN SD70MACs lead eastbound coal loads through Dewey, S.D., in May 1995. Tom Danneman

rain. What works successfully in Ohio and Indiana can be radically different from requirements in the Sierra Nevada or Rocky Mountains.

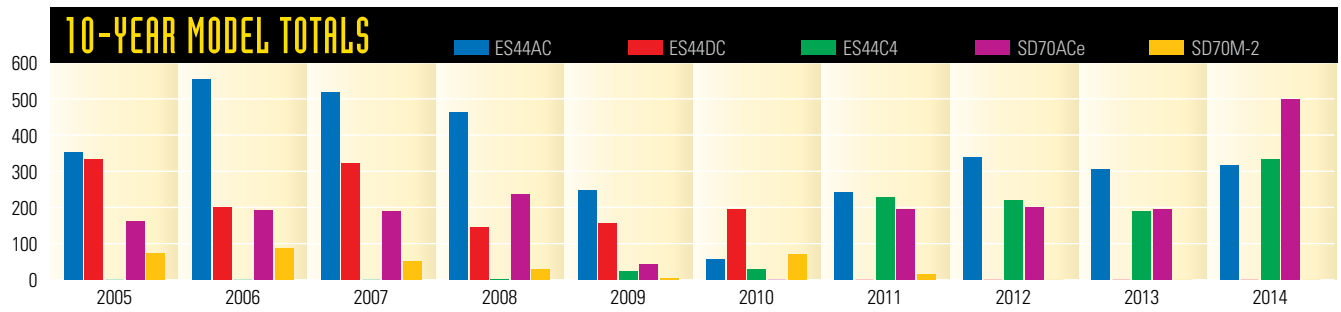
The classic solution has been to limit the weight of a freight train to avoid exceeding the strength of couplers on the cars directly behind the locomotives. A different solution is to "distribute" the locomotive power, reducing the number of units on the head end and placing the remaining locomotives at midtrain or on the rear end. Historically, this involved manned helper units, but the arrival of Locotrol enabled unmanned helper operation. This is where "distributed power" entered the equation. See item No. 8, further on.

5 Streamlining is dead; graceless locomotive design governs

In 1965, David P. Morgan said,"The streamlined A1A-A1A passenger cab unit is apparently as passé as the carrier pigeon," heralding the dawn of "a graceless era of locomotive design in which, perhaps necessarily, functionalism has supplanted esthetics." Today's locomotives may be "graceless," but esthetics don't move freight trains.

GM-EMD built its last streamlined E unit in December 1963. Railroads had dieselized many freight operations largely with EMD F units, but railroads in the mid-1950s began to prefer non-streamlined road-switcher or hood-type units. A streamlined F9 and a boxy GP9 had identical horsepower and tractive effort, but the Geep was bidirectional, and thanks to exterior walkways, easier to maintain. Operations and maintenance needs trumped esthetics.

MLW Industries (formerly Alco affiliate Montreal Locomotive Works) built the first wide-nose units in 1973 for Canadian National. Those M420s also started an industry trend in strengthening locomotive front noses for improved crashworthiness. The last conventional narrow-nose, high-horsepower units for a Class I



In low-speed, hard-pull situations, A.C. motors outperform D.C. significantly. To the point: NS SD70ACe No. 1138 grinds coal loads up Elkhorn Grade at Switchback, W.Va. Samuel Phillips

railroad were SD70s delivered to Illinois Central in 1999.

In 1990, the Association of American Railroads issued an industry standard for front noses with improved crashworthiness. The standard has been revised several times, and federal law for newly manufactured locomotives built after Dec. 31, 2008, now requires the design features.

Crashworthiness has helped to shape the increasing angularity of locomotive noses. The passenger and commuter world continues to use semi-streamlined noses, which are usually molded fiberglass covers applied over a strong crashworthiness bulkhead hidden from view.

A big advantage of streamlining is reducing aerodynamic drag, especially at higher speeds and mostly on the leading locomotive. Freight locomotives generally operate at lower speeds, and when they're in trailing positions behind the lead unit, any such advantage is diminished.

Ferromex EMD SD70ACe No. 4045 muscles a Canadian Pacific oil train into downtown Milwaukee on April 16, 2014. Drew Halverson

CSX ES44AC No. 3198 speeds past its Erie, Pa., birthplace with an eastbound intermodal train on June 24, 2015. Greg McDonnell

6 Narrowing the field — and then there were two

By 1965, the mainstream ranks of U.S. locomotive manufacturers had declined from six in the early 1950s to half that number. Baldwin and Lima (after merging as Baldwin-Lima-Hamilton in 1951), and Fairbanks Morse called it quits, leaving GM-EMD, GE, and Alco.

"Electro-Motive wrote up orders for almost 2.4 million horsepower in 1964," noted Morgan, remarking further that the figure accounted for "comfortably more than double the domestic business of its two rivals combined."

Alco exited the market in 1969. GE — declared "Best Supporting Actor in the locomotive game" by Morgan in 1965 — ultimately turned the tables on its rival. For the past two decades, the domestic locomotive world has been upside down, with GE outselling EMD (in any of its three forms) since the mid-1990s. The current sole-supplier situation in the U.S. is likely to be short-lived.

"A locomotive's territory can now be defined by where the rails go, not where the property ends." Headed for Charlotte, N.C., Kansas City Southern ES44AC 4836 leads NS train 80A over Trace Fork Viaduct in Amonate, Va. Samuel Phillips

7 The horsepower race is pushing builders toward A.C.-D.C. designs

Direct current is just about gone. A.C.-D.C. is "yesterday." A.C.-D.C.-A.C. is "today and tomorrow."

The domestic locomotive industry is now in its third generation of electrical transmissions, having started early in the 20th century with all-D.C. transmissions. Locomotive builders switched to A.C.-D.C. designs by 1965, and began the commercial transition to A.C. traction in 1993.

The GP35 was GM-EMD's last all-D.C. locomotive, with its 2,500-hp engine powering a massive D.C. generator. To harness the generator's power, engineers used ever more complex control systems, and as electrical complexity increased, maintenance became more complicated and reliability declined. The solution was the more efficient and reliable A.C.-D.C. transmission, with the engine turning an A.C. alternator, and the variable-frequency A.C. power being converted into D.C. power (for the D.C. traction motors) using power diodes.

The introduction of A.C. traction motors brought about the next step: A.C.-D.C.-A.C. transmission. The diesel engine powers an A.C. alternator, with the A.C. output power rectified into D.C., which goes into power converters — also called insulated gate bipolar transistors or IGBTs. These high-power electronic switches convert the positive- and negative-polarity D.C. power into a synthetic A.C. "waveform." On some A.C. traction locomotives, the power inverters produce the synthesized A.C. power wave by switching D.C. power on and off more than 500 times per second at low locomotive speed, when maximum tractive effort is required.

A.C. traction motors require complex power conversion equipment, but have two key advantages over D.C. motors. A.C. traction motors are essentially "self correcting" in low-speed, high-tractive-effort, wheel-slip situations. Furthermore, A.C. motors are extremely simple, robust, and resistant to moisture and heat. A D.C. motor's two worst enemies are water, which can cause electrical short circuits, and heat, which can degrade electrical insulation and distort the copper commutator assemblies.

In low-speed, hard-pull situations, A.C. motors outperform D.C. significantly. A.C. motors were common in Europe starting in the 1950s, largely on straight-electric locomotives. North American philosophy was to stick with D.C. motors. Canadian Pacific started the shift to A.C. traction in 1984, when it invested $6 million to experimentally rebuild one-of-a-kind MLW M640 No. 4744 from a 4,000-hp, D.C.-traction, C-C locomotive to an A1A-A1A configuration with four A.C. traction motors. Four 881-hp A.C. motors from Brown Boveri Canada were installed to match the available diesel engine power rating. CP also wanted to assess the ability of four A.C.-powered axles to do the same work as six D.C. motors.

As noted in a late-1980s technical paper on the project, CP verified that A.C. motors could achieve much greater wheel-to-rail adhesion (the percent of weight on the wheels converted into tractive effort or pulling force) than D.C. motors, and that A.C. motors were more resistant to failures caused by moisture and heat.

In 1992 the Association of American Railroads formed an ad hoc committee to investigate A.C. traction, with technical input from 10 railroads (BC Rail, Burlington Northern, C&NW, Conrail, CSX, Kansas City Southern, Norfolk Southern, Santa Fe, SOO Line, and UP) to develop a specification for a fleet of up to 26 experimental A.C. locomotives. A Journal of Commerce newspaper article describing the AAR project on Jan. 14, 1993, said that the railroads would likely negotiate individually with locomotive builders to acquire experimental A.C. units. The article quoted one railroad representative saying that U.S. roads had

EVERYMAN'S LOCOMOTIVE: 1964 VS. 2014

	1964: EMD GP35	2014: GE Transportation ES44AC
		
Engine	16-567D3A	GEVO-12
Cylinders	16	12
Main generator/alternator	D32 (generator)	GMG205
Traction motors	D67 (x4)	GEB13 (x6)
Traction horsepower	2,500	4,400
Maximum speed	71-83 mph (by gear ratio)	75 mph
Continuous tractive effort	52,000 pounds	166,000 pounds
Starting tractive effort	65,465 pounds	180,000 pounds
Continuous min. adhesion	21 percent	39 percent
Dynamic braking effort	n/a	98,000 pounds
Nominal weight	245,000 pounds	416,000 pounds
Length	56 feet 2 inches	73 feet 2 inches
Height	15 feet 3 inches	15 feet 5 inches
Fuel capacity	2,600 gallons	5,000 gallons
Oil capacity	243 gallons	450 gallons
Cooling water capacity	275 gallons	450 gallons

Members of a small fleet of GE Tier 4 test beds dispatched for pre-production, revenue-service tests on several roads, Nos. 2041 and 2025 work a BNSF intermodal at Berthold, N.D., in April 2015. Steven M. Welch


UPSU 600660
2041
2041

Class I statistics 1964 vs. 2014

Ton miles
1964: 665 billion
2014: 1.851 trillion
Source: Assoc. of American Railroads

not moved toward A.C. traction earlier because D.C. traction had not yet reached its limit of performance. However, that day was getting close. The committee's goal was for experimental six-motor A.C. units with 5,000-hp engines, but the AAR-sponsored A.C. test fleet never arrived.

Spectacular! The closest thing to John G. Kneiling's integral train, a UP coal train, with AC4400CWs fore, midtrain, and aft, wraps around Big 10 Curve, west of Denver. Mike Danneman

Shortly after publication of the Journal article, Burlington Northern announced an order for 350 4,000-hp SD70MAC units from GM-EMD, rendering moot the concept of an industry-sponsored "evaluation fleet." Within months, the A.C. traction wave swept the industry, from CSX in the East to UP and C&NW in the West, all of which ordered from GE. The two-builder domestic A.C.-D.C.-A.C. era was born.

A.C.-D.C. technology was not dead, however, as many roads opted for both D.C.- and A.C.-motored locomotives. The world's largest order for locomotives, for example, was Union Pacific's five-year, 1,452-unit deal for D.C.-motored SD70Ms from GM-EMD in 2000-2004. (UP has since acquired only A.C.-motored units.)

Today, every major freight railroad in North America — BNSF, CN, CP, CSX, KCS (which owns KCS de Mexico), Ferromex, Ferrosur in Mexico, NS, and UP — has been acquiring only A.C. locomotives for over-the-road service. NS and CN were the last converts to A.C., in 2008 and 2012, respectively. A.C. traction has even expanded into the regional railroad world: Iowa Interstate, Florida East Coast, and Arkansas & Missouri have acquired A.C.-traction locomotives.

8 Bigger trains plus more horsepower will make midtrain power mandatory

In 1965, the most common freight cars in North America carried 70 tons of freight. The 100-ton-capacity car was just beginning to appear nationwide.

Longer, heavier trains with all power on the head end increasingly produced more coupler failures, or "break-in-two" events. Two U.S. railroads experimented in the 1960s with unmanned, remote-control, intrain helper locomotives. In 1964-65, Louisville & Nashville tested F7A No. 830, equipped with an electronic "sensing and computation control system" from General Railway Signal, a pre-computer control system the size of a kitchen refrigerator filling

the front nose. The front coupler had small electronic "strain gauges" to sense if — and to what extent — the coupler was in tension (pulling a load) or compression (pushing a load). GRS gave the system the inelegant name of Train Multiple Unit-er, and L&N used No. 830 as the sensing-and-control unit with Alco RS3s in the middle of coal trains as long as 242 cars. No. 830 operated automatically and autonomously: When its front coupler was stretched, it applied increasing power, and when the coupler was bunched, it started reducing power.

In August 1964, Southern Railway began testing a radio-control system named Locotrol, made by a small Florida electronics manufacturer, Radiation Inc. Unlike the strain-gauged coupler system on L&N 830, Locotrol gave the locomotive engineer full control of the midtrain consist, including throttle setting, dynamic brakes, and the train's automatic air brakes, making the midtrain units function as if controlled by an onboard engineer. Locotrol electronics were also large and bulky, so Southern's approach was to equip certain locomotives with Locotrol control equipment (units with white number boards) and to use a remote-control "radio car" (looking like a doorless box car) as a midtrain receiver controlling the remote locomotive units. What Southern pioneered with Locotrol was the operation of long, heavy trains with abundant horsepower while reducing the risk of a break-in-two. Today's technology is microprocessor-driven, and comparable locomotives are dual-purpose, so they can control remote units as well as be controlled remotely.

In 1992, C&NW experimented with 150-car coal trains in Wyoming and Iowa; the objective was to increase coal tonnage handled per train. By the late 1990s, following the UP-C&NW merger, UP coal trains were shifting to all-A.C. power with Locotrol's successor, known as Distributed Power, allowing as many as four remote consists in any train instead of only one. Western coal trains soon grew from 110 cars to as many as 140 cars, with one or two A.C. units on the rear end. A.C. traction with DP was, however, only a part of the shift to longer coal trains. Many passing sidings, loading tracks at the mines, and unloading tracks at power plants had to be lengthened to handle the longer trains.

Four A.C. units with distributed power can now move as much coal as six D.C. units in the 1980s. Morgan's 1965 midtrain predictions were spot-on. What he could not foresee was that A.C. traction, ever-heavier cars, and distributed power would all combine (along with changes in train operations) to effect a major increase in freight-train productivity.

9 Integral trains, a threat to conventional locomotive designs?

John G. Kneiling introduced the integral train concept in a January 1968 TRAINS article, "The Next Breakthrough: The True Train." In it, he preached radical shrinkage of the U.S. railroad network, operating small numbers of "integral" trains, and abandoning all switching and classification

2014 NEW LOCOMOTIVE CONSTRUCTION

GE: 746 (Erie 497, Fort Worth 249); EMD/Progress Rail: 613 (Mexico 378, Muncie 235); MPI: 59; Siemens 23, NREC: 14; Brookville: 7

Railroad	Qty.	Road number	Builder	Type	Order/Serial No.	Build date	Notes
Amtrak	23 (70)	608-630	Siemens	ACS-64	**	01/14*-12/14*	1
BHP (Australia)	18	4450-4467	EMD	SD70ACe/LCI	20138907-001 to -018	10/14-11/14*	4
BNSF	7	6500-6506	GE	ES44C4	62349-62355	11/14*	3, 9
BNSF	12 (25)	7186-7196, 8006	GE	ES44C4	62060-62070, 62080	01/14*	10
BNSF	6 (161)	7931-7935, 7937	GE	ES44C4	63013-63017, 63019	12/14*	3, 10
BNSF	285	8007-8291	GE	ES44C4	62081-62348, 62546-62	01/14-11/14*	11
BNSF	190	8520-99, 8400-99, 8990-8999	EMD	SD70ACe	20136925-001 to -190	04/14-12/14	5
BNSF	20	8500-8519	EMD	SD70ACe	20116581-001 to -020	04/14*-05/14*	4, 7, 12
Canadian National	60	2865-2924	GE	ES44AC	62654-62698, 62842-56	08/14*-12/14*	2
Canadian Pacific	60	2270-2329	EMD	GP20C-ECO	20137934-001 to -060	07/14*-12/14*	4
CBH (Australia)	3	CBH023-CBH025	MPI	MP27CN	SN 2595-01 to -03	09/14-12/14	13
Central California Traction	2	1201-1202	Brookville	BL12CG	9919-9920	11/14-12/14	
CFCL Rail (Australia)	3 (10)	CM3308-CM3310	MPI	MP33C	SN 2432-08 to -10	01/14	14
CFCL Rail (Australia)	6	CM3311-CM3316	MPI	MP33C	SN 2549-01 to -06	03/14-05/14	
CFCO (Congo)	10	CC1301-CC1310	EMD	GT38AC	20118584-001 to -010	01/14-02/14*	4
Citirail (CREX)	35	1401-1435	GE	ES44AC	62723-62757	06/14*-08/14*	2
CLN Vale (Mozambique)	50	1801-1850	GE	DASH 9-40BBW	62357-62406	03/14*-11/14*	2
Colas Rail (United Kingdom)	5 (9)	70806-70811	GE	PH37ACmi	61863-61867	**/14	2
EMD	1 (2)	0001	EMD	SD70ACe	20138909-001	09/14*	15
Florida East Coast	24	800-823	GE	ES44C4	62699-62722	10/14*-12/14*	2, 16
GBRf (United Kingdom)	21	66752-66772	EMD	JT42CWRM	20128816-001 to -021	06/14*-10/14*	4
GECX	2 (5)	2021-2022	GE	ES44AC	61739-61740	04/14	8
GECX	13 (20)	2025-2037	GE	ES44AC	62517-62529	11/14*-12/14*	8
GO Transit	7 (10)	660-666	MPI	MP40PH-3C	SN 0712-04 to -10	02/14-10/14	
Iowa Interstate	3	514-516	GE	ES44AC	62986-62988	11/14	18
Kansas City Southern	10	4165-4174	EMD	SD70ACe	20146999-001 to -010	03/14-04/14	5, 19
Kansas City Southern	25	4175-4199	EMD	SD70ACe	20136954-001 to -025	09/14*-11/14*	4, 20
Kansas City Southern	50	4820-4869	GE	ES44AC	62563-72, 62758-62797	05/14*-10/14*	2, 21
Massachusetts Bay Trans. Authority	37 (40)	2002, 2004-2039	MPI	HSP46	0612-03, 0612-05 to -40	04/14-11/14	
Metropolitan Trans. Auth. (N.Y.)	3 (28)	OL937-OL939	MPI	MP8AC-3	ON 2204-26 to -28	01/14-06/14	
Montana Rail Link	5	4404-4408	EMD	SD70ACe	20136895-005 to -009	04/14*	5, 17
Norfolk Southern	25	1100-1124	EMD	SD70ACe	20126838-001 to -025	02/14	4, 22
Norfolk Southern	50	1125-1174	EMD	SD70ACe	20126988-001 to -050	11/14	4, 22
Pacific National (Australia)	7	PB1-PB7	NREC	2GS16B-AU	**	05/14-**	6
Port of Manatee	2	1001, 1011	NREC	2GS14B	**	01/14	6
PTKA (Indonesia)	5	CC20551-CC20555	EMD	GT38AC	20138951-001 to -005	06/14*	4
Rio Tinto (Australia)	9	9106-9114	GE	ES44ACi	62537-62545	08/14-09/14	2
Roy Hill Mining (Australia)	14	RHA1001-RHA1014	GE	ES44ACi	62573-62586	08/14-11/14	2
Tri-Rail, South Florida Regional	5 (12)	825-829	Brookville	BL36PH	**	02/14-06/14	
Union Pacific	60	8112-8171	GE	ES44AC	62457-62516	03/14*-05/14*	2, 23
Union Pacific	67	8172-8238	GE	ES44AC	62587-62653	05/14-09/14	2, 23
Union Pacific	29	8239-8267	GE	ES44AC	62813-62841	10/14*-12/14	23, 24
Union Pacific	73	8824-8896	EMD	SD70ACe	20126837-001 to -073	01/14*-07/14*	5, 25
Union Pacific	100	8897-8996	EMD	SD70ACe	20136990-001 to -100	10/14*-12/14*	5, 26
US Army	5	6517-6521	NREC	3GS21B-DE	216-6517 to 216-6521	09/14	6
Vale VLi (Brazil)	15	244-258	GE	ES58ACi	62798-62812	10/14*-12/14*	2

Quantities in parentheses are total number of units in that order if different from 2014 production. Locomotives considered rebuilds are not included.
* Estimated build date, unconfirmed by publication date. **Details are unconfirmed.

Notes:

1. Built by Siemens, Sacramento, Calif.
2. Built by GE, Erie, Pa.
3. Built by GE, Fort Worth, Texas
4. Built by Progress Rail Manufacturing Corp., Muncie, Ind.
5. Built by Bombardier at Ciudad Sahagún, Mexico
6. Built by NREC, Mount Vernon, Ill.
7. Completed by Progress Rail, Mayfield, Ky.
8. EPA Tier 4 emissions pre-production field test units. Nos. 2012-2022 were pre-built in 2013, but assigned 2014 build dates.
9. This group is part of BNSF 2015 budget
10. BNSF 7182-7196 built at Fort Worth, 7197-7199, 8000-8006 built at Erie
11. BNSF 8007-8065, 8275-8291 built at Erie, 8066-8274 built at Fort Worth
12. BNSF 8500-8519 released in P4 (four traction motors, four inverters) configuration from Muncie and sent to Mayfield for planned conversion to P6. This work was not done and the units remained in P4 configuration at delivery.
13. Order No. 8363, 96-ton, 2,700-hp, narrow gauge locomotives
14. Correction to previously reported quantity; order is for 10 units plus option for an additional six locomotives
15. Prototype/demonstrator for Russia
16. Units 806 and 808 released in primer, painted at Mid-America Car, Kansas City, Mo.
17. 4400-series numbers distinguish these as Tier 3 from previous 4300-series units. Nos. 4400-4403 weigh 420,000 pounds and are assigned to road service, while 4300s weigh 428,000 pounds and are assigned to helper service.
18. Painted at Mid-America Car, Kansas City, Mo. Unit No. 516 received a Rock Island heritage scheme.
19. Advanced order built on frames originally intended for BNSF production
20. Units built in P6 configuration, Nos. 4182 and 4183 released in primer, painted at Mid-America Car, Kansas City, Mo.
21. Nos. 4850-4852 and 4855-4857 released in primer, painted at Mid-America Car, Kansas City, Mo.
22. For finishing and final test, Nos. 1125-1126 sent to Mid-America Car, Kansas City, Mo., Nos. 1132, 1136-1138, 1140, 1141, 1144,1159, 1163, 1169 to NS Juniata Shop, Altoona, Pa. All 50 units are provisioned for LNG.
23. Ballasted to 432,000 pounds, UP designation C45AH
24. Nos. 8239-8252 built at Erie; 8253-8267 built at Fort Worth.
25. Ballasted to 425,000 pounds, UP designation SD70AH
26. UP 8940, 8951-8955 shipped to North Platte, Neb., for finishing and testing.

Data prepared by Sean Graham-White

On June 28, 2015, a BNSF eastbound freight twists through Sully Springs, N.D., with a mixed consist of a BNSF ES44C4, NS ES40DC, and a former BN SD70MAC. Tom Danneman

A duo of Canadian National GE ES44ACs, led by No. 2856, swing into Slinger, Wis., on the railroad's Waukesha Subdivision. Drew Halverson

yards. Kneiling's plan was similar to the Beeching Report published in Britain in 1963, the key difference being that Lord Beeching's recommendations were enacted. Carload rail movements in the U.K. disappeared and a shift to containerized rail was only modestly successful.

Kneiling's concept involved two steps. The first was to use existing diesel locomotives and selected freight cars, operated in dedicated unit-train fashion, but in rapid-turnaround service to maximize revenue generation. The second stage was to build brand-new, lightweight equipment, tailored for low-cost, high-mileage service, and to break away from the concept of loose-car traffic, which was switched in yards, coupled into trains, moved around, uncoupled, re-switched, etc.

Kneiling even proposed doing away with locomotives as we know them, placing traction motors underneath the load-carrying cars themselves, along with on-board diesel or gas-turbine power modules (and tank car-like fuel tenders) at various points within the integral train. He had a regular TRAINS column, "The Professional Iconoclast," which consistently generated one of two reactions: praise or contempt. Those who liked his forward thinking felt that he pointed to railroading's future (understand that in the 1960s many people considered railroads as being a dying industry). Others believed that he was an annoyance and/or totally unrealistic.

The "integral train" never came to be, largely because of railroad deregulation, new technologies, and changes in operating practices. On Oct. 14, 1980, President Jimmy Carter signed the Staggers Rail Act into law, economically deregulating the U.S. railroad industry. Throughout the 1970s, one-third of U.S. freight railroads had gone into bankruptcy, threatening the survival of the entire industry. Without economic deregulation, the future of freight railroading in the U.S. looked dismal. The Staggers Act helped to change railroading's future.

Freight railroading has evolved in other ways. "Run-through" trains now operate intact through many traditional "corporate border points" like Chicago without switching cars or locomotives. And locomotive-pooling agreements enable railroads to exchange and account for each other's locomotives and diesel fuel, much like renting an automobile at an airport.

Unit trains today still use conventional freight cars, operating in dedicated sets on assigned routes. We don't have "cab-less power blocks," but the increasing use of run-through and distributed power makes many trains, both unit trains and merchandise trains, look like Kneiling's first-stage integral train concept.

As Dave Ingles noted in the 37th annual motive power survey in 1985, Chicago, Burlington & Quincy and Union Pacific began pooling GP9s in 1960 on the "CGI"

manifest train between the Q's Chicagoland yard in Cicero, Ill., and UP's Denver yard. Burlington also had similar power-pooling arrangements with Rio Grande and New York Central. By 1968, Southern Railway and Southern Pacific had a power-pool and car-pre-blocking arrangement between Birmingham, Ala., and Houston, with only refueling and crew changes occurring where the two roads met in New Orleans.

Today a trackside observer can see what has become a dizzying and sometimes confusing array of everyman's locomotives on everyone's railroads. Ferromex and KCS de Mexico locomotives, for example, are now frequent visitors in the U.S. and even Canada. And how about a CP train operating in Ontario with a UP unit on the point and a Ferromex DP unit on the rear?

The operating economies of run-through trains and power pooling have become so compelling that North American railroads are the only freight operations worldwide in which capital equipment is exchanged so often. The flexibility of today's version of everyman's locomotive (with common features and capabilities) did much to keep integral trains from arriving.

10 Everyman's diesel has arrived: the new common denominator

Indeed, everyman's diesel has arrived, and the basics of Morgan's definition from 50 years ago still hold:

A high-horsepower machine. Today, "high horsepower" means 4,400, a 76-percent increase from the 2,500 hp of Morgan's day, but his point stands.

Robust. How many family automobiles average 100,000 miles per year, or operate a million miles and then get rebuilt?

Nonexotic. The diesel-electric combination remains the basic North American formula for rail propulsion, and it has been challenging diesel-hydraulics in Europe. Turbines have come and gone. Electrification has been studied and proposed many times on multiple properties but still faces huge financial and operational challenges.

Running off the miles. Thanks to run-through trains, power pools and commonly equipped and interoperable locomotives, a locomotive's territory can now be defined by where the rails go, not where the property ends.

Staying out of shops. The latest locomotives now operate 184 days in the U.S. between government-mandated inspections, six times longer than in 1965.

Long-range machines. The average fuel tank today is 25-percent larger than the largest in 1965.

An efficient ton-mile producer. During the past 50 years, U.S. rail tonnage has increased by 27 percent, freight train-miles operated have grown by 19 percent and the diesel-locomotive fleet has dropped in size by 10 percent. Meanwhile, U.S. railroad fuel efficiency has grown by 145 percent. U.S. freight railroads use only one-half of 1 percent of all domestic energy consumed.

Then as now, the best is yet to come

Morgan's 1965 closer rings true today.

Tremendous changes and improvements have occurred in locomotives, trains, freight cars, and operating practices over the past 50 years — many of them matching Morgan's thoughts, and others going far beyond. Morgan was generally prescient in foreseeing the future of the locomotive.

Who knows what the next 50 years might hold for locomotive development? Possibilities include new fuels like natural gas, new engine technologies, and innovations yet to be imagined. But remember this: In his 1956 book, "Super-Railroads for a Dynamic American Economy," John W. Barriger described the diesel locomotive as the technology that made maximum-capacity locomotion available to any railroad. Proving the point, after World War II, Barriger replaced ancient 1920s-vintage 2-8-2 steam locomotives on his 521-mile Monon Railroad with F3 units not unlike those that replaced giant 2-8-8-4 articulateds on the larger Northern Pacific Railway.

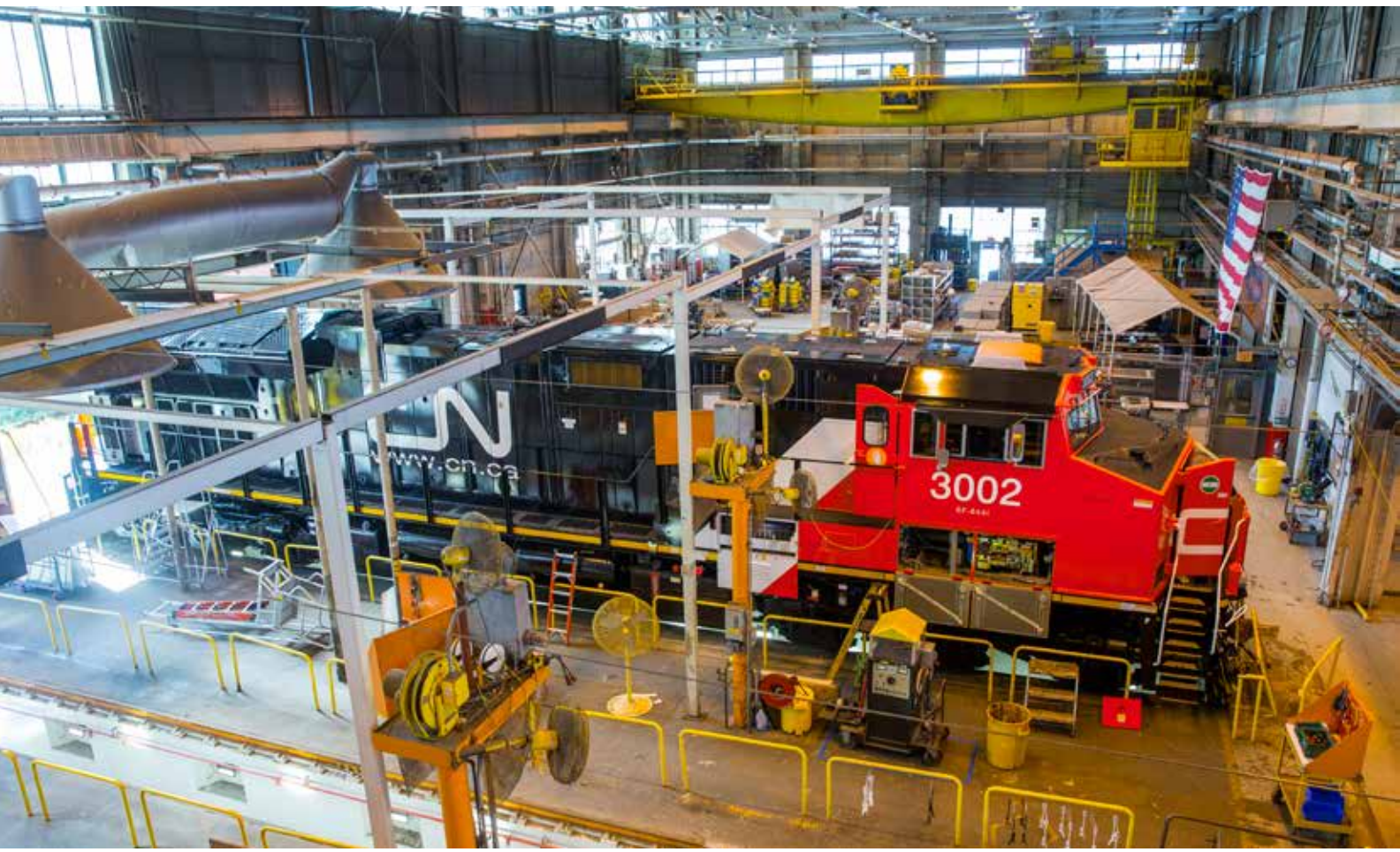
"The exceptional locomotive of one decade," said Barriger of the diesel, "becomes the accepted standard of the following one." If David P. Morgan were still trackside today, I'm sure he would be looking for tomorrow's newest headlight on the horizon. T

MIKE IDEN has been employed in the railroad industry for more than 35 years. The comments and opinions of the author are his own, and do not represent the policies or practices of any prior or present employer.

A pair of bright red Canadian Pacific GE ES44ACs, Nos. 8720 and 8809, power a westbound grain train through the beautiful but treacherous Thompson River Canyon, just north of Lytton, British Columbia, on July 20, 2015. Drew Halverson

New Power Profile

GE Transportation's



Just about ready to roll, Canadian National ET44AC No. 3002, one of the first production-model Tier 4 locomotives, undergoes pre-delivery testing in Building 26 at GE's Erie, Pa., plant on June 24, 2015. Five photos, Greg McDonnell

Massive radiators in an "inverted V" are a critical component of Tier 4 technology and the most distinguishing feature of ET models.

As spelled out on the flanks of BNSF 3911, the Tier 4 upgrade of the successful A1A-A1A ES44C4 is designated ET44C4. "ET" stands for "evolution technology."

Tier 4 lineup

They're here. The next generation of Evolution Series locomotives has arrived. GE Transportation unveiled its first Tier 4 ES44AC prototype in 2012. Since then, the builder has fielded a fleet of more than two dozen pre-production test-bed Tier 4 Evos for in-house and over-the-road testing as part of a $600-million, decade-long program to develop and perfect a heavy-haul locomotive to meet the EPA emission standards that took effect Jan. 1, 2015. The 27 pre-production Evos were simply designated ES44AC by the builder, but the vast technological advances and physical and mechanical changes incorporated into the Tier 4 locomotives called for all-new model designations for the full-production models brought out this year.

The builder introduced the GE ET44AC and its A1A-A1A counterpart, the ET44C4. As the model designations imply, they're the 4,400 hp, A.C. traction, Tier 4-compliant successors to the ES44AC and ES44C4. ET stands for "evolution technology."

Coming at you, the new models retain the familial look that has defined GEs for decades, but behind that familiar face is a dramatically refined, new-generation Evolution Series locomotive. The Tier 4 models are redesigned from the platform up. Indeed, the platform itself has been lengthened by 16 inches, from the 73-foot, 2-inch ES44 standard to 74 feet, 6 inches.

Most of the changes are internal: control systems with a separate power supply and 50 percent more sensors to enhance reliability, performance, and diagnostics; variable speed auxiliaries designed and configured to improve fuel efficiency and reliability, and eliminate the need for an auxiliary alternator. Less subtle are the massive radiators that form a large inverted "V" at the rear of the locomotive. The huge radiators are the signature of a new two-stage charged air system that provides a significant increase in cooling capacity to achieve improved locomotive performance and meet temperature limits required for Tier 4 emission capability.

Ahead of the radiator section, the increased height of the engine hood (GE calls it an engine cab) only hints at the radically redesigned prime mover inside. The GEVO-12 engine has been beefed up with a larger, heavier mainframe to accommodate larger bearings and a longer, toughened crankshaft. A new top-feed injector system; double-wall, high-pressure fuel lines; and two-stage turbochargers that reduce thermal stress and boost fuel efficiency have enhanced the performance of the GEVO-12. Exhaust gas recirculation ensures that the new engine meets Tier 4 standards for oxides of nitrogen emissions.

The first production model ET44ACs (for Canadian National and CSX Transportation) and ET44C4s (for BNSF Railway) were on the assembly floors at Erie, Pa., and Fort Worth, Texas, by spring 2015. GE, currently the sole supplier of heavy-haul, Tier 4 freight locomotives, has orders for more than 1,300 units on the books. T

BNSF No. 3911, the first Erie-built ET44C4, keeps company with one of the original Tier 4 test beds in the Building 60 test facility at GE Erie.

Coming at you, CN No. 3000, the first production-model ET44AC, has the look of generations of GEs, but there's a wealth of new technology behind that familiar face.

GE Transportation Tier 4 locomotives

Model	ET44AC	ET44C4
Emissions compliance	EPA Tier 4	EPA Tier 4
Engine type	GE GEVO-12	GE GEVO-12
Number of cylinders	12 cylinder, V-type	12 cylinder, V-type
Traction horsepower	4,400	4,400
Axle configuration	C-C	A1A-A1A
Control system	GE Consolidated Control Architecture	GE Consolidated Control Architecture
Traction configuration	A.C./A.C., inverter-per-axle	A.C./A.C., inverter-per-powered-axle
Truck	GE Hi-Adhesion	GE Hi-Adhesion
Wheel size	43 inches	43 inches
Length	74 feet, 6 inches	74 feet, 6 inches
Height	16 feet,1 inch (over antennas)	16 feet, 1 inch (over antennas)
Weight	426,000 pounds	416,000 pounds
Crashworthiness	S-580 compliant	S-580 compliant


642
642
AMTRAK

Siemens ACS-64

Newly delivered Nos. 639 and 642 pose side by side at Amtrak's Wilmington, Del., shop.

Still new, Amtrak No. 601 coasts into 30th Street Station in Philadelphia with Washington-bound *Northeast Regional* train No. 193 on March 20, 2014. Sayre Kos

Left: Dressed in special paint to honor military veterans and members of the United States Armed Forces, Amtrak No. 642 awaits formal commissioning to service at Wilmington, Del., on May 25, 2015. Two photos, Gary Pancavage

The newest high-speed, electric locomotives in North America, Amtrak's ACS-64 "Cities Sprinter" motors, are turning heads on the Northeast and Keystone corridors as they quickly displace aging AEM-7s and HHP-8s on conventional trains on the nation's fastest and busiest passenger network. European-designed and American-made, the A.C.-traction ACS-64 is based on Siemens' successful Eurosprinter and Vectron locomotives. The new American cousins are equipped with Siemens' SIBAS 32 traction and locomotive control systems, single-axle controls, and integrated HEP — all of it packaged in a full-width, double-cab monocoque carbody. Nominally rated at 6,700 hp, the ACS-64 is capable of seamless operation on all three A.C. catenary voltages (25 kV 60 Hz, 12.5 kV 60 Hz, and 12 kV 25 Hz) on Amtrak's Boston-Washington Northeast Corridor and the Philadelphia-Harrisburg, Pa., Keystone Corridor.

Amtrak ACS-64 No. 610 kicks up a blizzard as it rips through Cornwells Heights, Pa., with the southbound *Crescent* on Jan. 27, 2015.

Siemens was awarded the $466 million, 70-unit Amtrak contract in October 2010, and as part of the deal, the firm established an assembly plant to build the locomotives in Sacramento, Calif. The first ACS-64s rolled out of the Sacramento plant in May 2013. After months of extensive tests, class engine No. 600 kicked off the ACS-64 era, departing Boston with Northeast Regional train No. 171 on the morning of Feb. 2, 2014.

By spring 2015, Amtrak had half of the 70-unit fleet on the property, and had laid up all of the HHP-8 motors as well as all D.C.-traction AEM-7s. Indeed, many of the D.C. AEM-7s were already being scrapped. Amtrak intends to have all 70 ACS-64 locomotives in service, and all of the older motors retired, by the end of 2016.

In May 2015, the Southeastern Pennsylvania Transportation Authority announced a deal to purchase 13 ACS-64s (with an option for as many as five more) for its Philadelphia-area commuter services. The SEPTA Sprinters will replace the agency's eight older motors — seven AEM-7s and a single ALP-44 — and provide power for expanded services.

Handling eight Amfleet coaches with ease, class motor No. 600 "David L. Gunn" cruises through Newark, Del., with Northeast Regional train No. 141 on Jan. 2, 2015. Four photos, Gary Pancavage

Amtrak ACS-64 "Cities Sprinter"

Builder	Siemens, Sacramento, Calif.
Maximum speed	125 mph
Catenary voltage and frequency	25 kV 60 Hz, 12.5 kV 60 Hz, 12 kV 25 Hz
Rated power	6,400 kW maximum, 5000 kW continuous
Head-end power	1,000 kV
Maximum tractive effort	72,000 pounds
Weight	217,000 pounds
Length	67 feet
Width	10 feet
Height (without pantograph)	12.5 feet
Distance between truck centers	32.5 feet
Wheel diameter (new)	44 inches
Wheel arrangement	B-B

With a mix of Amfleet, Heritage, and Viewliner cars in tow, Amtrak No. 602 hurries train 97, the Miami-bound *Silver Meteor*, out of Philadelphia on April 20, 2014.

True colors. No. 642's red, white, and blue tribute to veterans stands out against the standard garb worn by sister motor 639.

Florida East Coast Railway train No. 101, with rock loads up front, hustles over Spruce Creek at Port Orange, Fla.
Tom Danneman

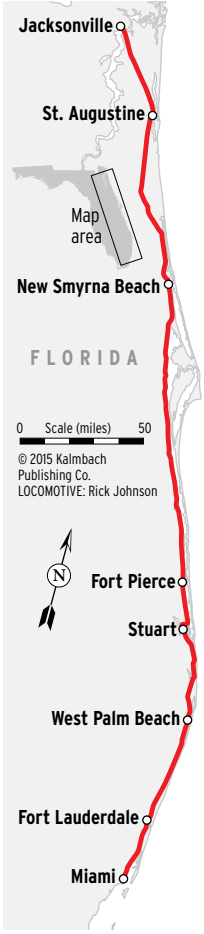
GE takes the Sunshine

State

Florida East Coast's new GE ES44C4s embody the railroad's bold vision by way of its retro *Champion* livery

by Drew Halverson

SYSTEM MAP



Palm fronds sway in the salty breeze along Florida's fog-shrouded San Sebastian River. An 8-foot-long alligator lurking in the weeds slowly emerges from below the water's surface as a muffled rumble reverberates off the shoreline. This is a new sound, one never before heard along these banks. Nothing like the thundering EMD prime movers of the past; it's more of a low chug. The rumble grows louder. From out of the mist, two gleaming General Electric ES44C4s appear. All decked out in Florida East Coast Railway's unmistakable red-and-yellow *Champion* livery, they sprint alongside the tranquil tidewater and send the gator sliding back into the murk.

The Champs present a striking sight, one that FEC founder Henry M. Flagler would surely have been proud of. It's a sight the old alligator will quickly grow accustomed to. This is the dawn of a new era along the Sunshine State's eastern coast, and GE powers it.

MOVING FORWARD

An industry trailblazer since its birth in September 1895, FEC has always had a knack for finding growth opportunities. First — and most notable — was the railroad's Key West Extension, a route connecting Miami to Key West via a series of overseas bridges that's still regarded as one of the greatest railroad engineering and construction feats in the country's history. Devastated by the 1935 Labor Day hurricane and doomed by the effects of the Great Depression, the extension was abandoned. The bridges became part of U.S. Highway 1 to the Keys, but the brave venture put FEC on the map in terms of potential trade with Cuba, Latin America, and the West via the Panama Canal. That, of course, was Flagler's vision from the beginning.

Forward thinking has helped FEC prosper through an ever-shifting economic environment. Innovations such as two-person crews, end-of-train detectors, and cabooseless trains are just a few strategies first implemented by FEC that later became norms of the industry. Today's 351-mile main line rests on rock-solid concrete ties — many of which were produced in the railway's own crosstie facility.

Today, FEC leaders draw upon that tradition of innovation and move toward future opportunities. Leading the charge is president and CEO Jim Hertwig, who recently championed intermodal development at PortMiami and Port Everglades. The goal: to attract post-Panamax ships (and their containers) to southern Florida as soon as the widening of the Panama Canal is completed in 2016. With the prospect of additional traffic, on top of already-increasing intermodal shipments, came the inevitable need for another bold move: an update in motive power.

DRIVING CHANGE

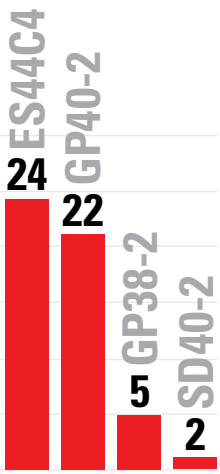
Florida East Coast has been an Electro-Motive stronghold since 1939, when 2,000-hp EMC E3s powered the popular *Henry M. Flagler* and *Champion* passenger trains — and introduced the epon-

Surrounded by tidewater swamps in St. Augustine, a pair of ES44C4s power train No. 210. Mike Danneman

FEC ES44C4 No. 823 leads train No. 226 through thick morning fog. Drew Halverson

Train No. 101 swings into St. Augustine. Eric Hendrickson

A machinist at Bowden Yard in Jacksonville inspects new GE ES44C4 No. 818. Mike Danneman



ymous paint scheme in the process. For 75 years, FEC relied on an all-EMD fleet, from E units, BL2s, GP7s, GP9s, SW9s, and SW1200s, to GP38-2s, GP40-2s, SD40-2s, and SD70M-2s.

All that changed in 2014 as FEC spurned tradition and signed a deal with GE Transportation for 24 ES44C4 locomotives. The new C4s made their FEC debut on Nov. 21, 2014, as Nos. 803 and 804 worked their maiden revenue run out of Jacksonville. During the following weeks, the remaining 22 ES44C4 locomotives were delivered from GE's Erie, Pa., plant.

As the GEs came on line, FEC's six-axle EMDs were quickly displaced. All but two of the road's SD40-2s were leased out, and the former front-line fleet of 11 leased SD70M-2s was returned to the lessor. Charged with local work and yard duties, FEC's four-axle EMDs remain, including 25 GP40-2s (three of which are being overhauled at Progress Rail Services) and five GP38-2s.

So, why the change? "The SD70M-2s were great locomotives, but the time came to move on," says Fran Chinnici, FEC's senior vice president of engineering, mechanical, and purchasing. "GE earned our business by providing a locomotive solution with enhanced technological capabilities, increased strategic value, reduced total cost, and improved fuel efficiency. GE was very aggressive in their approach in terms of outlining the functionality and future benefits of the new technology offered by the locomotives, such as the capability to utilize the power in dual-fuel operations (liquefied natural gas and/or diesel). The inherent value of these units and future technological opportunities made this new partnership with GE a very smart choice for FEC."

The ES44C4s, purchased for through freight service between Jacksonville and Miami, are state-of-the-art: more fuel-efficient and cleaner environmentally than previous models. "The ES44C4 provides 4,400 hp with four driving A.C. motors and the same tractive effort as a six-axle D.C. locomotive," says Bill Lauro, director of locomotive sales at GE Transpor-

Framed by palms and pines, train 210 rolls through Bunnell, Fla.
Drew Halverson

Train 226, led by ES44C4 No. 820, speeds north alongside U.S. Route 1, south of Jacksonville.
Mike Danneman

When it rains it pours, nowhere more than Florida. Train 101 twists through an afternoon storm, just south of Magnolia siding. Drew Halverson

POWER PLAYERS

FRAN CHINNICI
Senior VP, Engineering, Mechanical, & Purchasing

DAVE KOBRYN
Locomotive Superintendent

tation. "The ES44C4 provides new A.C. technology with better reliability, availability and significant fuel savings versus older-style locomotives." The ES44C4s replace SD40-2s on a two-for-three basis.

One of the most important factors in FEC's selection of GE was the potential for using liquefied natural gas, a fuel that can provide economic and environmental benefits to railroads. According to Chinnici, GE provides an LNG conversion rate of 80-20. That means that each ES44C4, using GE's NextFuel Retrofit Kit with dual-fuel LNG technology, can sip a combination of 80 percent LNG mixed with 20 percent diesel, a tasty cocktail that provides a significantly lower total fuel cost.

Chinnici plans to construct and test two LNG tenders in 2015. "They'll be built from the wheels up," he says, "each with a high-strength, rigid center beam and structural integrity much like that of a locomotive platform. Atop this high-strength platform will be a double-wall, 10,000-gallon cryogenic tank." Once the initial testing satisfies all state and federal safety operating hurdles, FEC plans to have as many as 12 to 14 tenders produced to support the 24 ES44C4 locomotives.

Florida East Coast is working with the Federal Railroad Administration to ensure that the equipment, operating practices, policies, and procedures are developed and designed to maximize operating safety. "We will have measures of success built into our process throughout the testing phase, and FEC will expand testing and implementation of LNG based on the ability to perform against these objectives," Chinnici says.

According to Lauro, GE has local service engineers who will support FEC's testing and expand support as the railroad makes equipment decisions. "We are connected to support FEC in its future LNG efforts and to expand our technology partnership with new solutions that benefit both companies," he says.

On a day-to-day basis, the new ES44C4s receive expert care from FEC Locomotive Superintendent Dave Kobryn and his mechanical team. Kobryn, a proud FEC employee of 33 years, is charged with maintaining the railroad's entire locomotive roster, as well as business cars *Azalea* and *St. Augustine*. "He treats the locomotives like they're his own," Chinnici says.

When it comes to pride in his company, Kobryn isn't alone. Swing by FEC's headquarters at

Jacksonville's Bowden Yard, where renovated offices and a new dispatch center are filled with determined staff, all of whom share the leadership's first-mover mindset.

And outside those air-conditioned rooms rest a handful of new GEs awaiting another journey south. Thanks to Hertwig, they wear the beautiful *Champion* livery inspired by FEC's flagship trains of old. Chinnici ensured that the livery was recreated with the best paint and attention to detail that GE had to offer.

Don't expect FEC's *Champion* image or its fighting spirit to fade any time soon.

DREW HALVERSON is Trains' *graphic designer. He would like to thank Fran Chinnici, Debra Phillips, Bill Lauro, and Jessica Taylor for their assistance with this story.*

ES44C4 No. 819 leads train 123 over the St. Lucie River in Stuart, Fla.
Drew Halverson

LOCOMOTIVE ANNIVERSARY SPECIAL

Old soldiers never die

by Ted Benson

It's a long way from Empire to Eston — 1,070 miles as the Canada goose flies — from winter quarters in California's San Joaquin Valley to summer in Saskatchewan's land of "golden fields and harvest moons," as the motto of the town of Eston has it. Eston, bordering the South Saskatchewan River, is light years away from the world once inhabited by Modesto & Empire Traction Co. No. 602. The third in a trio of General Electric 70-ton diesels bought by the central California switching road, 602's arrival in April 1952 brought the end for M&ET steam power.

"The right engine for the right job," M&ET 602 (left) switches the Gallo winery in its Modesto hometown in April 1966. Still in full M&ET dress in September 2012 (above), No. 602 is the right engine for a new job in Eston, Sask. Left, Ted Benson; David Styffe

Amassing a combined service record of 637 years under the banner of M&ET, plus previous owners ranging from Southern Pacific to West Virginia's Cherry River Boom & Lumber Co., the largest concentration of 70-tonners in North America toiled until 2009. Heralding the durable GEs as "the right engine for the job," M&ET reaped the rewards of meticulous maintenance as the roster started to expand in 1968, eventually growing to 10 operating units with five more set aside for parts or rebuilding.

Unwitting victims of their own longevity, growing bulk traffic pushed the tractive effort of M&ET's 70-tonners to the breaking point by the mid-2000s. With state air-resource regulators cracking down on "unfiltered" diesel power, the railroad conceded the inevitable. Two used EMD SW1500s joined the roster in 2006, followed by a pair of new Railpower RP20BD gensets in 2008. The arrival of five more leased Railpower units sealed the 70-tonners' fate in 2009. Earmarking engines 600 and 613 (ex-SP 5119) for preservation, M&ET sold the other seven operable GEs and scrapped the remaining organ donors.

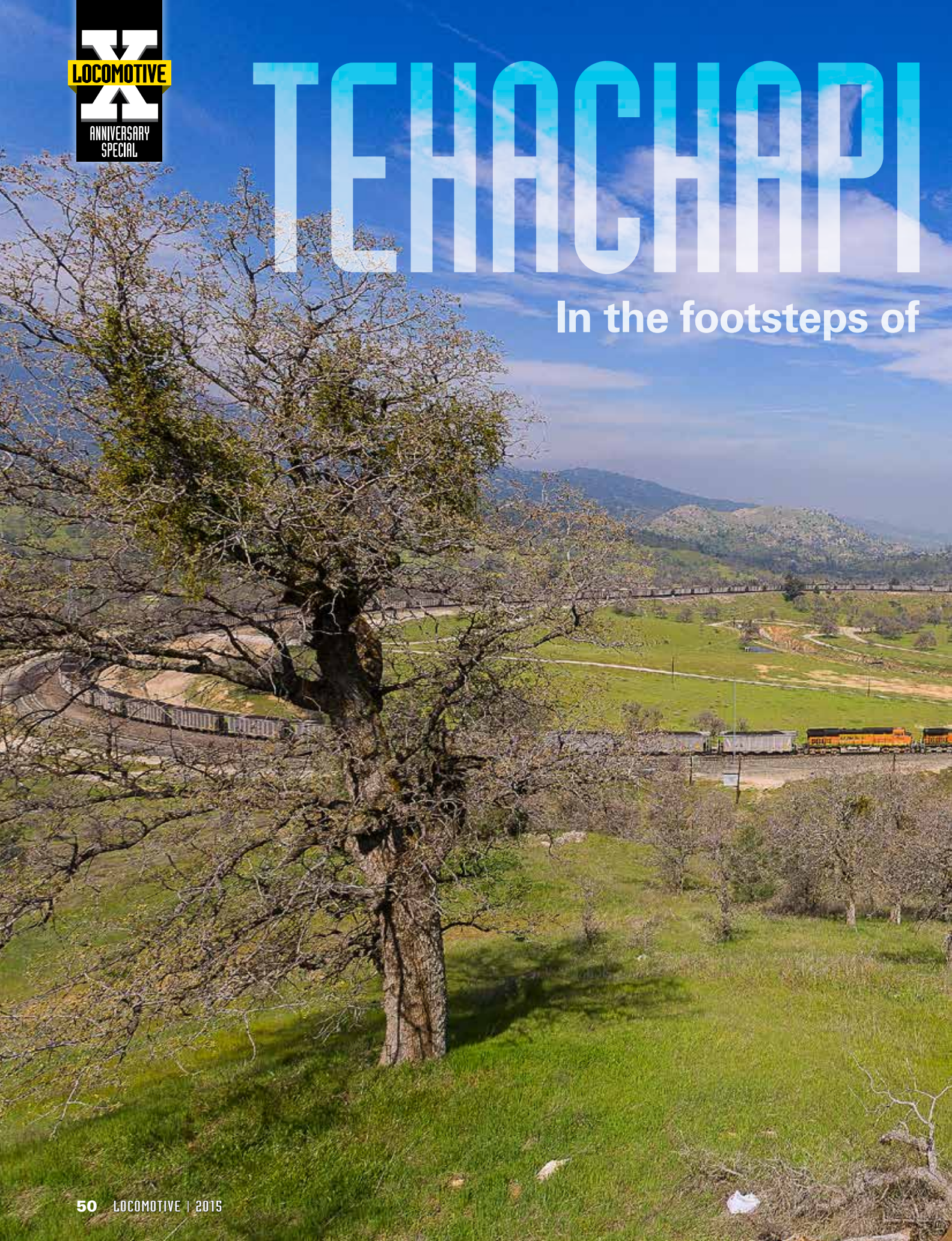
Summer 2011 found units 601-605, 607, and 608 Canada-bound on lowboy trailers, billed to Mobil Grain Ltd. in Aylesbury, Sask.

A year later, the sight of the former Modesto & Empire Traction No. 602, cast against a heroic horizon southwest of Saskatoon, was a dramatic contrast for those accustomed to 70-tonners prowling the uninspired collection of power lines, storage tanks, and concrete tilt-up warehouses of east Modesto. Now tasked with spotting hoppers at the West Central Rail & Road terminal, the 602 was spending Labor Day 2012 at rest in Eston, one track away from Mobil Grain's Big Sky Rail, a former Canadian National operation acquired in 2011. A long way from Empire, the old soldier seemed right at home, contemplating her twilight years with heaven hovering above. ▮

LOCOMOTIVE X ANNIVERSARY SPECIAL

TEHACHAPI

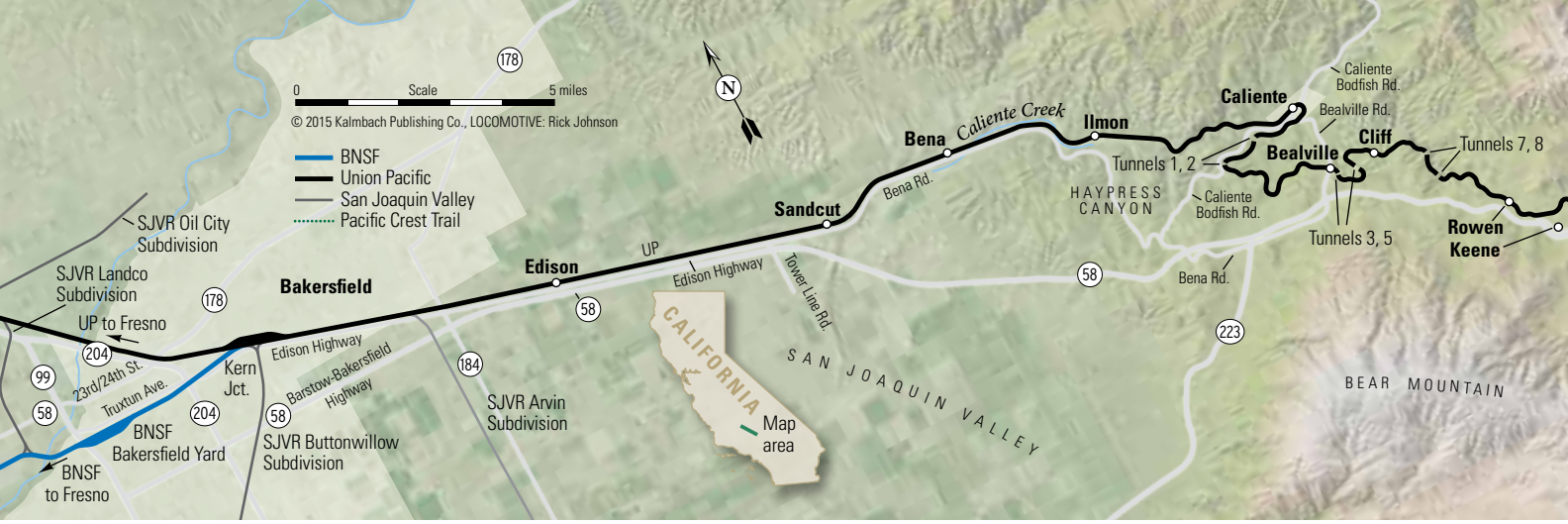
In the footsteps of



REVISITED

Richard Steinheimer by Ted Benson

With four late-model GEs on the head end and a GE-EMD quartet on the rear, a northbound BNSF coal train wraps itself around the famed Tehachapi Loop at Walong, Calif. David Styffe



Ash Hill, Beaumont, Cajon ... the list of California mountain crossings photographed by Richard Steinheimer reads like an encyclopedia of legendary railroad grades. Cuesta, Donner, Feather River Canyon, Grass Lake, Siskiyou Summit ... Over the course of a half-century behind the camera, Steinheimer created an unforgettable document of flanged wheels waging war with gravity across the Golden State.

And then there was Tehachapi.

No matter where in California Steinheimer called home during the majority of his 81 years, Southern Pacific's 67.6-mile main line between Bakersfield and Mojave remained a constant source of inspiration. Built in 1876 and jointly operated with Santa Fe since 1899, the railroad's dramatic traversal of Tehachapi Pass provided camera fodder for Steinheimer throughout the second half of the 20th century.

Steinheimer's fascination with Tehachapi began in 1947, not long after the high-school senior took a job with a photo finisher and purchased his first professional camera, a 3¼-inch-by- 4¼-inch Speed Graphic. Exploring the far-flung world of the Southern Pacific, whose main line ran behind his childhood home in Glendale, Calif., Steinheimer soon discovered how much railroading he could wring out of a round-trip ticket aboard the steam-powered *San Joaquin Daylight* between Glendale and Bakersfield.

"The train was always double-headed for the Soledad Canyon and Tehachapi grades — usually two 4-8-2s or a 4-8-2 and a 4-8-4 — and there was only a 2½-hour layover in Bakersfield before catching the return train," he recalled in the 1999 book, "Done Honest & True." The end result was 330 miles and "12 wonderful hours of heavy mountain railroading for the sum of $3.80." In short order, Steinheimer made the acquaintance of Donald Sims, and by 1948, the two were piling the miles on a pair of worn-out Ford sedans with road trips to Barstow, Mojave, and beyond.

Like a swallow returning to San Juan Capistrano, Steinheimer kept going back to Tehachapi, expanding his body of work with multiple explorations of Caliente, Woodford, and the line's signature landmark, the magnificent loop at Walong. The ever-evolving parade of trains passing his camera was matched only by advancing railroad technology following World War II.

Daylight doubleheaders had transformed into shiny new red-and-orange Alco PAs behind tiger-striped RSD5 helpers when Steinheimer documented Espee's expedited recovery from a devastating July 1952 earthquake. A decade later, SP's passenger Alcos had bowed to scarlet-and-gray FP7s on trains 51 and 52. Warbonnet EMDs did the same on Santa Fe's *San Francisco Chief*, supplanting the elegant PAs that "Stein," as he was known by friends, first captured in time exposures of the *Grand Canyon Limited* at Mojave prior to the *Chief*'s inauguration in 1954.

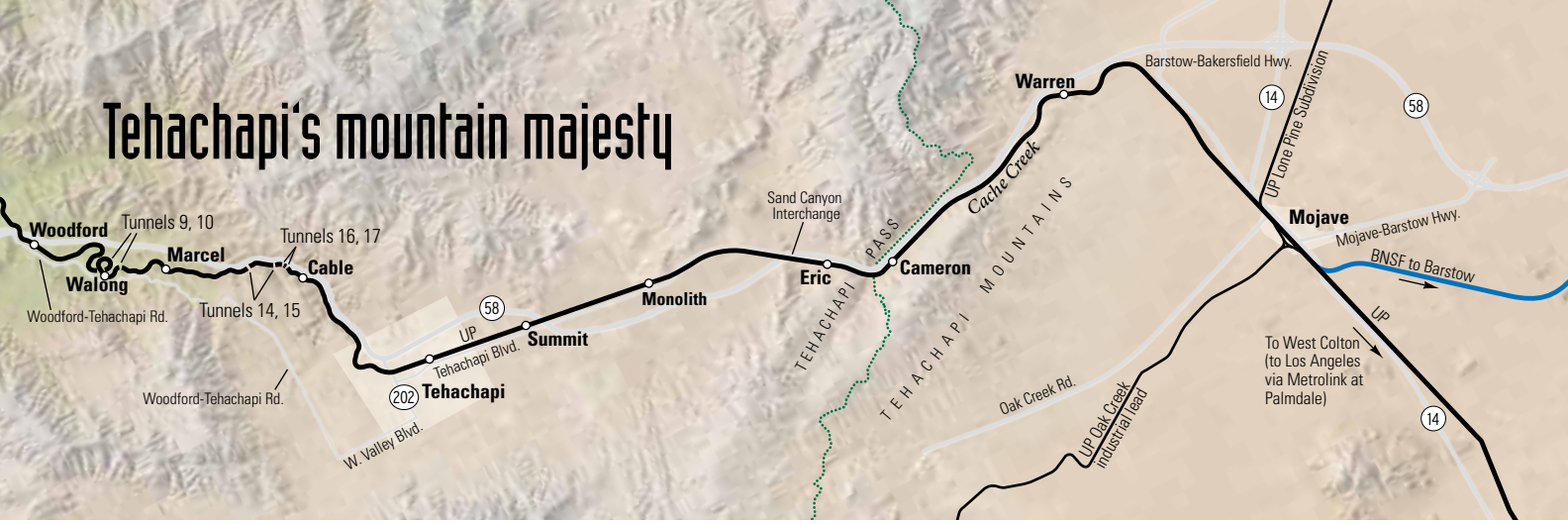
Santa Fe No. 199, the fastest train over Tehachapi in 1977, makes light work of the short, steep climb to Cameron.
Richard Steinheimer; two photos at right, Greg McDonnell

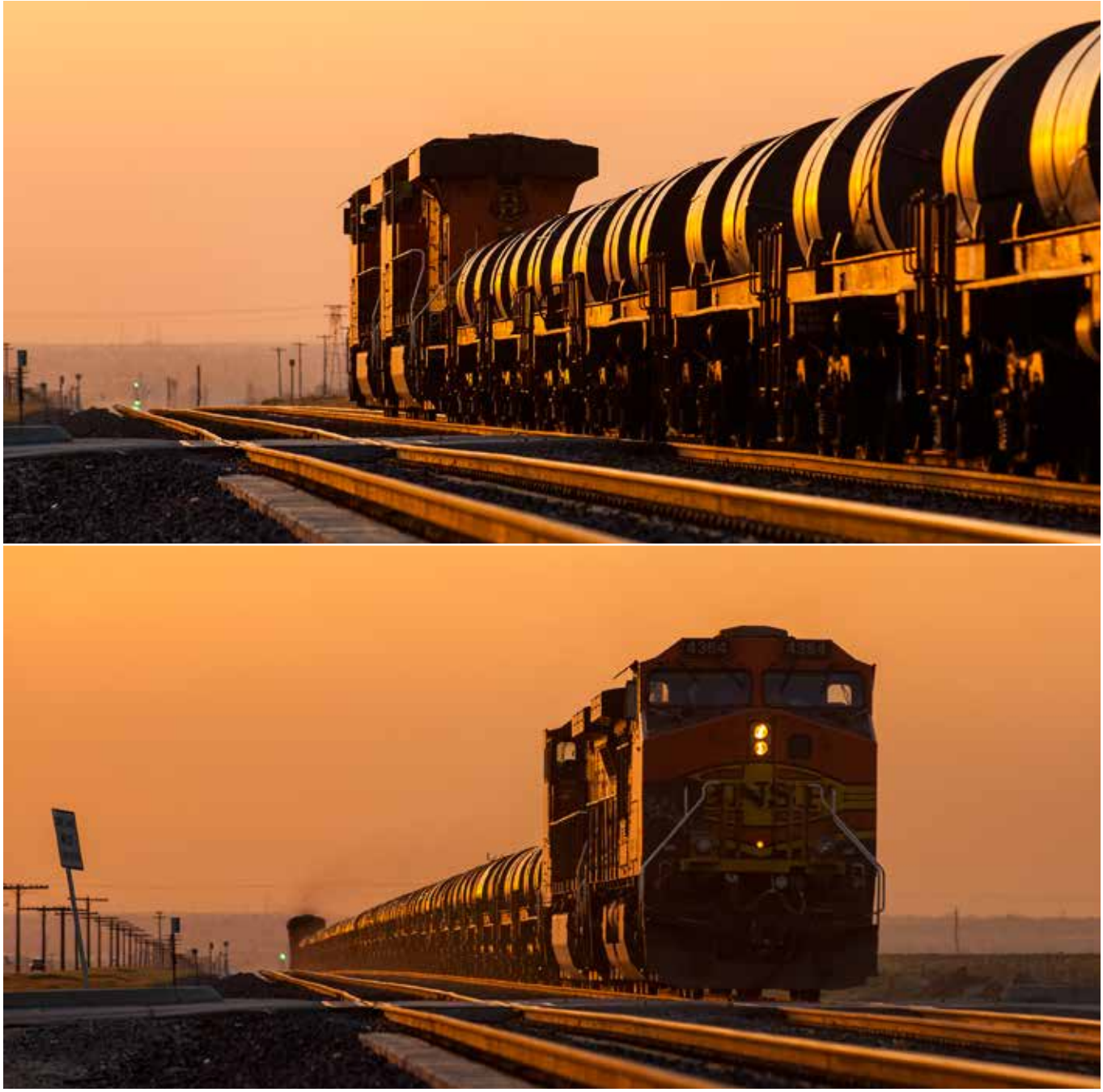
A second generation of diesel power held sway by 1971, when Amtrak's advent ended scheduled passenger service on Tehachapi. Santa Fe FTs were the only road diesels in town when Stein first visited Bakersfield; Espee's F3s arrived in summer and fall 1947. Eighteen years later, "covered wagons" were on the way out when Stein captured factory-fresh SD35s "brushing aside the wetness of an April 1965 snowstorm" at Summit Switch. Tehachapi was now "a six-motor haunt" echoing to "SD7s and SD9s, too."

The action depicted in a February 1966 TRAINS Photo Section would be dominated by "a whole new generation of diesel-electric locomotives now in production at Electro-Motive," according to the double-truck GM ad thrust through the middle of Steinheimer's "SP California Spectacular."

By 1976, Stein was back at Walong, focusing on radio-control master and remote units lumbering around the loop. EMD Tunnel Motors built at SP's behest were now breathing easier in their uphill battle with Tehachapi's multiple bores,

Tehachapi's mountain majesty





Rolling through Sandcut at sunset, a quartet of GEs — two ES44DCs on the head end (top) and two Dash 9-44CWs on the rear — hold back a short-but-heavy train of coil steel loads on the descent to Bakersfield on March 19, 2010.

Doubleheaded Southern Pacific 4-8-4s lead the *San Joaquin Daylight* through Caliente about 1947. Richard Steinheimer

Rear DPUs roll overhead at Caliente as a cottonseed train meets a southbound BNSF intermodal. David Styffe

Coming in off the range, cowboys wait for BNSF Railway piggybacks at the Caliente crossing.

en route to the Palmdale Cutoff, Cajon Pass, and a sprawling classification yard in West Colton — all newly constructed in the previous decade. Literally "layering" his coverage, this time in full color, Dick again delivered the goods with a story-telling cover shot for the next "Steinheimer spectacular" for the pages of TRAINS, based in far-away Milwaukee.

"Tehachapi!" the second of Steinheimer's three photo essays on California's legendary mountain railroads, occupied 18 pages in the January 1977 issue of TRAINS. Recalling his three-decade love affair with Tehachapi, Stein outlined the railroad's history, highlighted by reminiscences from Loyd Langford, a Santa Fe locomotive engineer the photographer had befriended prior to Langford's retirement in 1976. From the foot of the San Joaquin Valley in Bakersfield, the pair took readers on a leisurely exploration of the mountain crossing, similar to Stein's 1974 study of Cajon.

Tehachapi's technological transition was reflected in Steinheimer's move to medium-format cameras and an increasing reliance on 35mm Kodachrome. As always, his passion for people stood tall in the story. On the final spread, Langford was seen symbolically

The scene is little changed as Union Pacific No. 8975 and an ES44AC pass the same spot in Caliente in April 2015.

With factory-fresh BNSF ES44C4 No. 7113 in the lead, southbound intermodal train Q-RICATG6 09 roars uphill between Caliente and Bealville on April 9, 2013. Three photos, Greg McDonnell

California poppies decorate the lush green hills of spring as a pair of UP SD70Ms approach Tunnel No. 2 with a northbound intermodal.
Two photos, Greg McDonnell

walking away from a Santa Fe SD45-2 after completing a run. "Thanks, Loyd," Stein concluded. "You've helped other people who may want to come out here and see for themselves what railroading is like on one of the toughest and busiest mountain railroads in the world."

Four decades later, Tehachapi is an international attraction, thanks in part to Steinheimer's imagery. While the cast of characters has dramatically changed following the Burlington Northern-Santa Fe merger and Union Pacific's absorption of Southern Pacific, several time-honored touchstones remain on what many consider to be North America's most dramatic railroad stage.

Steam remains as close as the water tank footings at Woodford, where a concrete Stonehenge frames diesels undreamed of in the days when Loyd Langford came up the hill with 60 cars and a quartet of thirsty 2-10-2s. Working on multiple blind curves, with no more than lanterns, whistles, and hand signals for communication, the full crew swung into action. Breaking their train in four places to spot each locomotive beside a water plug, Loyd's team had everything back in place and ready to pull in 14 minutes. "It was a pride thing ... how fast we could work together to take water."

Today, visitors can stand at Woodford and marvel at such accomplishments while trains sporting at least one, sometimes two, sets of distributed power units, take a good 4 minutes to pass without stopping. Manned helpers have been gone for the last 10 years, but growing traffic levels keep the line busier than ever. Tehachapi averaged 35 trains a day between 2000 and 2010, with BNSF alone handling more than 7,000 containers a day at decade's end. Confront-

Winter fog swirls around the helpers of a heavy eastbound Southern Pacific manifest grinding up the Tehachapi grade at Bealville. Richard Steinheimer

The drought-ravaged hills are parched to summerlike brown as BNSF and CP GEs and a former BN SD40-2 approach Bealville with a Modesto manifest in April 2015.

ing a projected 80-percent traffic increase to 14,000 containers daily by 2020, the state of California announced an ambitious double-tracking project in a 255-page environmental impact report released in 2012.

Regulatory wrangling and missed deadlines for public dollars cut the original 8-plus-mile project down to 3 miles by early 2015, all of it privately funded by BNSF. As originally proposed, the project was to begin with 1.01 miles between Walong and Marcel, and finish

BNSF GEs grind past the water tank footings at Woodford, "a concrete Stonehenge" and diesels undreamed of in the days of 2-10-2s.

with 2.69 miles from Bena to Ilmon. Included in the project were 2.75 miles from Caliente to the north end of Bealville siding, the former west switch at Allard, just beyond Tunnel No. 2. Recognizing the "visual character" of the area and "conditions with critical views," particularly around the tunnel, California Department of Transportation planners initially considered public access as "highly sensitive due to the recreation activity they support." As of this writing, no work had begun on the revised project.

The fact that bureaucrats and businessmen recognized the recreational activities of railfans as an economic factor might bring a smile to Steinheimer. Tehachapi proper has come a long way since the days when Stein was sitting down to dinner at the Mountain Inn, a few blocks west of Kelcy's Restaurant and the Santa Fe Motel. His favorite 24-hour eatery is gone now, but a number of new dining establishments have popped up along Tehachapi Boulevard, along with a pair of upscale hotels facing the tracks next to the Best Western Mountain Inn. For those seeking excellent Mexican cuisine, Domingo's in Tehachapi's Old Town district, 2 miles west of downtown, is worth the effort to find.

For most enthusiasts, the SP No. 23 standard wood depot at the corner of Tehachapi Boulevard and Green Street is the center of the local universe. At first glance, the structure appears to be the culmination of a

restoration project that was on the verge of completion in 2008, when a blaze sparked by illegal fireworks destroyed the original 1904 building. Undaunted, the Friends of the Tehachapi Depot rolled up their sleeves, rolled out the blueprints, and recreated what had been lost. Opened in 2009, the Tehachapi Depot Museum has become a focal point for community pride.

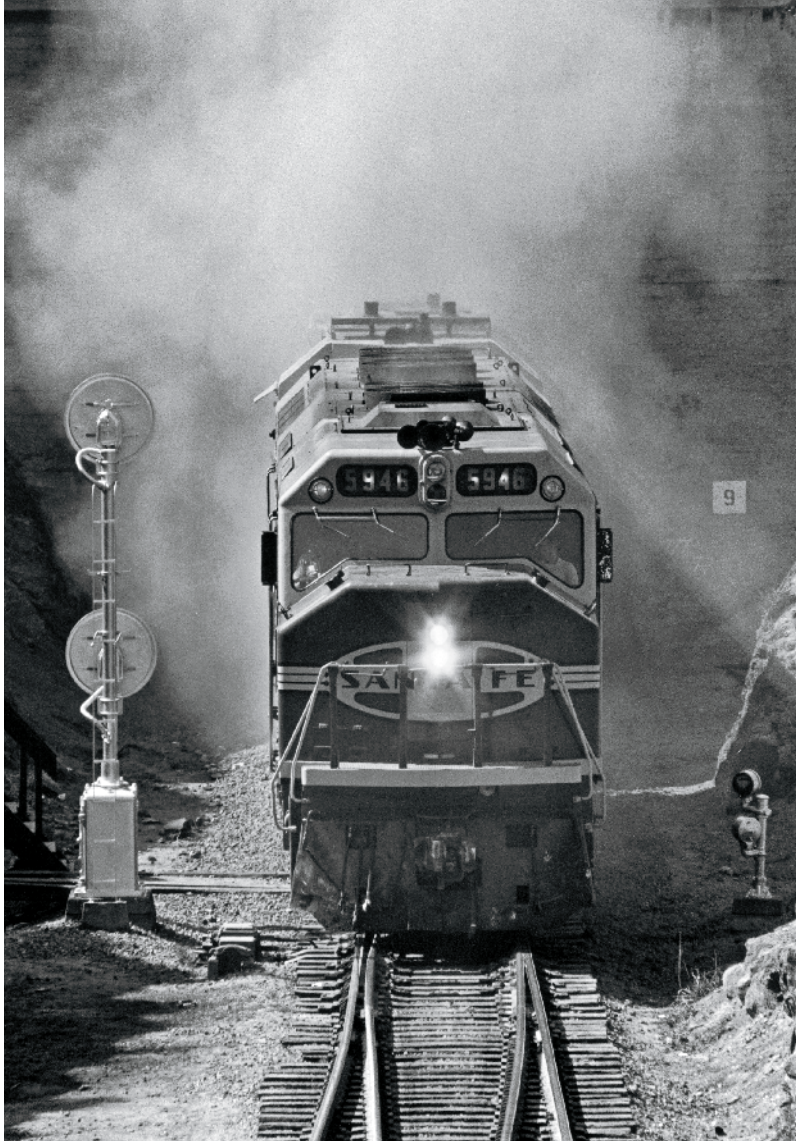
Visitors taking advantage of the depot's spacious viewing platform are treated to an ongoing display of commerce on the move, enjoying a place where time stands still on a railroad never ceasing to evolve. Rolling stock aside, perhaps the best barometer of progress on the hill is provided by the train-order semaphore signal framing the mainline parade beside the Tehachapi depot's telegraph bay. Train orders are long gone — Mojave, the last open office, closed in 1986, with the building razed in 1992.

Resurrected last June after six decades' absence, the venerable order board at Tehachapi underscores the most visible change on the hill since the coming of diesels — the installation of positive train control-compliant signaling completed in 2014. Union Switch & Signal Co. searchlight signals had been guarding rail movements over the hill since the arrival of centralized traffic control between Bena and Tehachapi in 1942-43. Union H-series heads replaced Style-B semaphores down the east slope to Mojave following World War II, as a combination of CTC and double track kept the line fluid through the remainder of the 20th century.

Once UP took over, the aging signal system with its relay-driven components was living on borrowed time. Ultimately, the old order yielded to simpler, state-of-the art equipment. The last searchlights on the line, an interesting group protecting the double track between Mojave and Warren, finally came down on Nov. 17, 2014. Union Pacific graciously donated a few of the silent sentinels to local preservationists, with some of the obsolete gear joining the late Bill Stokoe's remarkable collection in the "signal garden," adjoining the Tehachapi depot museum.

Today, almost 70 years after Richard Steinheimer first roamed Tehachapi, the basic attraction remains the same: "heavy mountain railroading." The hill is a crucible for tractive effort — only the strong survive. Expect the latest in motive power when following your muse to Sand Cut and Woodford. Seeking old stuff? The SD60Ms and rebuilt SD59X units working UP locals out of Mojave are as ancient as it gets. Dash 8 locomotives are senior citizens on Tehachapi.

Far from home, Norfolk Southern Dash 9-40CW 9808 and SD60I 6733 cross Tehachapi Creek at Woodford just after sunrise. Three photos, Greg McDonnell



Sporting a fresh coat of "dress blue," Santa Fe FP45 5946 boils out of Tunnel No. 9 at Walong with an eastbound freight on March 24, 1972. Ted Benson

All considered, motive power pales in comparison to the railroad being traveled. If you're not moved by the sight of glistening new EVOs and 8,000 feet of multi-hued containers dropping into Mojave at dawn's first light, the train etched in sharp relief against the sheer mountain wall, it's time to check for a pulse. Even the most jaded viewer can't deny the drama of 10,000 feet of unit grain train circumnavigating the loop at Walong. If there's anything more sublime than a bobcat prowling the oak-studded slopes of nearby Rowen at dusk, or a moonlit night spent atop Tunnel No. 2, encircled by headlights beneath the ghostly shadow of Bear Mountain, no one's found it yet.

"This pass is something. You can tell people I never got tired of it as long as I ran engines here." Four decades on, Langford's sentiments ring true. T

TED BENSON, 67, has been exploring and documenting Tehachapi since 1972. Forty three years later, he has yet to exhaust its photographic potential.

Ted Benson at Kelcy's Cafe in Tehachapi.

EPILOGUE

Tehachapi!

The exclamation mark that punctuated the title of Richard Steinheimer's January 1977 TRAINS cover story was neither frivolous nor exaggerated. Tehachapi! If you've ever set foot on the magnificent 67.6-mile mountain railroad that climbs and twists and tunnels its way over the Tehachapi Mountains from Bakersfield to Mojave, you're bound to endorse Stein's deliberate use of punctuation.

"Glory, the memories," wrote TRAINS editor David P. Morgan on page 3 of that January issue, as he recalled: "... the flathead V-8 of my red 1938 Ford wringing out all of its 85 hp on Highway 58 in search of trains ... the fire-eating whale look of the cab-forward 4-8-8-2 leading the West Coast around the Loop near midnight ... standing beside Southern Pacific's chief engineer as he directed Morrison-Knudsen crews laying a shoofly around collapsed Tunnel 5 in the aftermath of the 1952 quake ... watching four Santa Fe F7s — 66 cars forward — thunder over our cupola roof on the Loop ..." Tehachapi!

Stein at work on Tehachapi, July 4, 1976. Steve Patterson

The motive power evolution hasn't diminished the spectacle of Tehachapi. How could it? Innovations, from A.C. traction to microprocessors to remote-controlled distributed power, have taken tonnage ratings to unimagined heights and instigated all manner of operating efficiencies. Technology has enhanced train-handling capabilities and made manned helpers as archaic as a water stop at Woodford. But it hasn't tamed the mountain.

In 21st century terms, the battle to move tonnage over the Tehachapis is as compelling as it has ever been. Today's A.C. diesels are pitted against the same hills and the same forces of gravity confronted by the AC-class 4-8-8-2s that awed Morgan and inspired Steinheimer to return to this mountain main for decade after decade after decade. Generations have followed in their footsteps.

Tehachapi Loop may be the marquee act on the Bakersfield-Mojave stage, but the performances that play out over the entire 67.6 miles of main line are no less riveting. Pace a trio of UP GEs along the Edison Highway, sprinting past packing houses and palms as they muscle a southbound manifest out of Bakersfield. Or watch the sanders help steel wheels grip as a heavy drag inches up to the north switch at Bealville for a perfectly executed meet. Hear the whine of dynamics and A.C. motors as EVOs and EMDs hold back a mile or so of mixed freight on the downhill approach to Woodford, or the sleep-shattering racket of a quintet of BNSF GEs barking out of Mojave with the red-hot Z-WSPNBY intermodal, bound for Richmond, Calif. Tehachapi today is every bit as deserving of Stein's exclamation point.

The drama of railroading on this desert mountain beckons visitors from throughout the country and around the world, but even the locals in Kelcy's Cafe in downtown Tehachapi have been seen to pause their conversation, set down their coffee, and take in — if only for a moment — the passing trains framed in the picture windows that look out across Tehachapi Boulevard to the main line.

Tehachapi. "This is one of those places," Stein wrote, "that tells you to shut your mouth and open your eyes." Tehachapi! — *Greg McDonnell*

BNSF GEs shatter morning calm as Richmond, Calif.,-bound Z-WSPNBY hammers uphill at Eric.

The sun casts a magenta glow on the mountains as a pair of UP GEs drop downgrade into Mojave with southbound stacks. Five photos, Greg McDonnell

The Bloomer bountiful harvest

An Illinois short line where corn — and venerable Geeps — are king

Story and photos by Steve Smedley

Line's

The unmistakable rhythm of twin Electro-Motive Division 567 power plants reverberates off the old fire bell outside the all-volunteer department in Cullom, Ill., as Bloomer Line Engineer Paul Jones pulls an empty grain train into the Livingston County village. Locals pour out of the post office, "the train is here!"

Big doings for this hamlet of 563 souls. Jones radios the loading crew at the Alliance Grain Co. elevator as he slowly spots the first of 35 cars for loading beneath the spout. Workers wearing five-point fall-protection harnesses begin to open the Fiberglas doors on the first few covered hoppers, as a dust of "bees' wings" — a slang term for the light outer shell of a corn kernel — fills the air.

Corn and soybeans are the backbone of the 52-mile Bloomer Line. Another major customer is the Colfax Potash Center, located in the town of the same name. Colfax Potash receives mini-unit trains of the fertilizer, which farmers use for soil treatments in the spring and fall. Other traffic includes wheat, plastic pellets for a plant that makes agricultural drainage systems, and occasional storage cars.

The Bloomer Shippers Connecting Railroad was formed in 1985, when the fledgling outfit acquired

Looking splendid in Burlington Route-inspired coats of Chinese red, veteran Bloomer Line Geeps 7504 and 7591 roll grain empties near Cullom, Ill., on Nov. 2, 2013.

Framed in the fire bell outside the quarters of the Cullom Fire Protection District, Bloomer Line GP9 No. 7549 and a leased GP35 rebuild arrive in Cullom, Ill., on a cold Tuesday morning in March 2014.

the Barnes-Herscher, Ill., portion of the Illinois Central Gulf Bloomington District, saving local farmers' rail connection to the outside world. Originally headquartered in Chatsworth, the line started with former Northern Pacific GP9 No. 91. The Bloomer Line grew substantially in 1990 when Norfolk Southern decided to abandon its former Wabash line from the south Chicago suburb of Manhattan to rural Gibson City.

Alliance Grain Co., the Bloomer's current owner, saved its vital mainline connection by purchasing the NS line from Risk, the former diamond crossing of the original Bloomer Line, to Gibson City, protecting rail service to its eight grain-elevator members. Along with the purchase came a realignment of operations and the addition of a two-track engine house at Gibson City, headquarters of Alliance Grain.

Further securing the future of the Bloomer Line was Alliance's 2005 opening of One Earth Energy LLC. Located on the west side of Gibson City, One Earth receives much of the Bloomer's on-line corn traffic, and ships out ethanol.

The majority of the Bloomer Line's remaining corn and soybean business is interchanged with NS and Illinois Central at Gibson City. Little traffic is interchanged with Genesee & Wyoming-controlled Toledo, Peoria & Western at Chatsworth.

Easily the star among Bloomer's stable of hand-me-down power is No. 7549, a former New York Central GP9 that retains its original high short-hood configuration. While readily outperformed by newer EMDs leased from LTEX Rail, she steals the show whenever called for duty, and always gives her all. While much of the 7549's time is spent switching One Earth Energy, the first-generation Geep still sees some active road service. "The leasers make us more money, we can use two [of them] instead of three of our Geeps," says General Manager Eric Webb. "She's probably the best unit we have, but we can't get parts for the drum-style control stand anymore."

The 7549, the only high-nose locomotive in the Bloomer Line fleet, is a source of obvious pride of its operating department. "She just won't quit," Webb says. Having left the La Grange Ill., erecting halls of Electro-Motive in October 1955 as NYC 5943, the unit worked for Penn Central and Conrail before being rebuilt

Bloomer 7504 shows off its "frog-eye" headlight, a signature feature of its 1970 rebuild by Illinois Central's Paducah shop.

"It's a wonderful piece of machinery." Engineer Paul Jones at the throttle of GP9 7549, turned out of EMD La Grange in October 1957 as New York Central 5943.

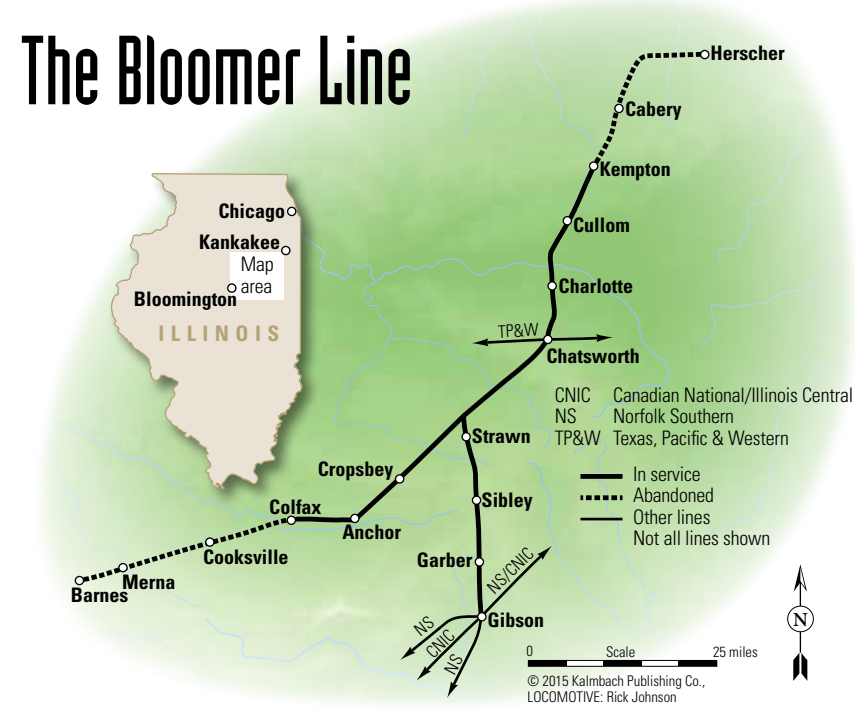
at the Illinois Central Gulf shops in Paducah, Ky., in 1978. The Geep got its current number from Conrail, and the Bloomer acquired it in 1997, along with sister 7561, another ex-NYC unit.

Jones, an engineer for many years with the Bloomer Line, has a fondness in his heart for the 7549. "It's a wonderful piece of machinery. She's the most dependable one of the fleet, giving us the least problems," Jones says.

Two GP35 rebuilds leased from LTEX round out the Bloomer fleet, but Webb says that the company has been on a slow and steady plan to rebuild its track to support six-axle locomotives in the future.

"We have a few miles left between Risk and Chatsworth to re-lay with 136-pound rail, replacing rail rolled in 1895. The tie conditions are not bad, but the old rail is giving out," notes Webb, adding that, in winter 2014-15, breaks occurred on almost every trip a loaded train made across the ancient rail. "Everything is run in yard limits, with trains not exceeding 20 mph," he says.

"Once the rail is done, we are hoping to look at replacement power. Former Norfolk Southern SD38s could be in our future, but we have to get the railroad in shape to support them. I don't care what the horsepower is," Webb says, "It doesn't matter what size train it is; we need the tractive effort. We are not going that fast."

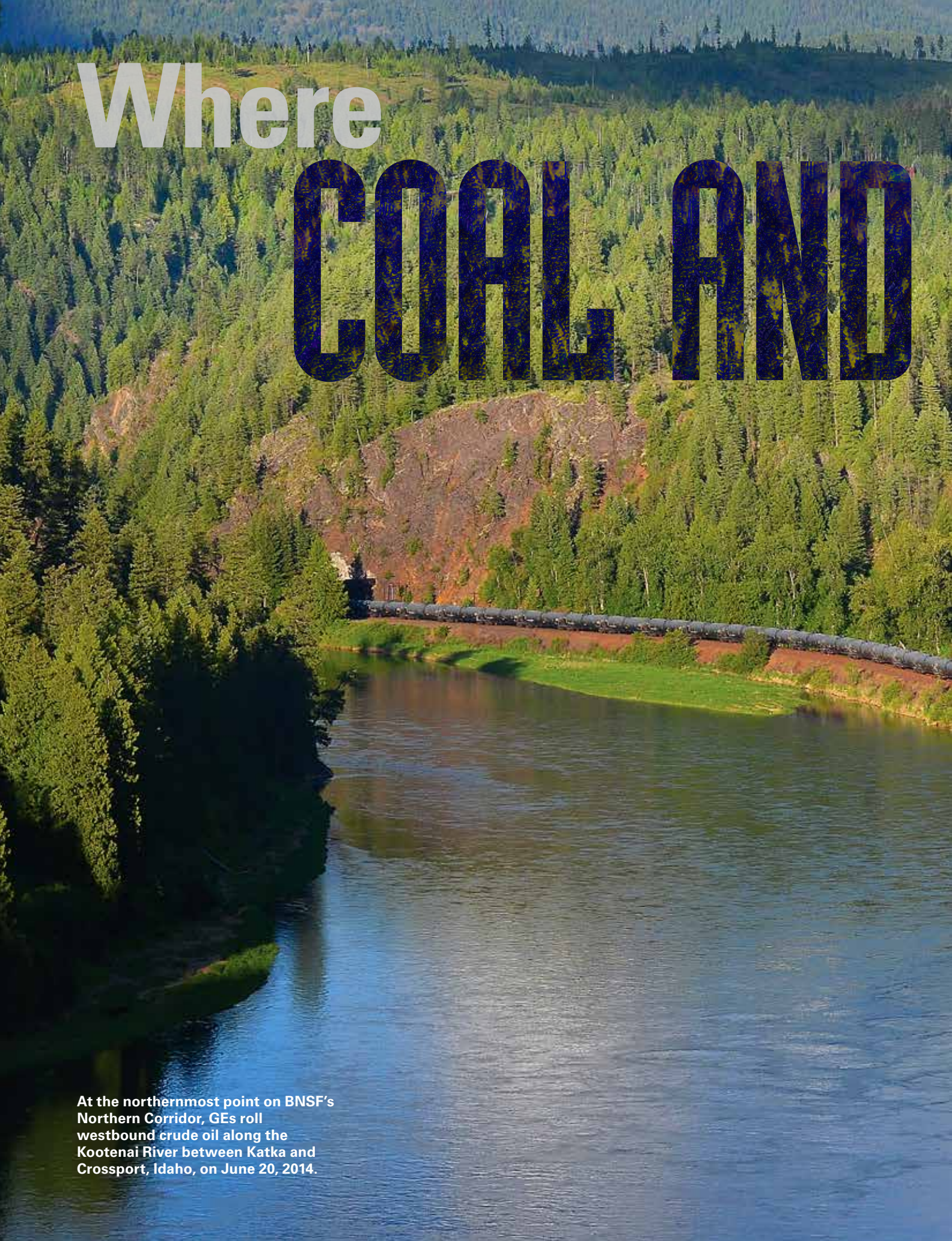


For now, the 7549 and her Chinese-red sisters — reminiscent of the Burlington Route — will answer the call to duty.

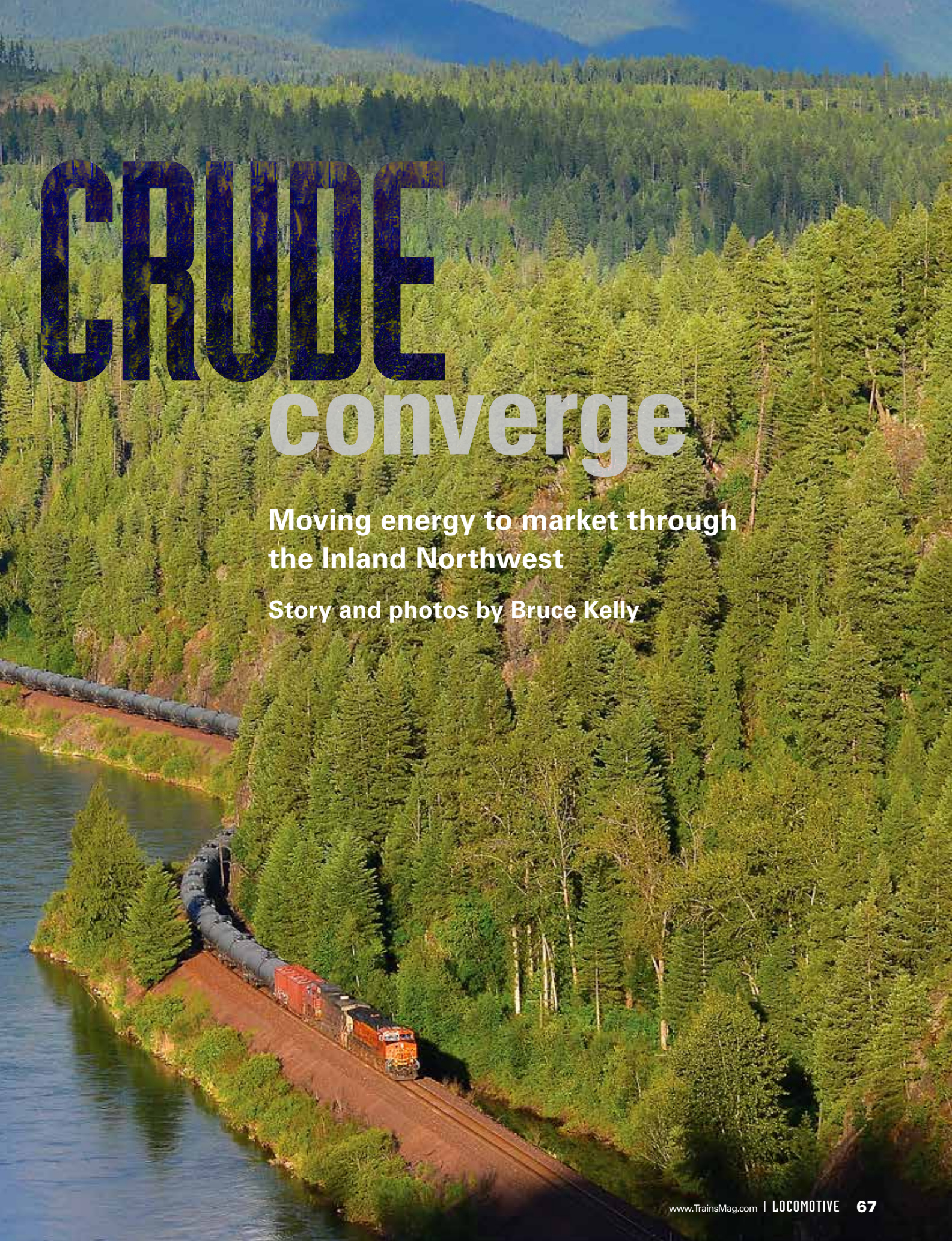
"She hasn't quit on us yet!" exclaims Jones, looking in the side mirror as the last car comes off the old Bloomer Line at Risk and rolls onto the former Wabash main. Jones quickly buries the throttle, and the 7549 digs in, doing what the gods of dieseldom and EMD intended. "Just listen to her!" T

STEVE SMEDLEY has been a photojournalist for 33 years. The New Jersey native lives in Atlanta, Ill., with wife Donna, son Samuel, and three vicious attack dachshunds.

Where COAL AND



At the northernmost point on BNSF's Northern Corridor, GEs roll westbound crude oil along the Kootenai River between Katka and Crossport, Idaho, on June 20, 2014.



CRUDE converge

Moving energy to market through the Inland Northwest

Story and photos by Bruce Kelly

The Spokane skyline and distant peaks rise above the Latah Creek Bridge as BNSF ES44C4 No. 6827 and ES44AC No. 5792 work westbound crude oil through town on June 6, 2014.

In the June 1953 issue of Railroad magazine, photographer Phil Hastings described Spokane, Wash., as "the most important railroad center in the northwest quadrant of our country, and the only city west of the Mississippi River which enjoys through passenger service on three different transcontinental lines." With its once-vaunted and varied passenger service now condensed down to Amtrak's *Empire Builder*, Spokane today is nowhere near the important passenger hub that Seattle and Portland, Ore., have become. But freight traffic through Spokane is as big a deal now as it's ever been.

One glance at the map explains why. From as far away as the southeastern tip of Nebraska and even Chicago, a web of main lines and feeder routes gradually converge in a northwestward direction, like streams flowing into a mighty river that ultimately disperses into the sea. Getting there requires passage through one of the few gaps in the far northern tip of the mountainous

With SD70ACes fore and aft, a BNSF Railway coal train off Montana Rail Link crosses Lake Pend Oreille near Sandpoint, Idaho, taking Main 1 through East Algoma with loads bound for Roberts Bank, British Columbia.

Bakken crude oil gets the high green through Hauser Junction, Idaho, as GEs meet at speed on March 4, 2015.

On Christmas Eve 2013, a Union Pacific train led by Canadian Pacific ES44AC No. 9367 is tied down on the Coeur d'Alene Branch at Coeur d'Alene Junction, Idaho, with a string of Canadian crude-oil loads stretching beyond the horizon.

barrier that is the state of Idaho. In fact, Sandpoint, Idaho, is the unassuming but all-important junction — more lakeside tourist mecca than railroad town — where separate rail lines become one for the final approach into the Spokane area.

BNSF's Spokane-Sandpoint "Funnel" runs heavy with traffic that's handled through seaports in the Pacific Northwest, be it containers full of foreign merchandise coming east or hoppers moving export grain west. To that, add all manner of mixed freight, chemicals, and increasing domestic intermodal traffic, which at times seems to put more trailers and containers on the track for J.B. Hunt, UPS, Schneider, and other U.S. carriers than there are from international shipping companies.

Only in the last few years have unit coal and unit crude become front-page news in the otherwise overlooked routine of railroad activity in and around Spokane. Not that coal is something new here. Powder River Basin coal has been rolling into the Northwest for close to a quarter-century. What has changed is the amount of coal being shipped through the region for export, and the number of export terminals now available in Canada and proposed in Washington and Oregon. Even though the region's two remaining coal-fired power plants are scheduled to close or switch to alternate fuels within the next decade, it's widely assumed that coal traffic through the Inland Northwest can only increase.

The same is being said about crude oil, which had actually been traveling by rail to refineries in the Northwest and elsewhere long before crude-by-rail was a catch phrase. But it was the passage of BNSF Railway train U-EPPAYW through Spokane in July 2012 that ushered in the era of unit trains delivering a hundred or so loaded tank cars in one shot to Northwest refineries and offloading terminals. U-EPPAYW sat stored on the Great Northwest Railroad in southeastern Washington for several weeks before being delivered to the newly expanded rail terminal at a Tesoro Corp. re-

finery in Anacortes, Wash. Unit-train facilities in either loop- or straight-track configurations have since been added to existing refineries in Tacoma and Cherry Point, Wash., and to a barge terminal at Port Westward, Ore., but getting additional crude-by-rail facilities approved has so far proven to be nearly as difficult as the effort to add new coal terminals.

To those who understand BNSF's operating strategy in the Northwest, unit crude and coal are being handled and routed much the same way as unit grain that's headed to port. In fact, the crude that BNSF ships west from the Bakken shale of North Dakota shares track with grain and other goods coming west from Minnesota, the Dakotas, and eastern Montana via the former Great Northern Hi Line. Coal, on the other hand, comes into the Northwest on BNSF and Montana Rail Link trackage of mainly Northern Pacific heritage, a course that's equally popular for grain and other traffic, including the occasional crude train that has been diverted from the Hi Line.

Take the low road

West of Spokane, unit trains of coal, crude oil, and grain would have a shorter trip to many Northwest terminals if they traveled over the Stevens or Stampede passes, but the higher costs and capacity constraints involved in moving such tonnage up and down those 2.2-percent grades are unfavorable to BNSF. Instead, this traffic takes the longer way west, via Pasco, Wash., and the lower Columbia River, detouring around the Cascades, rather than crossing over them. The added crew costs are more than offset by lower fuel consumption and the use of fewer locomotives. Empties, on the other hand, are commonly sent east over Stevens and Stampede, which helps to reduce conflict against the westward flow of loaded unit trains along the Columbia.

Loads of coal and crude converge at Sandpoint, along with grain and intermodal and everything else. Most unit trains have their head end and distributed power refueled at Hauser, Idaho, where three main lines run through a canopied servicing facility. (A fourth fueling track serves light power.) From Hauser Yard westward, it's a straight shot through Spokane, then southwest toward Pasco. Beyond there, BNSF's unit crude-oil trains can either diverge onto the Oregon Trunk Subdivision to head south into California, or continue west to the barge terminal at Port Westward, Ore., or loop all the way up to one of the refineries along Washington's coastal inlets.

Coal destinations in the Northwest are varied as well. From Spokane, BNSF delivers Powder River Basin coal to TransAlta's power plant in Centralia, Wash., located 50 miles south of Seattle. Coal trains bound for Portland General Electric's power plant southwest of Boardman, Ore., must be handed off from BNSF to Union Pacific at Spokane, since Boardman lies on UP's Portland-Salt Lake City main line. Boardman is scheduled to end its use of coal in 2020. Centralia is expected to follow suit in 2025.

BNSF moves more coal toward Roberts Bank, British Columbia, than it does to Centralia and Boardman combined. And the roughly two trains per day that the railroad delivers to the Roberts Bank export dock should soon be joined by additional coal trains that BNSF is planning to ship to a new rail-to-barge export facility under development at Surrey, B.C. On a less-frequent basis, MRL and BNSF jointly haul

UP ES44ACs wheel Alberta-bound empties north of Coeur d'Alene Junction on Jan. 7, 2015.

Taking the direct route from Puget Sound to Spokane, a Norfolk Southern SD70ACe looks rather lost leading an empty BNSF oil train through the desert coulee country approaching Irby, Wash., on March 21, 2014. Destination: Berthold, N.D.

petroleum coke to Roberts Bank from a refinery in Billings, Mont. These unit coke trains typically use solid sets of GATX hopper cars, making them distinguishable from the region's more common Powder River coal trains.

Crude also continues to find new growth opportunities through the Inland Northwest. UP began moving Canadian crude south through Spokane in 2013, but only as loose blocks of up to 50 or so tank cars coupled into regular manifest freights. True unit-crude service began in late 2014, with Canadian Pacific interchanging such trains to UP at Eastport, Idaho, about once or twice a week. Refineries and distribution terminals in California have been the main destination for this Canadian crude, although a number of trains have also been taken to Tacoma, Wash. Unlike the light Bakken crude that BNSF hauls out of North Dakota, what UP hauls south from Canada is heavy crude that is pipelined from the oil sands to a processing and loading terminal at Hardisty, Alberta. As of April 2015, these CP-UP unit-crude trains had become virtually nonexistent, though blocks of crude continue to roll south in daily manifests.

Turning the tide?

Aside from the expectation that the Boardman and Centralia coal plants will be closed, the future prospects for hauling carbon commodities into the Northwest remain somewhat of a mystery, and are largely dependent on political, environmental, and economic decisions being made far from the marketing offices and dispatching centers in Omaha, Neb., or Fort Worth, Texas. For now, while the tide of this traffic remains relatively strong, visitors could stay for 24 hours at the Sandpoint depot and expect to see as many as three or four crude-oil trains roll in off BNSF's Hi Line, and about the same number of coal trains from MRL. Less than a mile to the northwest, a visitor might also catch a glimpse of UP crude passing over Sand Creek and rattling across BNSF's Sandpoint diamond.

All of this Northwest crude-oil and coal traffic comes together in Spokane, where UP relies on BNSF trackage rights through the city, and where empty trains from California and the Pacific Northwest run upstream, past their loaded counterparts on the adjacent main. Crude-oil and coal trains here are still outnumbered by intermodals, manifests, and grain, which only adds to the mystique of seeing a mile-long string of gleaming black tank cars or fully loaded open-top gondolas, powered by locomotives both front and rear, throttled up for the climb out of Spokane on the Latah Creek Bridge.

That bridge, and such trains, did not even exist when Phil Hastings took his photographs here more than 60 years ago. And just a decade ago, who could have imagined that Spokane and the Inland Northwest would play such a vital role in moving unit crude and coal to market? It's an unlikely crossroads in America's march toward energy independence. I

BRUCE KELLY was associate editor of Railfan & Railroad *magazine from 1988 to 1996. He's been a digital prepress coordinator in northern Idaho since 1997, and serves as a contributing editor to* Railway Age.

Coal's steepest climb to the Northwest is MRL's Mullan Pass. On July 2, 2012, three head-end units (BNSF Nos. 9740, 9227, and 5919, left), a quartet of MRL SD70ACe midtrain helpers (center) and rear distributed power unit BNSF No. 5761 tackle Mullan's 2.2 percent with 125 loads from Montana's Signal Peak Mine to the export terminal at Roberts Bank, B.C.

Catch 'em while

Dilworth's streamliners gather Down Under ▪ by Bernie Baker

Mate, these new GEs and EMDs with all the modern conveniences are OK to drive, but they're hardly a patch compared to the locomotives I began with. Starting on the railways in 1982 meant there were still truckloads of covered wagons on the books, bearing in my mind that most were only 30 years old or younger back then.

Times have changed and we've had to change with them. As I write this, it's getting closer to winter here in Australia, and I think about worn door seals and leaking windscreens on 1950s-built streamliners. With layers of jackets and extra socks, you still breathe condensation.

Worse was when you selected dynamic brake — and any warmth in the cab was sucked back into the engine room as cold air was dragged in from the outside.

Yep, I miss those days, and I didn't care about the cold. Thanks to the company I work for now, Southern Shorthaul Railroad, I still get on those old bangers, although door seals have improved. They have air conditioning and refrigerators too. Behind the engine room wall, roots-blown 16-cylinder GM engines still make all the right noises as well, and some are fitted with those old-school dynamic brakes that howl in the night. But opportunities to work the old streamliners are becoming few and far between.

I'm envious when mates post pictures of an old GM they're currently working. These old girls are getting thin on the ground, and it's time to bring them together. The Streamliners 2016 event,

Streamliners in Australia are still working the main line. Southern Shorthaul Railroad operates several, including GM10, an ML1 seen working an empty rail train in the central west of New South Wales along with preserved A16C No. 4204, on hire from the Lachlan Valley Railway. Bernie Baker

you can

scheduled for Oct. 1-3 in Goulburn, New South Wales, Australia, will do just that, uniting a collection of old covered wagons from the Goodwin-Alco and Clyde-GM stables.

The Goulburn gathering will be an opportunity for all of us to capture days past. But don't despair just yet. Southern Shorthaul still has a reasonable fleet, as does Genesee & Wyoming Australia, with its turbocharged, 3,000-hp beasts. Chicago Freight Car Leasing Australia also has a few that can be found on freight and infrastructure (maintenance-of-way) trains.

So you need to catch 'em while you can, folks. I hope to see you at Streamliners 2016 in Goulburn for one helluva party and some great stories of days gone by.

For more information see www.streamliners2016.com.

The controls might be on the left, but the throttle is in notch 8, and the author has SSR GM10 making all the right noises. Look for both to be participants at Streamliners 2016 in Goulburn, Australia. Author's collection

Mainline running at age 63! DL RS3s 4118 and 4068 are bound for Scranton in May 2015. Greg McDonnell

Still rockin'

Spend a workweek with the Alco doc and his master mechanics at Delaware-Lackawanna's South Scranton shop

by Greg McDonnell and Paul Cordingley

The smooth whine of dynamic brakes and the guttural refrain of Alco 244s fill the air as rocky crags and the lush greens of early spring in Pennsylvania's Pocono Mountains blur past the open windows of an RS3. Delaware-Lackawanna No. 4068 is the second of two RS3s hurrying a train of grain empties from Mount Pocono to Scranton, Pa., on a pleasant May afternoon. Up ahead in the cab of D-L No. 4118, engineer Chad Tyk nudges the throttle a bit and tugs a couple blasts on a Nathan M3T horn as the Alcos lean into a tight curve. It's an exhilarating ride, rocking and rolling westward on D-L's onetime Delaware, Lackawanna & Western "Pocono Main" aboard a pair of 63-year-old RS3s. Mainline running at age 63!

The downhill sprint is light work for the veteran Alcos, but Tyk, conductor Nate Haydt, and the RS3s have been on duty since dawn. They've worked the steep grades of the Laurel Line to switch industrial customers prior to making a Scranton-Mount Pocono turn, and there are nearly three-dozen grain loads waiting for them to lug back to Scranton after delivering the empties to the Delaware & Hudson at Taylor yard.

The old girls put in a flawless performance, a remarkable feat for locomotives half their age. But no one expects any less from these, or any other of the 18 Alco and Montreal Locomotive Works machines maintained by D-L's South Scranton shop.

What does it take to keep a fleet of aged Schenectady- and Montreal-built locomotives in top operating condition and capable of reliable performance on a rugged mountain railroad? It takes hard, dirty work; an innate ability to understand the idiosyncrasies of complex machines; an encyclopedic knowledge of locomotive designs, parts catalogs, and suppliers; fearless improvisation, instinct, faith, guts — and more hard, dirty work.

"It's easy," says Alco guru and Delaware-Lackawanna Chief Mechanical Officer Don Colangelo. Easy? Don't believe it for a minute!

1

"How're you doing?"

Don Colangelo shouts his signature greeting over the rhythmic beat of a pair of idling Alco 244 prime movers as he finishes washing the cab windows of Delaware-Lackawanna RS3 No. 4068. You wouldn't expect to find a chief mechanical officer doing windows, but Colangelo isn't your average CMO. Washing windows is emblematic of the dedication, meticulous attention to detail, and pride in a job well done that Colangelo demands of himself and those who work for him. Not only is he the locomotive honcho of Scranton, Pa.-based D-L; he's also vice president of mechanical for parent Genesee Valley Transportation Co.'s network of short lines in Pennsylvania and upstate New York.

Presiding over the cramped, two-stall South Scranton shop that is home to a celebrated fleet of Alco diesels, Colangelo is team leader of the tight-knit band of hard-working men who keep these remarkable machines working — and working well. It helps that their boss is one of the most respected authorities anywhere on the care, maintenance, design, and operation of Alco diesels.

"We're a bit late," Colangelo explains, barely stopping to talk as he steps down from the RS3. "We took a bit of a beating with some unexpected stuff — but we're OK now." And with that, he swings aboard D-L No. 414 and flings open a set of hood doors to check the pulse and vital fluids of the Lehigh Valley-painted C420. A few feet away, mechanic Bill Strein wrestles with an m.u. cable to connect the 414 with the two RS3s coupled ahead of it, while Chris Jones inspects the running gear and brake shoes of the Alco trio, which is booked to work local job LL-1. By the time the sun hits the shop track, LL-1's power is serviced, checked, and ready to roll. It's Monday

2

3

4

1. Monday morning: Don Colangelo surveys the scene as PT-98's crew goes to work with RS3 No. 4068 in the lead.
2. Chris Jones, Colangelo, and D-L RS3 No. 4103.
3. No. 4103 awaits a repaired electric clutch; M630 No. 3000 is in for a wheel set/traction motor combo change. By week's end, they'll both be ready for the road.
4. From left, Jones, Bill Strein, and Colangelo work to replace the clutch coil for No. 4103. Photos 1-3, Greg McDonnell; Paul Cordingley

morning and the start of another workweek for Colangelo and his crew.

The pace doesn't slacken. Well before LL-1's train crew reports for duty at 8 a.m., the boys in the shop are deep into their second assignment of the day: replacing the clutch coil of the electric clutch in the cooling-fan assembly of RS3 No. 4103. It'll take teamwork to perform the complicated task — teamwork, a tow motor, and a 30-ton mobile crane to put the several-hundred-pound component back where it belongs. The job will be done before lunch.

"We're gonna be busy," Colangelo says, looking at the week ahead. "We'll get this one back in service," he says, gesturing toward No. 4103, and then he rattles off a weeklong agenda that would keep busy a shop twice the size. At the top of the list, the No. 5 wheel set/traction motor combo of M630 No. 3000 needs to be changed, a job that will require all five shop men, the shop's 30-ton Badger mobile crane, and the heavy lifting capabilities of the brawny 130-ton American wrecking crane positioned just outside the building. When that's done, the big Montreal needs additional truck work and a 92-day inspection.

All in a week's work

Monday

Service, inspect, and dispatch locomotives at Bridge 60 (downtown Scranton) and South Scranton shop. Repair and replace clutch coil in electric clutch for cooling fan in D-L 4103.

Tuesday

Service, inspect, and dispatch power for PT-98. Continue reactivation of D-L 4103. Replace No. 5 wheel set/traction motor combo on D-L 3000. Restart 5460.

Wednesday

Service, inspect, and dispatch locomotives at Bridge 60. Continue truck work on D-L 3000. Replace batteries in D-L 4103, adjust charging system; begin 92-day inspection.

Thursday

Service, inspect, and dispatch locomotives at Bridge 60. Replace P22 contactor shunts on D-L 414. Complete truck work on D-L 3000.

Friday

Service, inspect, and dispatch locomotives at Bridge 60. Locate and repair control ground and replace fuel pump booster motor on D-L 414. Complete 92-day inspection on D-L 3000 and place locomotive in service.


1


2

1. Easy does it. With the help of a 30-ton crane, Strein and Jones carefully work to install the newly repaired electric clutch in D-L No. 4103. 2. Work in progress: a complete overhaul, upgrade, and paint job for C425 No. 2457. 3. Heavy lifting. Shop crane lifts No. 3000 as all hands work to change the No. 5 wheel set/traction motor combo on the Montreal-built M630. 4. Hand signals. Bill Strein directs the crane operator as Chris Jones guides the rebuilt combo for No. 3000 into place. Photos 1-3, Greg McDonnell; Paul Cordingley

>> For a detailed D-L locomotive roster, visit www.TrainsMag.com/Locomotives

Two other locomotives require 92-day inspections, including No. 4103, which also needs electrical work to get it back on the road. Sitting in the second bay of the shop, C425 No. 2457 is torn down for a complete rebuild and upgrades. All that, plus the daily ritual of servicing, inspecting, and dispatching the locomotives required on D-L assignments. And the inevitable surprises. "You know how things go on the railroad!" Colangelo says, turning to bang out a few bars of Chopin's Funeral March on the piano that just happens to be nearby.

Week in and week out, the D-L shop crew works its magic, achieving remarkable performance and reliability from an aged fleet of Alco and Montreal Locomotive Works products that handle heavy-tonnage trains on a demanding mountain railroad. They may be long past their prime — the youngest, Montreal-built M420 No. 2045 is 42 years old; the oldest, a quartet of RS3s turned out of Schenectady 63 years ago — but those who know Alcos say that Colangelo's refinements have many of these old girls working better than ever. Watch (and listen to) a brace of Centuries lugging road freight PT-98 up the legendary Pocono Mountain grades of the onetime Delaware, Lackawanna & Western, or ride a pair of RS3s working a Carbondale local or Mount Pocono grain extra, and you'll quickly concur.

"My guys can fix anything," Colangelo says with unflinching pride. "Spend a week here and see what we get done." Now there's an offer too good to refuse.

Is there a doctor in the house?

Some days get off to an easy start; this isn't one of them. Colangelo is just buttoning a freshly laundered work shirt and settling in at the shop on a quiet Thursday morning when the phone rings. It's Mike Masakowski calling from Bridge 60: C420 No. 414, one of three units marked for PT-98, will not start. The engine won't even crank. Colangelo digs for the keys to his trusty 1974 Ford F250 pickup. "Want to go for a ride?"

This CMO makes house calls. PT-98, called for 9:30 a.m., requires three locomotives for tonnage and can't be delayed. The clock is ticking as the drama plays out:

7:50 a.m.
Colangelo piles into his old Ford pickup and heads to Bridge 60.

7:56 a.m.
Colangelo is on scene at Bridge 60 and begins assessment of No. 414 with Masakowski. Electrical panels are opened; breakers are thrown as the starting sequence is repeated. Dead silence.

8:13 a.m.
Time for deep troubleshooting: "Follow the 43 wire," Colangelo declares, working from instinct and a phenomenal knowledge of the complex circuitry. "It's there someplace." Colangelo and Masakowski isolate and test each element of the starter circuitry. It's an old-school task, performed with a simple tester and a jumper crafted from a strand of wire. Each component is checked in quick succession. Colangelo tersely calls the shots, "OK, try it here. OK, now here."

8:17 a.m.
Bells sound out in the cab as circuits are energized. The mystery is solved; the "P22" contactor shunt is worn and broken. Colangelo bypasses the circuit; the engine cranks and roars to life. Now for the fix.

8:20 a.m.
The full extent of the failure is confirmed. The shunt wires must be replaced, but the contactor frame is undamaged and can be bolted tightly back into place. It's a straightforward task but the shop is a couple miles away. Lesser men might have the unit kicked out and deal with the issue later. "We can have this changed out and ready to go by 9:30, right?" Colangelo says emphatically. It's a challenge, not a question.

8:24 a.m.
Colangelo is back in the old Ford, heading to the shop for parts. Masakowski and Chris Jones (who's joined in after changing a brake shoe on D-L No. 2452, the middle unit in the consist) are assigned to remove the failed parts and prep No. 414 for repair.

8:43 a.m.
Colangelo returns with the parts. Everyone has an eye on the clock.

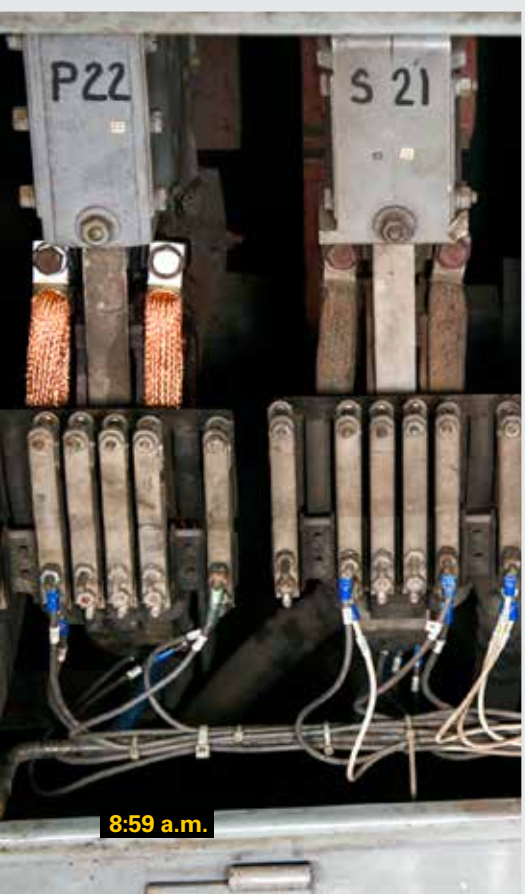
8:59 a.m.
Parts are installed and the interlock adjusted. Colangelo hits the starter button on the back wall of the cab; No. 414's 12-251 engine cranks over and comes to life immediately.

9:02 a.m.
The work is checked one last time. The panels are buttoned up and the repair is signed off.

9:05 a.m.
Colangelo is back in the old Ford, returning to the shop to resume the day's planned work on M630 No. 3000 and RS3 No. 4103. PT-98's power is good to go. They don't call him Alco doc for nothing. — *Paul Cordingley*

Photos: Greg McDonnell and Paul Cordingley

8:17 a.m.

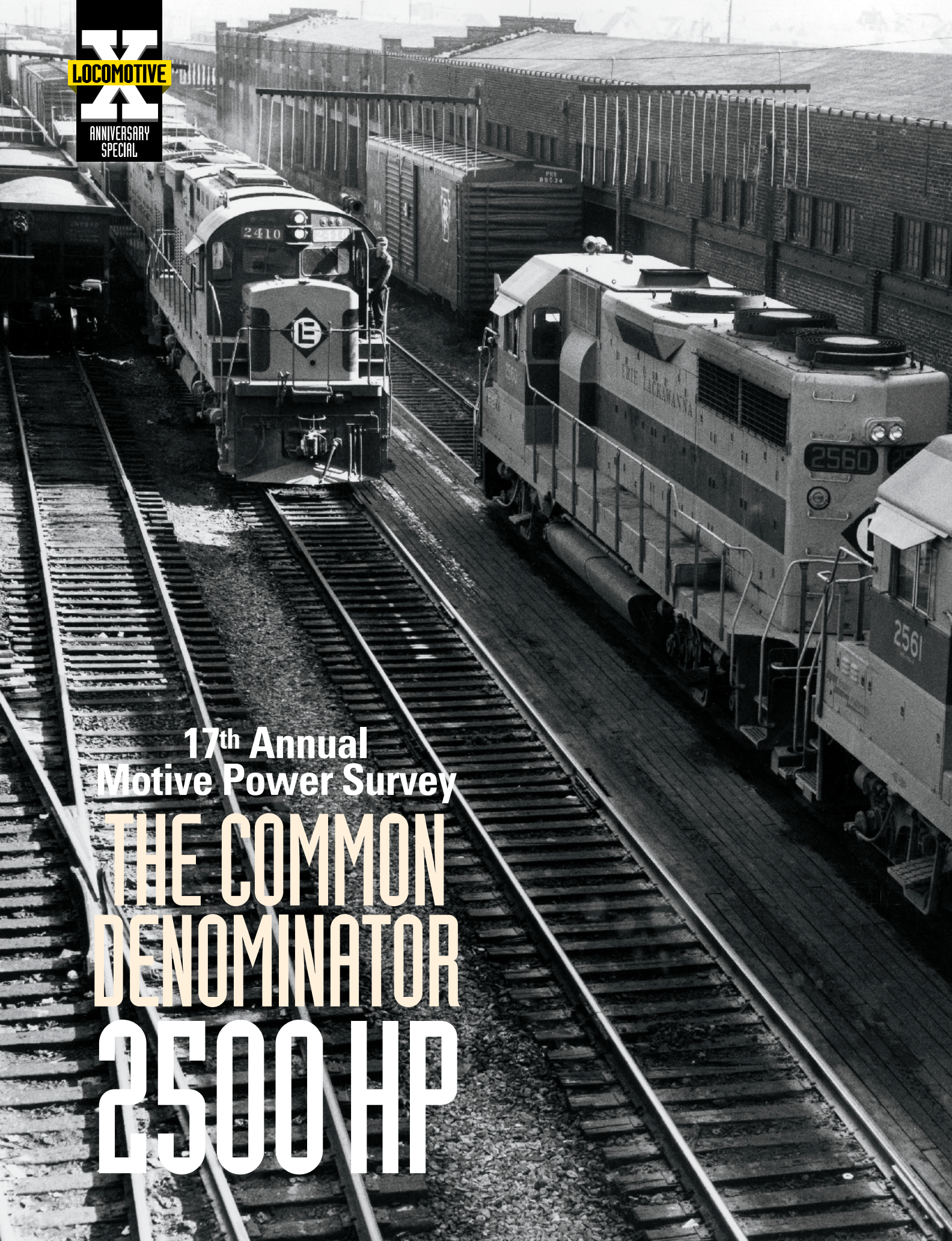


8:59 a.m.

9:02 a.m.

LOCOMOTIVE X

ANNIVERSARY SPECIAL



17th Annual Motive Power Survey

THE COMMON DENOMINATOR 2500 HP

But the horsepower curve will climb next year

by David P. Morgan

In marking report cards for the locomotive market, we would accord a grade of B, perhaps even B+, to the year 1964. Approximately 1,000 diesel units were placed in service by Class I railroads in the U.S. — fewer than a third the number built during each of the three boom years of steam locomotive replacement, 1950-1952, but eminently satisfactory when compared with the fewer than 300 units delivered as recently as 1961. Any year in which New Haven can muster the funds for new locomotives and in which a fair number of 1,200-hp switchers crop up in the order columns may be defined as a good year.

Keep in mind, too, that as a barometer the number of units installed in a given year has become quite as obsolete as carloadings. For just as freight cars are bigger and hauling more, so too has the typical new diesel of a decade ago, the 1,600/1,750-hp B-B, been eclipsed by today's almost universe choice, the 2,500-hp B-B or C-C.

Seldom if ever had there been such singularity of choice in the market as was displayed in 1964. Everyman's unit packed a V-16 engine rated at 2,500 hp for traction purposes, the only option being contingent on whether one wanted to express that power in four motors for speed (more than half the customers did) or in six for better footing on the hills (Coast Line's now-famous six-motor-unit advocacy picked up such converts as the Chessie camp, Pennsy, and Espee). One could almost count the exceptions to the rule on one hand. Illinois Central remained with normally aspirated units (if one excludes those older Alco hoods acquired with Peabody Short Line) by adding a dozen 1,800-hp EMD GP28s … trunk lines, short lines, and terminal roads caused a modest rebirth in the long dormant yard-engine field … and Union Pacific went whole hog on jumbo-size, twin-engined 5,000-hp units by ordering a

Second-generation Alcos and EMDs face off on Erie Lackawanna as GP35s meet C424s during a crew change at Binghamton, N.Y., in 1964. J.J. Young Jr.

"Point of no return on couplers." Midtrain power (former FTB remote control receiver and three GP30s) on Southern No. 154 at Chatham, N.C. Curt Tillotson Jr.

pair of GE U50s and 44 EMD DD35s. Alco juggled the ratings a bit by continuing to offer the Century 424 and barnstorming a quartet of "most powerful single-engine unit" candidates, 2,750-hp Century 628s; but its hardcore best seller, in common with that of the competition, remained a 2,500-hp B-B, the Century 425.

Only a few questions broke the routine. Why, for example, is Union Pacific so pleased with its 5,000/5,500-hp two-units-in-one goliaths while everyone else in railroading (save Southern Pacific, which has dabbled a bit) treats them like the plague? The criticism runs like this: 5,000-hp units are simply too big and inhibit flexibility; if one engine fails, the other is tied up in the shops while its mate is repaired; the shop width and cranes won't handle 'em. Yet in an era when 10,000-hp locomotive combinations are commonplace and up to 30,000-hp teams are not unheard of, the two-in-one units offer significant purchase-price and long-term savings. UP, it is true, has a habit of buying high-horsepower locomotives which the rest of railroading views with more curiosity than envy (notably gas turbines), but in this instance Omaha may enjoy the last laugh.

What UP means to 5,000-hp twin-engined units, Southern Pacific, of course, means to diesel-hydraulics. Now that Rio Grande has thrown in the sponge, Espee alone is operating fluid-drive power (the fleet consists of six cab-type 4,000-hp Krauss-Maffeis imported in 1961 by both Espee and D&RGW; 15 more KMs of a refined hood version brought in during 1963-1964; and three 4,300-hp Alco Century 643-H units put to work last fall). San Francisco HQ makes no comment on the hydraulics, which seem to spend much of their time running up and down the flat San Joaquin Valley as single units. Significantly or not, the West's largest railroad ordered no more of them in 1964, concentrated instead on 2,500-hp B-Bs and C-Cs — just like everybody else.

One question raised last year by Electro-Motive's offering of a 90-mph six-motor unit with a steam generator — the SDP35 — appears to have been answered. The streamlined A1A-A1A passenger cab unit is apparently as passé as the carrier pigeon. Write it off the books as a casualty not only of declining passenger train-miles but of a graceless era of locomotive design in which, perhaps necessarily, functionalism has supplanted esthetics.

Electro-Motive wrote up orders for almost 2.4 million horsepower in 1964, a banner year during which its GP35 gave chase to its previous top-selling GP30 and won. That was comfortably more than double the domestic business of its two rivals combined, and in mid-1965

"Omaha may enjoy the last laugh." Twin-engine DD35, U50, and Century 855 "goliaths" gather at Council Bluffs, Iowa. Union Pacific

GM's locomotive division confirmed rumors that it would step up the competition by offering a brand-new model line in 1966 [page 3, July 1965 TRAINS]. By putting out to pasture the most famous engine in all of dieseldom — the Kettering-inspired two-cycle 567 — Electro-Motive will be able to raise the present 2,500-hp ceiling (sole exception: Alco's Century 628 and 630) up to a 3,000-hp average and a 3,600-hp maximum, thanks to the larger displacement of a new 645-series line of engines complemented (in the turbocharged versions) with an alternator for more efficient production of electrical energy. Thus, beginning next year, the market will offer a four-axle unit with exactly double the horsepower of the F3 and F7 (and its rival makes) with which most of railroading discharged steam.

And the Oscar goes to ...

Yet if EMD once again deserved an Oscar for its performance in 1964, then General Electric was clearly entitled to the Best Supporting Actor award in the locomotive game. Last year the U25B — deservedly famous for its simplicity and for its air filtration system and first application of 2,500 hp on four motors — came into its own; it rang up so many orders and reorders (along with its six-motor mate, the U25C) that GE managed to edge out Alco for the No. 2 builder slot (532,500 vs. 406,900 hp). Erie was particularly delighted (just as La Grange was annoyed) with the enthusiasm with which old-line EMD customer Burlington ordered and reordered GE diesels.

The Q incident meant more to GE in prestige than in sales dollars, true, but nevertheless morale soared. To hold onto its No. 2 position, General Electric will have to elevate unit horsepower in 1966 and shift to an A.C./D.C. transmission. Just how much elasticity the Cooper-Bessemer-sired and GE-redesigned and -produced FDL-16 has in it is known only to Erie; and the firm is keeping mum on its plans for an alternator. However, GE was the first to attain 2,500 hp on four motors and has in the past talked of a technology capable of building 4,000-hp-plus four-motor units. Moreover, the plant is well versed in rectifying A.C. power to D.C. as a result of its experience with the E-44 straight-electric freight locomotives built for the Pennsy and will presumably act as a supplier of the electrical transmission equipment for Alco's new A.C./D.C. Century 630.

Which leads us to the industry's most versatile builder: Alco Products. Last year Schenectady turned out the highest horsepower single-engine diesels, the highest horsepower double-engine diesels, the only homemade diesel-hydraulics (albeit with German transmissions), and its traditional big slug of 1,500-hp-plus export orders (2,491 units averaging 1,777 hp each). Moreover, this year Alco was the first to announce, and will be the first to place in revenue service, diesels with A.C./D.C. transmissions (three Century 630-model 3,000-hp C-Cs for Atlantic Coast Line). Now a division of onetime feedwater heater supplier Worthington Corporation, Alco faces with GE the competitive threat of EMD's newly announced 1966 line. Its reaction will not be to lie down.

"Out to pasture: the most famous engine in dieseldom." Prototypes of EMD 1966 line rub shoulders with Santa Fe F units, Geeps, and Alco Alligators. EMD

The continuing horsepower race in dieseldom reflects the rails' desire — indeed, necessity — to retain and capture more of such high-rated traffic as piggyback, containers, auto parts, and new automobiles, all of which are synonymous with speed. Piling more and more horsepower on the front drawbar pushes railroading nearer and nearer that point of no return on coupler strength, which will make midtrain power mandatory. Although Western lines have employed automated helpers in the past, only Southern (with radio-controlled midtrain units) and Louisville & Nashville (with a self-sufficient sensory-couplers-equipped midtrain unit) are now known to be exploring the field. Indeed, locomotives as such might even be replaced someday by mobile power plants developing current for traction motors beneath the payload, if integral trains of the description pictured in March 1965 TRAINS get off the drawing boards.

For the foreseeable future, though, Everyman's diesel, no matter where located in the consist, will continue to be an increasingly higher horsepowered, robust, nonexotic ton-mile producer, designed and manufactured to run off as many miles a month as, and often more than, E units once did on Florida streamliners, to stay out of the shops, and even to stretch the mileage (thanks to fuel tanks with up to 4,000 gallons capacity) between oil hoses. Do these second-generation diesels live up to their builders' broad claims? The operating statistics of U.S. railroading say yes. Diesel ownership hit a high of 28,359 units in 1959, declined to approximately 27,500 last year; yet ton-miles — 551.6 billion in 1958 — climbed to 665 billion in 1964. Again, the rails hit an all-time high of more than 70,000 gross ton-miles per freight train-hour last year — better than double prewar performance.

And the best is yet to come. I

"Oscar winner and best supporting actor." Rio Grande GP30s mingle with Rock Island U25Bs in Denver's North Yard. Richard Steinheimer

Oregon Pacific SW1 No. 100, "the most famous diesel in the Northwest," runs along the Heleco Spur in Milwaukie, Ore.
Scott Lothes

One of everything

Oregon Pacific Railroad hosts an eclectic mix of EMD switchers in the City of Roses

by Justin Franz

In the early 1960s, when Richard "Dick" Samuels was in high school, he got a D in shop class. The grade wasn't because Samuels was incapable: He could easily have completed the metal dustpan and a sugar scoop that were required of all students, but he was too busy turning wheels for his 1.5-inch-scale model of Portland Traction Co. SW1 No. 100.

Growing up in the 1950s and early '60s in the Portland, Ore., area, Samuels often watched Portland Traction and thought that the railroad's 1952-built EMD SW1 would be the perfect modeling project. Little did he know that his collection would one day include the real No. 100, as well as the eclectic mix of switchers that make up the roster of today's Oregon Pacific Railroad. "We've got one of everything," Samuels says.

Dick Samuels

For nearly a quarter of a century, the Oregon Pacific has faithfully served industries in and around Portland. And heading up the operation is Samuels, 71, and his three sons.

Today, Oregon Pacific operates two separate pieces of railroad: the 5-mile East Portland Division, once part of the sprawling Portland Traction, and the 7-mile Molalla Branch, former Southern Pacific.

The East Portland Division's roots date to the 1890s, when a series of electric and traction railroads were built throughout the Portland area. By the diesel era, the passenger traffic had all but evaporated. In 1962, SP and Union Pacific purchased what had become the Portland Traction Co., and they operated it as a switching railroad for the next three decades.

Samuels got his first taste of railroading along that same line, thanks to his grandfather, who was head of the Oregon State Police traffic division. "Railroaders had a way of drinking too much and getting in trouble with the law," Samuels says. "Grandpa Dick would contact the offenders and offer them a deal if his grandson was treated to special experiences around the railroad."

Those experiences included running a Spokane, Portland & Seattle steam switcher around Portland Union Station, riding a three-unit set of Baldwin AS616s on SP's Tillamook Branch, and even running an Alco PA on the point of the *Shasta Daylight* to Salem, Ore., where the state police had a cruiser waiting to bring him home.

Continued on page 93

No. 100 eases past the OPR shops with a single reefer in tow on Feb. 18, 2011. Kyle Weismann-Yee

SW1200 No. 1202, a former CP SW9, crosses Johnson Creek on the Americold Spur in Milwaukie. Scott Lothes

On Valentine's Day 2011, OPR SW8 No. 801 crosses Highway 99E in Canby with six cars.
Scott Lothes

OPR 1413, a rare ex-CN GMD1, leads a mixed train through the rain on March 14, 2015.
Kyle Weismann-Yee

No. 801 ambles past RSG Forest Products in Liberal, one of the major Molalla Branch customers. Scott Lothes

SW1 No. 100 moves alongside the Willamette River in East Portland. Scott Lothes

Continued from page 89

During his teenage years Samuels occasionally helped the Portland Traction crews with their daily switching, and in 1963, while Samuels was in college, he got his first railroad job on the Northern Pacific Terminal Co. He was often assigned to the coach job that took incoming passenger trains to the balloon track at Lake Yard for turning. It was the perfect gig for a college student because it left plenty of time to study.

After two years, Samuels left the railroad and opened a locksmith business, and later, a steel fabrication shop in Milwaukie, Ore., but his passion for the rails never dimmed. Throughout the 1970s and early 1980s, the business continued to grow, and Samuels began to bid on rail salvaging projects.

In the 1980s, he purchased his first locomotive to switch carloads of steel beams and tubing at his shop. A Davenport 20-ton switcher, SPMW 570, was built in 1941 for the U.S. Army and later became SP's shop switcher at Brooklyn Yard in Portland. Today, it is owned by the Pacific Northwest Chapter of the National Railway Historical Society and slated for display at the Oregon Rail Heritage Center in Portland.

In the late 1980s, Portland Traction filed for abandonment, and Samuels, who was one of the road's four remaining customers, led an effort to save it. He established the East Portland Traction Co. in 1987, and later acquired several locomotives, including No. 100, which had been sold to shortline holding company Watco a few years earlier.

It took four years to make a deal with UP and SP to purchase the 5 miles of Portland Traction that remained between East Portland and Milwaukie. On April 1, 1991, Samuels became the president of an operating railroad. In 1993, he took over the Molalla Branch, which now operates between Liberal and the Canby interchange with UP. Initially operated separately as the East Portland Traction and the Molalla Western, Oregon Pacific combined the two in 1997.

In its nearly quarter-century of existence, Samuels' short line has continued to grow. In the late 1980s, Portland Traction was moving about 125 carloads annually, but in 2014 Oregon Pacific (including the Molalla Branch) moved more than 1,000 carloads.

Moving that tonnage is a diverse mix of mostly EMD switchers, including No. 100, known by rail enthusiasts as "the most famous diesel engine in the Northwest." Also on the roster is No. 1413, a former Canadian National GMD1 built in 1959, and three other end-cab EMD switchers. The oddball in the mix is a General Electric 70-tonner built in 1949 as SP 5100. The GE has been out of service for years but is usually on display at the Oregon Rail Heritage Center.

In recent years, Oregon Pacific has operated passenger excursions along the East Portland Division on Saturdays from January to November. Samuels says the rides have become popular with families, and they're a fun way to show off the railroad.

On occasion, the passenger train has been a mixed train as freight work on the line is done in conjunction with the excursion. Freights on the Molalla Division are usually operated during the week, with switching duties performed as needed.

Samuels says he hopes business will continue to grow in the future, particularly out of a new industrial park, but he does not see any major expansions on the horizon.

"We're making enough money to feed four families," he says. But even if the goal is to put food on the table, railroading is still fun for Samuels and his boys. The 1.5-inch-scale model of his favorite engine now sits in the railroad's headquarters, not far from the real thing just outside.

JUSTIN FRANZ is a writer and photographer for the Flathead Beacon *in Kalispell, Mont. He offers special thanks to Kyle Weismann-Yee and Scott Lothes for their assistance with this story.*

Happy 50th birthday, EMD 434G

by David Baer

During the mid-1960s, Alco, Electro-Motive, and General Electric were locked in a race as each builder attempted to squeeze more and more horsepower from their respective diesel engines. EMD's response included development of a successor to its venerable 567-series prime mover, and an all-new locomotive line to go with it.

The arrival of EMD's wildly successful "1966" locomotive line, powered by the new 645-series engine, was heralded by the quiet introduction of a small group of unlettered, somberly painted test locomotives. First to hit the road, the granddaddy of all EMD SD40s was built in June 1964 as EMD "SD40X" pro-

Just days old, EMD 434G (left) poses for the company photographer at La Grange, Ill., in 1965. In the employ of Wheeling & Lake Erie a half-century later, the historic locomotive works through Bolivar, Ohio. EMD; Matt Arnold

totype No. 434. Built on a stock frame, EMD 434 looked for the most part like an SD35, save for three same-size fans atop the radiator section.

In 1965, EMD built eight more SD40X test beds, numbered EMD 434A-434H. Completed between April and July, these were also constructed on stock SD35 frames. While EMD 434A-434F were built with distinctive flared radiators, the final two units, EMD 434G and 434H, featured conventional radiator sections, giving them an appearance similar to No. 434.

At the end of their barnstorming careers, EMD 434 became Gulf, Mobile & Ohio 950, while EMD 434A-434H were sold to Union Pacific and numbered 3040-3047.

UP retired the SD40Xs during the 1980s and listed them for sale. UP 3046 — originally EMD 434G — was sold to a dealer in October 1988, resold to Wisconsin Central's Oxford Leasing, and hired out as WC 3046. In 1992, it was leased to and later purchased by regional carrier Wheeling & Lake Erie, becoming W&LE 3046.

Rebuilt to SD40-3 specifications in July 1998, W&LE 3046 turned 50 in July 2015: quite an accomplishment for any hard-working road locomotive. While older sister EMD 434 was retired as Illinois Central 6071 and donated in 2010 to the Monticello Railway Museum in Monticello, Ill., W&LE 3046 continues to rack up miles in revenue service.

LOCOMOTIVE X ANNIVERSARY SPECIAL

On Aug. 9, 2014, W&LE 3046 and former BNSF 6989, a much younger Canadian-built sibling, lead train 214 through Bolivar, Ohio. A half-century after rolling out of La Grange as a somber, black experimental, the old girl is looking good and is still going strong.

Happy 50th Birthday, EMD 434G!

1. A new locomotive-building super power? Dressed in Caterpillar yellow and hauling Cat equipment, Electro-Motive SD70ACe demonstrator No. 1201 leads Norfolk Southern train 055 at Centerville, Ill., Oct. 25, 2012. Mark and Mike Mautner

A decade of locomotive landmarks

The top 10 motive power topics and trends since 2006

by Chris Guss

1 Caterpillar gets EMD
Caterpillar rocked the railroad world with the June 2010 announcement that Cat-owned Progress Rail Services would purchase Electro-Motive Diesel for $820 million. The union of EMD and Caterpillar — a global powerhouse with world-wide clout — has the potential to create a locomotive-building superpower.

2 D.C. traction is dead
The year was 2012 and Canadian National Railway placed its first order for A.C.-traction locomotives (25 ES44ACs), effectively ending production of new D.C.-traction, domestic road-freight locomotives. The shift to A.C. traction began with Burlington Northern Railroad's landmark 1993 order for 350 EMD SD70MACs.

3 EVOs and ACes rule
Heralding an era of unprecedented standardization, the Big Two builders have streamlined their domestic catalogs to essentially a single A.C.-traction freight model each: GE's ES44AC (and its A1A-A1A ES44C4 derivative) and Cat-EMD's SD70ACe rule the marketplace — and the road.

4. CN ET44AC No. 3000 at GE Erie, Pa., in June 2015. Greg McDonnell

4 Evolution revolution
GE Transportation kicked off its Evolution Series locomotive line in 2005. The culmination of a seven-year, $250-million program to develop a fuel-efficient locomotive, the Evolution Series was designed to not just meet the then-new Tier 2 emission regulations, but to serve as a platform to ultimately meet Tier 4 requirements a decade down the road. GE engineers got it right. The builder has sold more than 7,500 EVOs worldwide, and production model, Tier 4-compliant locomotives began rolling off GE assembly lines in Erie, Pa., and Fort Worth, Texas, in spring 2015. Canadian National and CSX Transportation have already taken delivery of new Tier 4 ET44ACs, and BNSF Railway is getting A1A-A1A ET44C4s, successors to the road's EVO of choice, the ES44C4.

5 Got gas?
The booming domestic oil industry has unlocked natural gas in large quantities, driving the price down and interest up as a locomotive fuel once again. Railroads, locomotive builders, and third-party players continue to develop and test equipment while rules governing its safe use and transport are being refined.

6 Genset roller coaster ride
Gensets have seen an amazing rise and fall in interest within the North American market over the past decade. Union Pacific kicked off the trend in 2005, and to date, every Class I, with the exception of Canadian National, has purchased them. Sales have been down in recent years, with orders trending toward a smaller niche role in the industry.

7 Passenger power plays
Small builders such as MotivePower, Brookville Equipment, and Siemens have dominated the passenger-locomotive business since the Big Two backed away about a decade ago. Legacy builders are back, though, with EMD building new F125 passenger models, and GE providing propulsion for MotivePower HSP46 locomotives delivered to Boston's Massachusetts Bay Transportation Authority.

8 Rebuild revival
The choice of new locomotive models may be limited, but rebuild options are endless. EMD's ECO-repower program debuted in 2009, and has breathed new life into hundreds of locomotives. Norfolk Southern, Union Pacific, CSX, and BNSF have programs to rebuild and upgrade four- and six-motor locomotives in-house and with contract shops. Norfolk Southern and BNSF are upping the ante, exploring conversion of older D.C. locomotives to A.C. traction.

8. BNSF and NS are experimenting with A.C. conversions of D.C. locomotives. Built as a Dash 9-44CW, BNSF 616 was upgraded to an A1A-A1A "AC44C4M." GE

9 Tier 4 at last
Three of the four EPA emission tiers were brought to bear during the past decade, culminating with the implementation of Tier 4 regulations on Jan. 1, 2015. The EPA standards forced builders to create new and innovative ways to meet the tiered regulations with design changes ranging from subtle to radical, and achieved the most substantial reduction in locomotive emission ever. GE's Tier 4 locomotives are in production, while EMD will debut its demonstrators this fall.

10 One up, one down
Electro-Motive parent Progress Rail Services made history in 2011 with the opening of its Muncie, Ind., locomotive assembly plant, restoring the "Made in U.S.A." label to EMD-branded locomotives. Just months after the glitzy Muncie grand opening, EMD announced the closure of its London, Ontario, locomotive plant in February 2012. Completed in June 2012, Union Pacific SD70ACe No. 8773 became the last locomotive from London.

7. Will the "big two" take back the passenger market? MotivePower chose GE propulsion for its HSP46 model built for MBTA, and EMD has new F125s on the books for Midwest and California agencies. Greg McDonnell

Standard fare: BNSF ES44AC No. 5908 and SD70MAC No. 9190 work eastbound coal near Crawford, Neb. William D. Miller

First steps

by Greg McDonnell

The sun is setting on a September evening as eastbound BNSF Railway coal train C-CRMKCLO-67A grinds past Crow Butte east of Crawford, Neb. Bound from the Caballo Rojo Mine in Wyoming's Powder River Basin, to Kansas City Power & Light in Amsterdam, Mo., the train has an ES44AC and SD70MAC on the head end, another SD70MAC as a midtrain distributed power unit, and two more as rear helpers. That's standard fare in these parts.

Lead unit BNSF No. 5908 is one of more than 4,200 six-axle GEs in the employ of the railroad. The orange-and-black Dash 9s and EVOs are everywhere. In fact, they account for more than 60 percent of the BNSF locomotive fleet.

"Just another GE." I can almost hear photographer Bill Miller mutter the words as he framed the slow-moving train in the viewfinder of his Nikon. But wait, that run-of-the-mill GE has a story.

No. 5908 was fresh from the paint booth when I first encountered the sparkling new ES44AC at its Erie, Pa., birthplace on March 7, 2006. I was there to report on GE's new Evolution Series line of locomotives for the lead story in a magazine that had yet to make its debut; No. 5908 had yet to move under its own power.

BNSF No. 5908 takes its first steps on March 7, 2006, at its Erie, Pa., birthplace. Two photos, Greg McDonnell

At 10:50 a.m., the door of bay No. 6 of Building 26 slowly opened. Locomotive Test Leader Jim Pakiela climbed aboard No. 5908, cranked up the GEVO-12 engine, and the brand-new EVO took its first steps, moving into the morning sun to pose for photographs on the transfer table.

Six months later, on a September evening, I stood on the press floor at Quad Graphics in Sussex, Wis., and watched a Harris M-1000 2x4 press churn out the cover of the first issue of LOCOMOTIVE, on it: a photo of BNSF No. 5908 taking its first steps.

If you see BNSF 5908, say hello from an old friend. 1

Cover girl poses at Erie, Pa., on Mar. 3, 2006.

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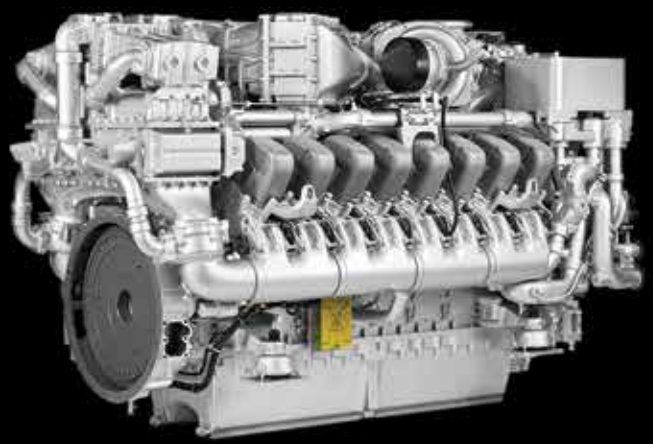

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