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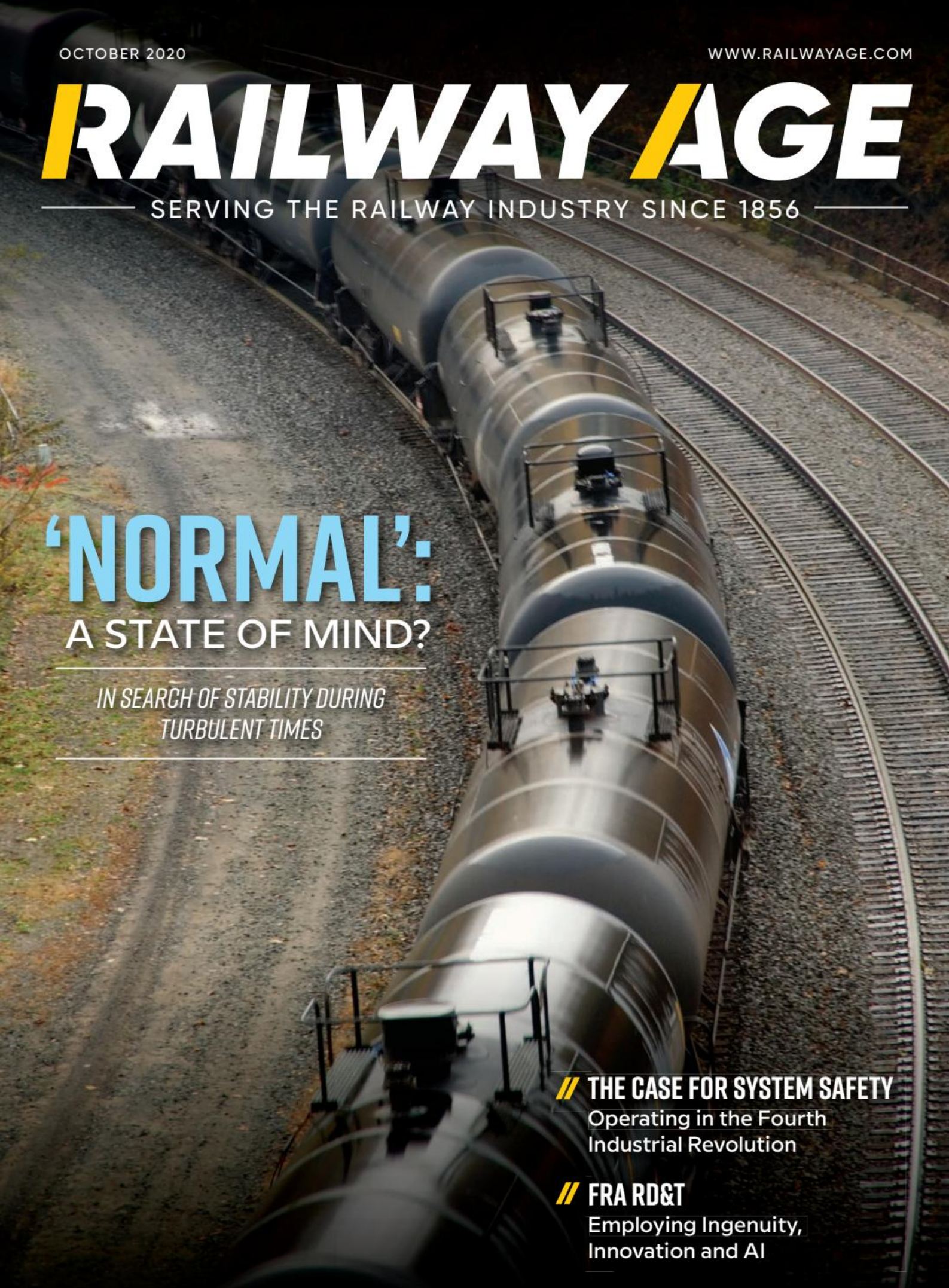

'NORMAL': A STATE OF MIND?

IN SEARCH OF STABILITY DURING TURBULENT TIMES

// THE CASE FOR SYSTEM SAFETY
Operating in the Fourth Industrial Revolution

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9

FEATURES

DEPARTMENTS

NEWS/COLUMNS

ON THE COVER:
A unit tank car train on the Norfolk Southern main.
Photo: Norfolk Southern

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BNSF

A Nod to King Lear

I am not a fan of William Shakespeare. Frankly, I find him difficult to read, though methinketh he doth said some pretty cool stuff: "This life, which had been the tomb of his virtue and of his honour, is but a walking shadow; a poor player, that struts and frets his hour upon the stage, and then is heard no more: It is a tale told by an idiot, full of sound and fury, signifying nothing." Or, "There is a tide in the affairs of men, which taken at the flood, leads on to fortune. Omitted, all the voyage of their life is bound in shallows and in miseries. On such a full sea are we now afloat. And we must take the current when it serves, or lose our ventures."

If there's anybody out there who would dareth to taketh it upon himself or herself to translate this into modern English (but not corporate-speak, please), contacteth me via electronic means.

Sir David of Nahass, our esteemed Financial Editor, who is most skilled in the fine art of equipment leasing and thus is a most astute observer of that most presently troublesome market we call freight car building, has been profoundly affected by these turbulent times in which we liveth. Thus, he hast taken it upon hisself (oops! *himself*) to calleth as he doth see-eth the situation, and to refer to B.S. (Bill Shakespeare's) King Lear, who if he had lived in the 21st century, probably would have owned a Learjet, don't you thinketh?

"In Shakespeare's tragedy *King Lear*, the eponymous character, an elderly king, is overwrought due to the loss of respect, power and love that befalls him as he recklessly discharges his kingdom to his ungrateful daughters," Sir David writes in the 2021 Railroad Financial Desk Book. "In a last gesture to retain some portion of his former regal life, Lear demands to be attended by a company of knights. When challenged on his desire to retain his retinue, Lear screams the famous line, 'Oh, reason not the need!' Lear wants to know why he must explain himself and what he wants. After all, he was once the king. That moment in the play is the beginning of Lear's shift from sanity to madness."

The madness is the Freight Rail Assistance and Investment to Launch Coronavirus-era Activity and Recovery (RAILCAR) Act (yet another politician-derived acronym!), which Sir David equates to the U.S. government's 2009 Cash for Clunkers program—which in my mind was dumber than GM shutting down Pontiac in favor of building Buicks for the Chinese market. Nothing against Buicks, mind you.

"Drama can be about folly," Sir David expounds. "This is the business of North American rail. It needs a strategy for growth and expansion. It needs a strategy to make freight rail a priority in North America. To create a strategy to incentivize the building of railcars in advance of the loads that need them is madness indeed."

I will leave you with a most favored quote from my immediate predecessor as editor of this 164-year-old publication, Luther Sigsbee Miller: "The mediocre are always at their best." Have fun figuring that one out. I'm still trying.

WILLIAM C. VANTUONO
Editor-in-Chief

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EDITORIAL AND EXECUTIVE OFFICES
Simmons-Boardman Publishing Corp.
88 Pine Street, 23rd Fl.
New York, NY 10005-1809
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Website: www.railwayage.com

ARTHUR J. McGINNIS, Jr.
President and Chairman

JONATHAN CHALON
Publisher
jchalon@sbpub.com

WILLIAM C. VANTUONO
Editor-in-Chief
wvantuono@sbpub.com

MARYBETH LUCZAK
Executive Editor
mluczak@sbpub.com

BILL WILSON
Engineering Editor/*Railway Track & Structures*
Editor-in-Chief
wwilson@sbpub.com

DAVID C. LESTER
Managing Editor, *Railway Track & Structures*
dlester@sbpub.com

Contributing Editors:
David Peter Alan, Roy Blanchard, Jim Blaze, Peter Diekmeyer, Alfred E. Fazio, Bruce Kelly, Ron Lindsey, Ryan McWilliams, David Nahass, Jason H. Seidl, David Thomas, John Thompson, Frank N. Wilner

Art Director: Nicole D'Antona

Graphic Designer: Hillary Coleman

Corporate Production Director: Mary Conyers

Production Director: Eduardo Castaner

Marketing Director: Erica Hayes

Conference Director: Michelle Zolkos

Circulation Director: Maureen Cooney

INTERNATIONAL OFFICES
46 Killigrew Street, Falmouth, Cornwall
TR11 3PP, United Kingdom
Telephone: 011-44-1326-313945
Fax: 011-44-1326-211576

International Editors
David Briginshaw
db@railjournal.co.uk

Kevin Smith
ks@railjournal.co.uk

David Burroughs
dburroughs@railjournal.co.uk

CUSTOMER SERVICE: 800-895-4389
Reprints: PARS International Corp.
253 West 35th Street 7th Floor
New York, NY 10001
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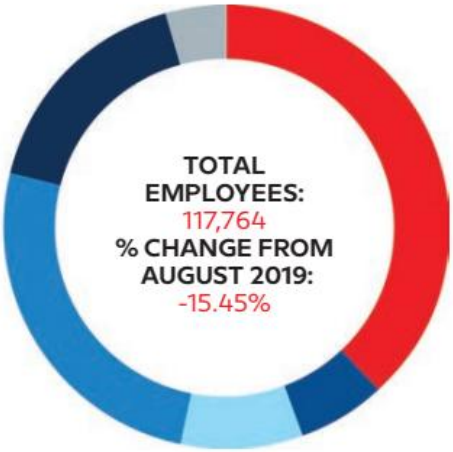
AAR: DOES SLOW AND STEADY REALLY WIN THE RACE?

"U.S. railroads might find out, because slow and steady (with a long way to go) generally describes the improvements in U.S. carload traffic in recent months. Total U.S. rail carloads fell 14.9% in August 2020 from August 2019, their 19th straight year-over-year decline. That's not great, obviously, but it's the smallest percentage decline since March 2020," the Association of American Railroads said last month. "Total U.S. carloads averaged 224,557 per week in August 2020, the most since March 2020 and up 21.4% from their low in May 2020. Total carloads have risen sequentially for three months. In August, energy-related commodities led the 18 (of 20) categories with carload declines."

RAILROAD EMPLOYMENT, CLASS I LINEHAUL CARRIERS, AUGUST 2020

(% CHANGE FROM AUGUST 2019)



- **Transportation (train and engine)**
  46,253 (-20.92%)
- **Executives, Officials, and Staff Assistants**
  7,491 (-2.75%)
- **Professional and Administrative**
  10,353 (-8.53%)
- **Maintenance-of-Way and Structures**
  29,433 (-6.94%)
- **Maintenance of Equipment and Stores**
  19,165 (-22.18%)
- **Transportation (other than train & engine)**
  5,069 (-8.09%)

Source: Surface Transportation Board

CLASS I EMPLOYMENT REMAINS WAY DOWN

Figures released by the STB show Class I total railroad employment decreased nearly 16% in August 2020, measured against August 2019, and is still the lowest since 2012. The double impacts of COVID-19 and a recession that actually predates the pandemic has stifled economic activity, and the impact on rail employment has been significant. Across the industry, headcount drops occurred in all employment categories, with Maintenance of Equipment and Stores dropping more than 22% and Transportation (train and engine) falling nearly 21%.

TRAFFIC ORIGINATED

CARLOADS

FOUR WEEKS ENDING AUGUST 29, 2020

MAJOR U.S. RAILROADS BY COMMODITY	AUG. '20	AUG. '19	% CHANGE
Grain	88,856	84,173	5.6%
Farm Products excl. Grain	3,495	3,327	5.0%
Grain Mill Products	36,212	36,724	-1.4%
Food Products	22,149	22,882	-3.2%
Chemicals	124,834	131,338	-5.0%
Petroleum & Petroleum Products	42,798	49,926	-14.3%
Coal	245,618	330,834	-25.8%
Primary Forest Products	3,936	4,888	-19.5%
Lumber & Wood Products	13,038	13,662	-4.6%
Pulp & Paper Products	20,150	22,053	-8.6%
Metallic Ores	17,539	24,095	-27.2%
Coke	11,786	15,630	-24.6%
Primary Metal Products	30,383	35,859	-15.3%
Iron & Steel Scrap	13,701	15,426	-11.2%
Motor Vehicles & Parts	64,639	68,090	-5.1%
Crushed Stone, Sand & Gravel	75,024	99,985	-25.0%
Nonmetallic Minerals	13,690	17,974	-23.8%
Stone, Clay & Glass Products	32,564	36,905	-11.8%
Waste & Nonferrous Scrap	14,054	14,469	-2.9%
All Other Carloads	23,761	26,784	-11.3%
TOTAL U.S. CARLOADS	***898,227***	***1,055,024***	***-14.9%***
CANADIAN RAILROADS			
TOTAL CANADIAN CARLOADS	***288,776***	***332,036***	***-13.0%***
COMBINED U.S./CANADA RR	**1,187,003**	**1,387,060**	**-14.4%**

INTERMODAL

FOUR WEEKS ENDING AUGUST 29, 2020

MAJOR U.S. RAILROADS BY COMMODITY	AUG. '20	AUG. '19	% CHANGE
Trailers	93,319	84,611	10.3%
Containers	1,029,635	1,005,228	2.4%
TOTAL UNITS	***1,122,954***	***1,089,839***	***3.0%***
CANADIAN RAILROADS			
Trailers	0	0	—
Containers	281,822	294,908	-4.4%
TOTAL UNITS	***281,822***	***294,908***	***-4.4%***
COMBINED U.S./CANADA RR			
Trailers	93,319	84,611	10.3%
Containers	1,311,457	1,300,136	0.9%
TOTAL COMBINED UNITS	**1,404,776**	**1,384,747**	**1.4%**

Source: Rail Time Indicators, Association of American Railroads

TOTAL U.S./CANADIAN CARLOADS, AUGUST 2020 VS. AUGUST 2019

1,187,003	1,387,060
AUGUST 2020	AUGUST 2019

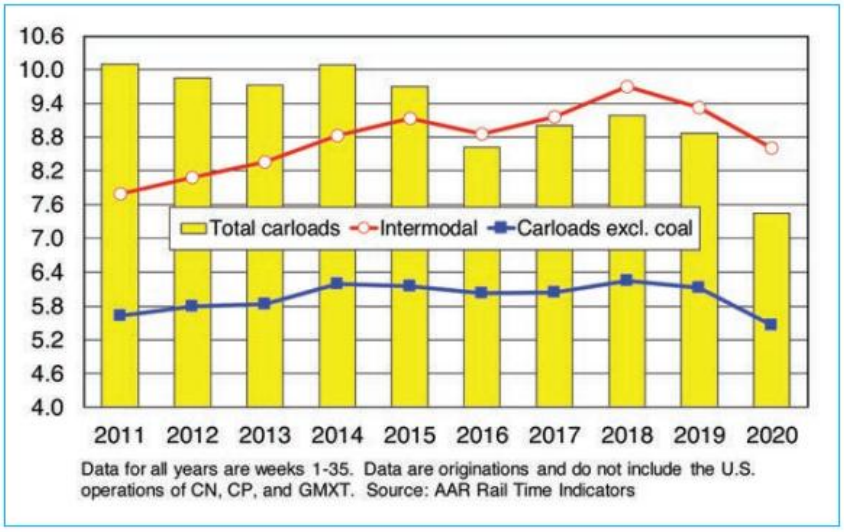
SHORT LINE AND REGIONAL TRAFFIC INDEX

CARLOADS

BY COMMODITY	ORIGINATED AUG. '20	ORIGINATED AUG. '19	% CHANGE
Chemicals	51,885	50,785	2.2%
Coal	15,472	20,621	-25.0%
Crushed Stone, Sand & Gravel	17,626	31,238	-43.6%
Food & Kindred Products	10,016	10,361	-3.3%
Grain	27,220	23,635	15.2%
Grain Mill Products	7,452	7,645	-2.5%
Lumber & Wood Products	9,110	9,364	-2.7%
Metallic Ores	2,379	2,631	-9.6%
Metals & Products	16,066	17,534	-8.4%
Motor Vehicles & Equipment	10,745	11,530	-6.8%
Nonmetallic Minerals	1,570	2,667	-41.4%
Petroleum Products	2,008	2,293	-12.4%
Pulp, Paper & Allied Products	18,207	18,197	0.1%
Stone, Clay & Glass Products	15,050	14,098	6.8%
Trailers / Containers	40,117	47,648	-15.8%
Waste & Scrap Materials	9,331	10,150	-8.1%
All Other Carloads	72,017	84,493	-14.8%

TOTAL U.S. CARLOADS AND INTERMODAL UNITS, 2011-2020

(IN MILLIONS, YEAR-TO-DATE THROUGH AUGUST 2020, SIX-WEEK MOVING AVERAGE)



Data for all years are weeks 1-35. Data are originations and do not include the U.S. operations of CN, CP, and GMXT. Source: AAR Rail Time Indicators

Katie Farmer to Succeed Carl Ice at BNSF; Class I 'Glass Ceiling' Broken

FOR THE FIRST TIME IN THE NEARLY 200-YEAR-OLD HISTORY OF NORTH AMERICAN RAILROADING, A WOMAN HAS BEEN NAMED CHIEF EXECUTIVE OF A CLASS I RAILROAD. On Jan. 1, 2021, BNSF Executive Vice President Operations Kathryn M. "Katie" Farmer will succeed Carl R. Ice as President and Chief Executive Officer. She will also assume leadership of BNSF's Board of Directors. Ice will retire at the end of 2020 and remain on the company's board.

Farmer, Executive Vice President Operations since September 2018, has spent her entire 28-year railroading career with BNSF, joining predecessor Burlington Northern as a 22-year-old management trainee in 1992. She has held leadership positions in every major function of the company, including operations, marketing and finance. Prior to EVP Operations, Farmer was VP Service Design and Transportation Support, Group VP Consumer Products, VP Domestic Intermodal and VP Industrial Products.

Farmer graduated from Texas Christian University – M.J. Neeley School of Business with a Bachelor of Business Administration (BBA), and earned an MBA in Finance from TCU.

Carl Ice has been with BNSF for 42 years. In 1995, he led a team that orchestrated the merger and subsequent integration of Burlington Northern Railroad and Santa Fe Railway. "Since then, he has helped lead the company and culture into what has become the largest Class I railroad in North America," BNSF noted. "Ice has been integral to the development of the company's operating and marketing plans." *Railway Age* named him 2016 Railroader of the Year.

"I want to thank all of the men and women of BNSF," said Ice. "I am proud of having worked with you and all of the things that we have accomplished together. One of the most important roles of a CEO is to ensure a strong succession plan is in place. Katie and I have been working toward this plan for a long time. She has held many different roles at BNSF with an ever-increasing impact with each new role as she has built trust and confidence throughout BNSF. I am pleased for Katie and the organization, knowing BNSF's future is in good hands. Katie is a shining example of BNSF's leadership model and BNSF will continue to build upon its legacy."

"I am humbled and honored to be asked to lead this incredible company and its dedicated employees—men and women that I have worked alongside for almost 30 years," Farmer said. "We are well-positioned in our approach to safety and meeting our customers' expectations while having the necessary capacity to grow with our customers. BNSF has long been a cost leader, and we will ensure that continues into the future. I look forward to continuing BNSF's success."

"Carl has had a huge impact on this company and this industry, having served on BNSF's leadership team for the entire 25 years of the company's existence," said Greg Abel, Vice Chairman Non-Insurance Operations of Berkshire Hathaway, BNSF's parent company. "I have great respect for him, and he leaves BNSF well-prepared for the next 25 years. Katie has had a long career with multiple roles at BNSF, which fits well with our efforts to develop our people. Her proven leadership and passion and commitment make her perfect for the role. We're thrilled that Katie is taking over the role and have the utmost confidence in both her and BNSF's future success."

Berkshire Hathaway Chairman and CEO Warren Buffett said, "BNSF is an iconic company and this is a historic day. Carl has been critical to BNSF's success for a very long time. I thank him for his leadership and his accomplishments. We look forward to Katie's leadership and more success. She possesses all of the qualities that make us excited about the future."

With her appointment, Farmer will become one of the highest-ranking women at Berkshire Hathaway, which in addition to a Class I railroad includes companies in insurance, utilities, industrial manufacturing, retail and automotive. Berkshire's Ben Bridge Jeweler, Fruit of the Loom and General Re also have women as chief executives.

BNSF

For IDOT, New Siemens Ventures

The Illinois Department of Transportation (IDOT) has begun taking delivery on 88 new Siemens "Venture" single-level passenger cars. The Siemens/IDOT contract dates to November 2017, when Caltrans and IDOT amended a $317 million contract for new passenger cars, replacing Nippon Sharyo with Siemens, which partnered with Sumitomo Corp. of America to fulfill a delayed multi-state order. The revised contract involved 137 single-level passenger railcars—49 for Caltrans and 88 for IDOT. The Venture cars are being built at Siemens' manufacturing hub in Sacramento.

WORLDWIDE

THE SÃO PAULO METRO last month invited bids for preliminary studies along the alignment of the proposed Line 20-Pink, which will connect Santo André with the future Santa Marina terminal station, in the Lapa region on the west side São Paulo. The studies will identify obstacles along the line, including buildings, soil type, ground water, and streams and rivers. The closing date for bids was Sept. 29. The studies for Line 20-Pink are part of a wider project to determine areas for train maintenance and storage facilities.

Art Peterson/WSP USA

NORTH AMERICA

BAY AREA RAPID TRANSIT DISTRICT (BART) has awarded **PARSONS CORP.** a $45 million engineering services contract for the agency's Train Control Modernization Project to implement CBTC, part of BART's $3.5 billion Transbay Corridor Core Capacity Program, which includes five new traction power substations, 306 new rail vehicles and development of a maintenance complex. Parsons has been providing engineering services to BART's CBTC program for the past five years, "leveraging experience on CBTC projects worldwide to shape the BART program," the company noted. Under the new contract, Parsons will provide DSDC (Design Services During Construction) for CBTC, which will replace BART's original, early-1970s, track-circuit-based, operator-attended ATC (Automatic Train Control) system on 125 miles of track, while minimizing the impact to revenue operations. Parsons is one of two DSDC contractors. The other is **SYSTRA,** with **HATCH** as a subcontractor. The new, moving-block CBTC system, to be supplied by **HITACHI RAIL STS USA, INC.**, will enable BART to increase projected Transbay Tube capacity to 30 trains per hour per direction in the core system area, from the current limitation of 24 trains per hour per direction.

Vancouver's C$2.83 billion Broadway Subway Project is expected to move forward this year, extending the existing SkyTrain Millennium Line 5.7 kilometers (3.5 miles) and adding six stations—despite the COVID-19 pandemic. Earlier this month, the **PROVINCE OF BRITISH COLUMBIA** announced that construction would begin in the fall, with its award of a C$1.73 billion contract to the **ACCIONA–GHELLA** joint venture to design, construct and partially finance the project. **BRITISH COLUMBIA RAPID TRANSIT,** on behalf of **TRANSLINK,** will operate and maintain the line, which is scheduled to open in 2025 and provide end-to-end service in 11 minutes. Additionally, the **BROADWAY SUBWAY CONSTRUCTORS GENERAL PARTNERSHIP (BSCGP)** has selected **THALES** to provide its SelTrac™ CBTC signaling technology.

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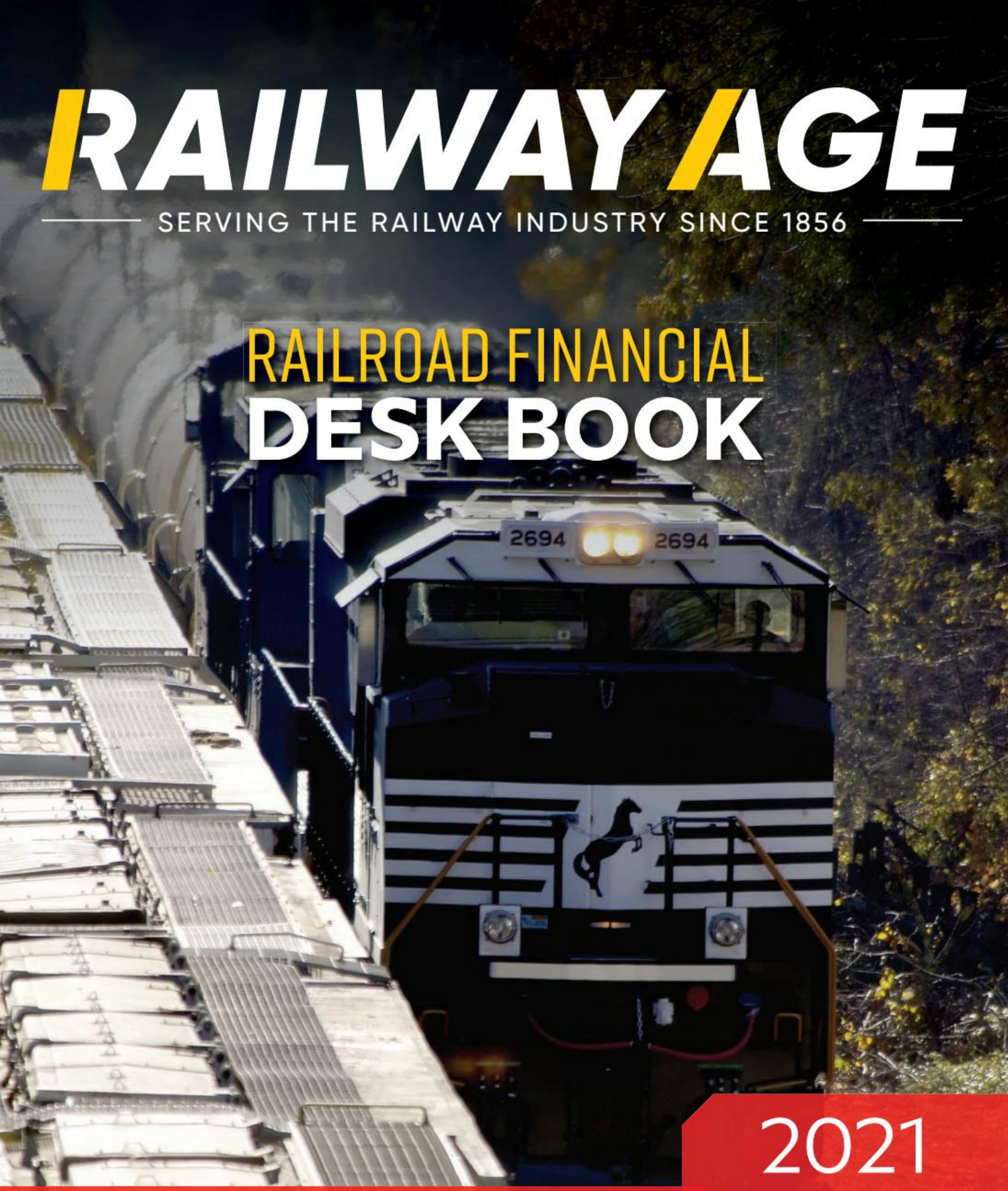

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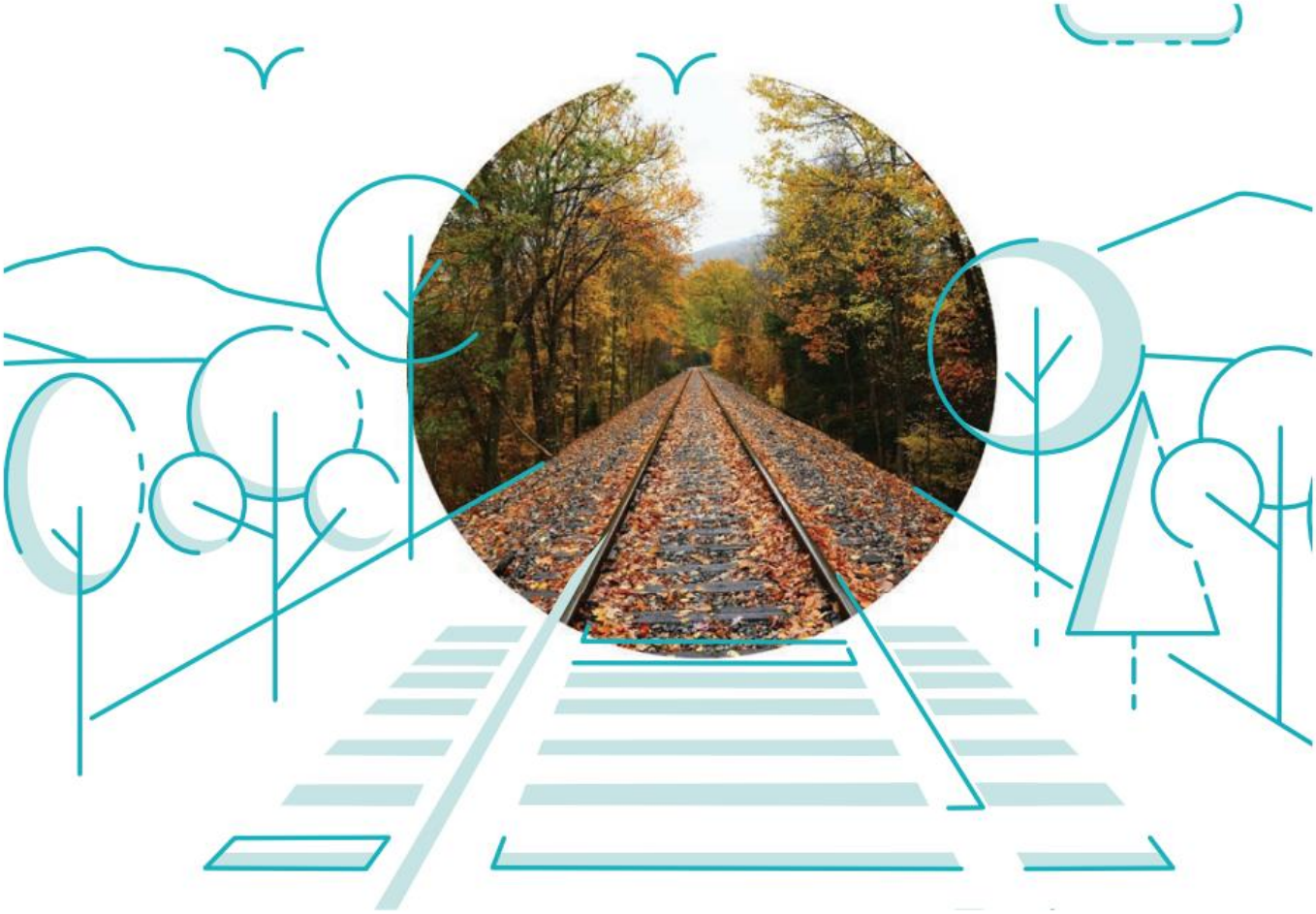

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REASON NOT THE NEED

BY DAVID NAHASS, FINANCIAL EDITOR

Welcome to the 2021 *Railway Age* Railroad Financial Desk Book. It's been about seven months since the COVID-19 pandemic began in earnest in the U.S. Generally, people, and by extension the rail finance community, would like things/business to return to normal. Normal, however, is as much a state of mind when it comes to North American rail, since heading into the pandemic, rail was heading into a softening market hoping for a rebound.

Within the shadow of this new pandemic-esque normal, rail has begun to get off the mat. While general freight has been lagging, intermodal levels have leapt up over load levels from 2019. This is spurring concerns, real and fictional, over the possibility of congestion, as oftentimes load levels rise faster than crews are returned from furlough. (See "Financial Edge," September 2020.)

While the industry searches for hope, stability and a sense of when it will be led to a land filled with greater promise, higher rates and increased loadings, Washington D.C., along with the Railway Supply Institute, have moved to engage Congress in formulating a rail equipment version of the infamous "cash for clunkers" automotive deal in 2009 (June to November 2009, when the $3 billion allocation was depleted). The Freight Rail Assistance and Investment to Launch Coronavirus-era Activity and Recovery (RAILCAR) Act was sponsored by six members of Congress and introduced in late August.

A short summary of the Act: In certain circumstances, car owners are offered a 50% tax credit for purchasing railcars with higher payload (increase of 8%) and a two-for-one railcar replacement. There is a similar provision tied to refurbishing assets or increasing fuel efficiency. Additionally, the RAILCAR Act would offer a 50% tax credit for the scrapping of older assets. (That 50% is calculated by subtracting the scrap value received from the current AAR Rule 107 value. The car owner gets 50% of that net amount.)

Many interested parties in the railcar and rail leasing industry would like an incentive to maneuver assets that are earning less than their keep into assets that might generate larger returns. So a two-for-one rationalization of older cars in the fleet (think 4,750cf covered hoppers) could be an opportunity for some modernization. And when you speak to a railcar manufacturer, they will point out that new car builds are a source of fleet modernization in capacity and gross rail load (GRL). That is a true statement.

But what gets lost in the translation is the fact that approximately two-thirds of the national fleet has been built since 1993, which was around the time cars started to be stenciled 286,000 GRL (the modern 286 truck design came into service in 2004). The move to 286 and the subsequent increase in capacity initiated many of the capacity changes that the RAILCAR Act supports. So while the move from 4,750cf to 5,400cf covered hoppers may create a five-to-four car count reduction, other car types—such as small-cube hoppers, centerbeam flat cars, many tank cars, coal cars, plastics hoppers and mill gondolas—are operating at max capacity or close enough to max capacity to not reach an 8% threshold, even if the two-for-one opportunity existed. Furthermore, in some cases where there have been changes in capacity, boxcars for example, those smaller capacity cars (Plate

CSX

C cars) remain in high demand due to the right-sized nature of the commodity being hauled. While Plate F boxcars may be the design favored for PSR, and while PSR may have more capacity, it does not increase utility or reduce total car demand.

Industry veterans will remember how tax credit incentives lead to the overbuilding cycle in the late 1970s and early 1980s. In the modern era, rather than tax credits being sold to doctors, dentists and attorneys, the tax credits can be packaged and sold to Google, Target and Amazon. (This has been a frequent circumstance that has supported the installation of renewable energy and affordable housing, in which the tax credits were packaged and sold to parties that could use them in a more efficient fashion. It has been going on for years.) The point is that tax credits do not create demand. Tax credits do not create loadings. Tax credits can create railcar orders. But without the demand for the cars being built, North American rail, the industry with 477,000 railcars in storage, is going to be adding to a fleet that doesn't need the additional capacity and additional cars.

One could see how lessors and OEMs could be in favor of the RAILCAR Act. And, to be fair, there is a benefit for intermodal cars and autoracks in addition to the aforementioned 4,750cf covered hoppers. The railroads maintain loading authority (OT-5) over which cars run on their tracks, so as a matter of business, the incentive to scrap cars won't cause lease rates to increase. The average age of the national fleet is roughly 19.5 years. A generation ago, railcars were running to their 40-year interchange life. Now, a railcar has an interchange life of 50 years. If tax incentives are needed to cull the fleet and cars generally will be moved out of service in 20 or 30 years, investors will have to readjust their assumptions about railcar investments and their expectations around returns. That moves the risk and cost back to the shipper. Rail needs to grow market share. Higher costs to the shipper for the railcar don't seem to be the pathway for success.

Industry sources with ties to Washington D.C. have checked in on the RAILCAR Act and the likelihood of passage. The Act has several factors lined up against it. ICYMI (in case you missed it), there's a pandemic going on. The drop-off in economic business activity and its impact on Main Street USA and its residents is extraordinary. While Congress lumbered along and succeeded in providing the first stimulus bill, efforts to provide the second stimulus bill have stalled. Additionally, ICYMI, this happens to be an election year. As Congress enters a lame duck period heading to the election, the ability of Congress to deliver the RAILCAR Act as an add-on to a second stimulus plan or even less likely in advance of the passing of a second stimulus plan is, well, unlikely. Lastly, bills resembling the RAILCAR Act have floated around in Congress for some time (years) prior to this most recent iteration. While that is not an indicator that it cannot (or will not) be approved as legislation, it does mean that it hasn't been put forth in meaningful fashion beforehand.

In Shakespeare's tragedy *King Lear*, the eponymous character, an elderly king, is overwrought due to the loss of respect, power and love that befalls him as he recklessly discharges his kingdom to his ungrateful daughters. In a last gesture to retain some portion of his former regal life, Lear demands to be attended by a company of knights. When challenged on his desire to retain his retinue, Lear screams the famous line: "Oh, reason not the need." Lear wants to know why he must explain himself and what he wants. After all, he was once the king. That moment in the play is the beginning of Lear's shift from sanity to madness.

Drama can be about folly. This is the business of North American rail. It needs a strategy for growth. It needs a strategy to make freight rail a priority in North America. To create a strategy to incentivize the building of railcars in advance of the loads that need them is madness indeed.

BNSF

AROUND THE MARKET

Overall rates and car demand continue to languish. One lessor suggested that the current downturn could last through the end of 2022. What has always been a tough job, being an operating lessor in North America, is that much harder right now. Here is what is happening on the lease rate front.

Covered hoppers (grain): A bumper harvest and rising soybean prices have slightly lifted the spirits of portions of the farming community. The downside: Grain car rates continue to languish, with 5,150cf to 5,200cf cars leasing below $300 full service, and older 4,750s running sub-$200. One hope here is that rising intermodal traffic levels may clog up certain corridors and create some demand, but reliance on that strategy is a risk. If you have cars in a lease, keep them there.

Covered hoppers (plastics): Rates on newer cars are sub-$500 (net). COVID-19-related trade reductions have softened demand in the short term. New capacity projects are unlikely to be put on hiatus even if natural gas reaches the projected $3.40 MMBTU and stays above $3.00 for all of 2021 (Energy Information Administration projections for 2021). The 5,800cf cars are a mixed bag; sub-$300 is the most common rate.

Covered hoppers (sand and cement): With more than 10,000 cars coming back from lessees entering bankruptcy, this market continues to flounder with no reasonable resurrection in sight. Rates here are a mix of older leases, with numbers starting with threes and fours being reduced to starting with twos or ones and headed to being sub-$100 (net and in some cases full). Cement shippers are looking forward to bottom line gains as they reap the rewards of hauling a commodity that fits in the same size car as the juggernaut that once was frac sand.

Coal: It is slightly more positive than small-cube hoppers if only for the fact that coal has been bad for a longer time. Rates again are all over the place, but sub-$100 (net) here is normal. As renewables continue

to out-generate coal (EIA, January-May 2020), hope continues to falter here. More than 80,000 coal cars were built from 2004 to 2009. Many of these are coming back into the market for the first time since being built. Continuing challenges lie ahead.

Tank cars: The interplay of regulation and softening demand has roiled parts of this market. DOT 117Rs (retrofit) cars are leasing for less than $350 (full). DOT 117Js (new) are leasing for mid-$500s (full). Other (non-crude) tank railcar types remain oversupplied, with the pressure car market continuing to remain stable with a negative bias.

Boxcars: This is a market that is both stable and oversupplied at the same time. The mix of demand for cardboard and the hoarding of toilet paper has helped to stabilize a market that prior to the pandemic was likely sitting on the edge where demand exceeds supply. Rental rates for 50-foot Plate F boxcars (non per diem) are in the low-$300s (full), with 60-foot cars in the mid-$400s (full, non per diem).

Mill gondolas: Similar to boxcars, mill gons are caught with some amount of demand for cars in a commodity market that cannot allow consumers to substantiate the need for equipment. While scrap has been on the rise ($245 per ton for Chicago heavy melt #1 in September), some softness in demand plus a lack of forward confidence continues to weigh on prices. Lease rates are mid-$300s (full service) for 50-foot cars, and low-$500s (full) for 66-foot cars.

ICYMI: FOMO COMES TO THE WORLD OF RAIL

"Financial Edge" March 2020 discussed the "Cult of OR" (a Tony Hatch term) being followed by Wall Street and the incredible stock price metrics of the Class I's, while posing the question of whether or not high flying equity values were prohibiting railroad loadings growth.

As an update, six of the seven Class I's had hit a 52-week high

William C. Vantuono

in late August/early September, even as loadings have been down YOY. But that is not the point of this segment. In July, the private equity firm Blackstone made an offer to buy Kansas City Southern for $190 per share, causing a 15% increase over the share price around the day the offer was made. By September, Blackstone had upped its bid to $208 per share, which with the assumption of debt rounded the total deal size out to $23 billion. Within a few weeks, KCS rejected the offer and halted ongoing discussions with Blackstone.

Now, it could be easy to target Blackstone as suffering from a bit of FOMO (fear of missing out). Warren Buffet buys BNSF in 2009. Brookfield takes Genesee & Wyoming private in 2019. Blackstone (and its partner Global Infrastructure Fund) could easily feel left out and could see KSU as a way of entering into the rail market in advance of the post-pandemic turnaround. Call it Blackstone CEO and Co-Founder Steve Schwarzman's anxiety of influence from Warren Buffet.

However, as convenient an explanation that might be, that is the least interesting part of the story. KCS President and CEO Pat Ottensmeyer has discussed the current environment at KCS, his role in the completion of USMCA (United States-Mexico-Canada Agreement) and the opportunities for growth in Mexico during *Railway Age*'s Rail Insights Conference and in his January 2020 *Railway Age* Railroader of the Year interview; KCS CFO Michael Upchurch addressed similar sentiments when he presented at the Cowen and Company Transportation and Sustainable Mobility Conference in September. The takeaways: The mix of nearshoring, industrial growth in Mexico, and labor rates that are less than those in China have KCS positioned for a long-term period of growth. Concerns about the KCS exclusivity in Mexico seem overblown, leaving KCS with a government concession running to 2047. With the contemplated expansion plans many corporations have in Mexico (Ford, GM, Foxcomm, to name a few) rail seems poised to benefit. KCS will be a primary beneficiary of that growth.

Credit Blackstone for turning FOMO into an early recognition of the possibilities offered by KCS. However, the real award and the kudos go to the executive team of KCS, whose stock was $158 on July 30 (and below $100 in March 2020). The move to $208 per share (total deal size: $23 billion including the assumption of debt) would have represented a 31.6% increase in the price of the common stock from July if KCS had accepted the offer. No one could have faulted KCS management for taking the money and locking in returns for its shareholders (more than double its low price over LTM). Management's bullishness on the value of the franchise, its potential for growth and the firmness of those beliefs is something needed in North American rail. KCS's rejection of the Blackstone bid was a bet that growth in Mexico will outdistance that 30% pop and that it will make its shareholder upside more than Blackstone is willing to pay, at least for the moment. Stay tuned.

DIRECTORY FOLLOWS ON PAGES 16-19

FINANCE COMPANIES

BUNDY GROUP

Bundy Group is a boutique investment bank that specializes in representing business owners and management teams in business sales, capital raises and acquisitions. The firm is a senior-driven organization with offices in Charlotte, New York and Virginia. Bundy Group has been a recognized expert in the rail and transportation industry for more than a decade and has numerous successfully closed transactions in the segment. In representing a business and its shareholders in exploring a sale or recapitalization, Bundy Group is focused on managing a structured process and delivering premium value for its clients. For more information about Bundy Group's work in the rail space, please contact Jim Mullens at jim@bundygroup.com or at 540-342-2151. For more information about Bundy Group visit www.bundygroup.com.

ARRANGERS

THE DAVID J. JOSEPH COMPANY

300 Pike Street, Cincinnati, Ohio 45202; Tel.: 513-419-6200; Fax: 513-419-6221; Trey W. Savage, VP Rail Group; Clint Rice, General Manager-Rail Equipment Group; Jeff Schmutte, Jeff Blake and Eric Hausfeld, Regional Sales Managers; Dan Dorsey, General Manager-Private Fleet; Steven R. Skeels, Chief Mechanical Officer; and Ann Edwards, Mgr. Retired Rail Assets (502-212-7365). The David J. Joseph Company's Rail Group provides a broad range of transportation services throughout North America: single investor, leverage leases, freight cars, portfolio evaluation, remarketing fleet management, purchases and sales of portfolios, and private fleet management. Other services include freight car inspections and engineering services from design of new cars to complete ISL extended life, modifications and analysis; in addition to railcar dismantling for scrapping and parts reclamation.

RAILROAD FINANCIAL CORPORATION

676 N. Michigan Avenue, Suite 2800, Chicago, IL 60611; Tel.: 312-222-1383; Fax: 312-222-1470; David G. Nahass, President, Email: dnahass@railfin.com; William J. Geiger, Senior Vice President, Email: wgeiger@railfin.com. RFC represents domestic and international clients in the following areas: debt and lease financing of all railcar types including coal cars, tank cars and covered hopper cars for sand and plastics; railcar and locomotive fleet acquisitions and sales; lease brokerage; mergers and acquisitions; equity and debt financing of rail property acquisitions, fleet and lease restructurings and/or refinancing. RFC also provides continuing education for the industry.

RR MERGERS & ACQUISITIONS

11 The Pines Court, Suite B, St. Louis, Missouri 63141; Tel: 314 878-1414; Fax: 314-878-1414; Robert Fowler, President, 314 878-1414 x227 Email: robert@rrmergers.com. Jack Sickles, Vice President, 314 878-1414x221 Email: jack@rrmergers.com. RR Mergers & Acquisitions has specialized in the sale of rail-focused companies for more than 15 years. Trusted professionals with long-standing relationships in the rail sector, RR Mergers interfaces with strategic and financial buyers finding the right buyer for a Company, to make the best deal happen. While maintaining confidentiality at all times, RR Mergers manages the total process of selling railroad industry suppliers, rail services companies and Short Line Railroads. RR Mergers provides advisory services to prepare the company for acquisition, developing a confidential information memorandum, negotiating term sheets, letters of intent and coordinating the due diligence process.

STRATEGIC RAIL FINANCE

1700 Sansom St., Suite 500, Philadelphia, PA 19103; (215) 564-3122. Michael Sussman, President and CEO. SRF has served for 23 years as trusted advisor to Class I and short line railroads, rail shippers, public sector agencies, and industrial developers. The firm has brought capital, clarity, and velocity to infrastructure development projects in 45 states and Canadian provinces. SRF integrates capital from public programs and private sources with growth marketing strategies and management consulting to position executives toward short-term objectives and long-term opportunities.

LESSORS

THE ANDERSONS RAIL GROUP

1947 Briarfield Blvd., P.O. Box 119, Maumee, OH 43537; Fax: 419-891-2749. Contacts: Joe McNeely, Rail Group President, 419-897-3646; Sean Hankinson, Vice President of Sales, 419-891-6352, Sean_Hankinson@andersonsinc.com; Sam Anderson, Vice President of Operations, 419-891-4436, Sam_Anderson@andersonsinc.com. The Andersons Rail Group, a part of The Andersons, Inc., has served the rail industry for more than 30 years. The group owns a fleet of nearly 25,000 railcars which it leases to customers handling a wide variety of commodities. It also provides repair, maintenance and component manufacturing services to private railcar owners through its 26 repair shops and steel fabrication facility. With extensive knowledge in taxation, government regulations and railroad requirements, The Andersons Rail Group offers quality products and superior customer service. For more information, visit www.andersonsrail.com.

AMERICAN INDUSTRIAL TRANSPORT INC. (AITX)

100 Clark Street, St. Charles, MO 63301-2075. Tel.: 636-940-6000; Fax: 636-940-6100; Website: aitx.com. American Industrial Transport, Inc., headquartered in St. Charles, Missouri, is a leading solutions-provider of railcar leasing and repair services. AITX provides customers across diverse industries a flexible portfolio of leasing options from a railcar fleet, sourced and managed in-house. AITX and its subsidiaries also operate world-class railcar repair services through its specialized repair network spanning across North America. Offering a range of services from full to light repair, AITX's repair capabilities include full-service repair facilities, mobile service units and onsite customer dedicated repair operations. AITX manages a lease fleet of more than 17,000 railcars owned by its affiliates and performs repair services on more than 10,000 railcars per year. Learn more about American Industrial Transport, Inc. at aitx.com.

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ATEL LEASING CORPORATION

The Transamerica Pyramid, 600 Montgomery Street, San Francisco, CA 94111; Tel.: 415-616-3486; Ken Fosina, Executive Vice President, Email: kfosina@atel.com. Since 1977, ATEL has leased rail assets to America's largest railroads and shippers.

ATEL specializes in the leasing of all types of rail assets, including railcars, locomotives and maintenance-of-way equipment. ATEL targets railcars and locomotives built prior to 2005, but prefers new maintenance-of-way assets. Leases can be full service, but net leases are preferred. ATEL executes lease transactions directly and through its Capital Markets desk. Each year, ATEL's Portfolio Management will sell rail assets from one of its Funds managing expiration.

CAI RAIL

Steuart Tower, One Market Plaza, 9th Floor, San Francisco, CA 94105. Tel: 415-788-0100; Fax: 415-788-3430. James H. Magee, President, email:jmagee@capps. com; Freddy Fernandez, Vice President-Operations, email:ffernandez@capps.com. CAI Rail is an operating lessor in the new and used railcar space. CAI performs full service, net, per diem and finance leases on all railcar types. We have complete maintenance, engineering, operations and field marketing staff. In addition, CAI offers a comprehensive rail car customization and refurbishing program to meet our clients' specifications. Our parent company, CAI International (NYSE: CAI) specializes in container leasing and sales as well as domestic and international intermodal logistics. So, let's get moving!

CARMATH, INC.

25965 482nd Ave., Brandon, SD 57005; Walker Carmon, Vice President, Tel.: 605-582-8340; Email: wcarmon@mwrail.com; John Goodwin, Sales Manager, Tel.: 605-582-8318; Email: jgoodwin@mwrail.com; Website: www.carmathinc.com. At CarMath, we believe every business should have the opportunity to lease quality railcars at a reasonable price. We have the ability to lease both large and small groups of cars with a wide variety of leasing options and will customize a leasing program to best fit your needs.

CIT RAIL

30 South Wacker Drive, Suite 2900, Chicago, IL 60606; Tel.: 312-906-5701. CIT's Rail division offers a full suite of railcar leasing and equipment financing solutions to rail shippers and carriers across North America. It manages one of the youngest and most diversified railcar and locomotive fleets in the industry and leverages its deep experience to empower customers. Contact us to learn how our transportation solutions can power your business. Visit cit.com/rail, call 312-906-5701 or follow @CITgroup.
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C.K. INDUSTRIES, INC.

P.O. Box 1029, Lake Zurich, IL 60047-1029; Tel: 847-550-1853; Fax: 847-550-1854; email sales@ckrail.net. Brian M. Harris. C.K. INDUSTRIES, a privately held corporation, began its U.S. leasing operations in 1980, and offers its services to shippers, short line, regional and Class I railroads in North America. New investment opportunities up to $10MM of both new and used types of freight cars will be considered. Our existing lease fleet offers a wide variety of car types to meet your lease requirements. We offer mid to long terms, either on a full service or triple net basis.

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300 Pike Street, Cincinnati, Ohio 45202; Tel.: 513-419-6200; Fax: 513-419-6221; Trey W. Savage, VP Rail Group; Clint Rice, General Manager-Rail Equipment Group; Jeff Schmutte, Jeff Blake and Eric Hausfeld, Regional Sales Managers; Dan Dorsey, General Manager-Private Fleet; Steven R. Skeels, Chief Mechanical Officer; and Ann Edwards, Mgr. Retired Rail Assets (502-212-7365). The David J. Joseph Company's Rail Group provides a broad range of transportation services throughout North America: single investor, leverage leases, freight cars, portfolio evalu-ation, remarketing fleet management, purchases and sales of portfolios, and private fleet management. Other services include freight car inspections and engineering services from design of new cars to complete ISL extended life, modifications and analysis; in addition to railcar dismantling for scrapping and parts reclamation.

GATX CORPORATION

Thomas A. Ellman, President, Rail North America, GATX Corporation, 222 W. Adams Street, Chicago, IL 60606; Tel: 312-621-6200 Fax: 312-621-6546 GATX is a leader in the rail leasing industry with more than a century of experience, preeminent expertise in specialized railcars, and a growing international presence. GATX meets shipper and railroad needs with one of the largest lease fleets of tank and freight cars and locomotives in the world. We provide our customers with a unique mix of financial (global financing, valuation, structuring, leasebacks, joint ventures, partnerships) and mechanical (regulatory, maintenance, engineering, cleaning, inspection) services in North America. Contact via www.gatx.com or 1-800-428-8161

GREENBRIER LEASING COMPANY

One Centerpointe Drive, Suite 400, Lake Oswego, OR 97035; 800-343-7188; Fax: 503-968-4383; Email: Marketing.Info@GBRX.com; Website: www.GBRX.com. Contacts: Larry Stanley, Sr. V.P. Finance; Tom Jackson, V.P., Marketing. GLC provides a full range of operating and financial leases of railroad freight cars to shippers, short line, regional, and Class I railroads. In addition to owning a fleet of nearly 10,000 railcars, we develop financial structures customized to meet a multitude of customer requirements including; full-service, net, and per diem leasing structures, with both short-term and long-term options, sale-leaseback and like-kind exchanges as well as upgrade and modification programs. Our approach allows customers to meet current needs and position their business to capitalize on future opportunities. The Greenbrier Companies [NYSE: GBX], headquartered in Lake Oswego, Ore., is the leading global integrated supplier of transportation equipment and services to the railroad and marine industries. We build new railroad freight cars in our 10 manufacturing facilities in the U.S., Brazil, Mexico, Poland, Romania and Turkey and marine barges at our Portland, Ore., deep-water site. We are the market leader in the design and production of intermodal, boxcar, gondola, tank car and covered hopper railcars. Our customers include railroads, shippers and leasing companies—partners who depend on us for innovative design, quality production and on-time delivery. In Europe, we build and refurbish railroad freight wagons through our operation in Poland. In Brazil, GBX is the leading manufacturer of railcars for the Latin American market thorough our joint venture called Greenbrier-Maxion. GBX offers full repair and refurbishment services on all railcar types through our 12 strategically located Greenbrier Repair & Services (GRS) locations. GBX also sells reconditioned wheel sets and provides

wheel services at 9 locations throughout the U.S. GBX manages GBSummit, a 50/50 joint venture with Sumitomo Corporation of Americas, where we provide finished and machined railcar axles. Finally, we perform management services for customers on approximately 368,000 railcars through our Greenbrier Management Services (GMS) group, which provides industry-leading asset management and regulatory compliance through GMS's new Regulatory Services Group.

INFINITY TRANSPORTATION

Powered by Global Atlantic. 1355 Peachtree Street, NE, Suite 750, Atlanta, GA 30309; Website: www.infinitygafg.com. Lee Martini, VP Sales & Marketing; Tel.: 678-904-6315; lee.martini@gafg.com; Brian Ottinger, VP Sales & Marketing; Tel.: 312-731-2763; brian.ottinger@gafg.com. Ken Johnson, VP Sales & Marketing; Tel.: 859-640-0362; ken.johnson@gafg.com Infinity Transportation is a private lessor with a fleet of more than 10,000 railcars of varying types. Lease packages are tailored to meet customer needs, including a variety of short-term operating leases and long-term leveraged leases, as well as other assignment and deployment arrangements. Infinity prides itself on exceptional customer service and flexibility with regard to leases and railcar modifications to find the transaction and equipment to best serve our customers.

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One South Wacker Drive, Suite 3110, Chicago IL 60606 - Phone: 312-803-8851: Dan Penovich, President; Chris Gerber, Vice President Sales and Marketing. Mitsui Rail Capital is a railcar operating lessor that offers some of the youngest railcars in our industry. From tank cars to covered hoppers to a wide variety of other car types, we deploy assets in every industry, including oil, gas, plastics, agriculture and steel. Our proactive approach enables us to know your unique needs and railcar requirements, getting well-structured deals done, faster. MRC has been in business for 20 years and is a joint venture between Mitsui & Co. Ltd. and JA Mitsui Leasing of Tokyo.

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695 Bond Street, Glenwillow, OH 44139; (440) 439-7088. John Roberts, CEO, Email: jroberts@relaminc.com. As a full-service leasing company, we offer complete MOW equipment leasing services. Each of our team members is knowledgeable, professional, prompt and courteous, one reason why our clients stay with us. We understand the importance of making every business transaction easy on the customer. We handle all the paperwork and logistics for every lease, so you can spend your time on more important things. We are committed to providing our clients with the highest level of service while remaining competitive in today's market. RELAM knows railroad operations and the equipment involved.
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RALTRAC, LLC

200 S. Wacker Drive, Suite 3100, Chicago, IL 60606; tel: 312-674-4742; fax: 312-421-2742; www.raltrac.com. RALTRAC (formerly RALCO) is a privately held, Illinois Limited Liability Company in the business of acquiring, managing and leasing railroad rolling stock on net or full services leases. The Company has the intellectual and financial resources necessary to compete in the small cap lease market where its size and structure provide it with a competitive advantage. RALCO also provides consulting and advisory services to its clients. Contact: Peter Urban, Principal, purban@raltrac.com, 847-975-3568 (mobile); Richard Johannes, Principal; Jason Urban, Principal.

RELCO LOCOMOTIVES, INC.

One Relco Ave, Albia, Iowa 52531. Tel.: 641-932-3030; Website:www.relcolocomotives.com. RELCO, as one of North America's leading locomotive rebuild, remanufacturing and leasing companies, can provide a full range of locomotive leasing and maintenance services. Since 1961, RELCO has developed a reputation for providing the finest motive power and custom maintenance packages to fit any need:

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SMBC RAIL SERVICES LLC

300 South Riverside Plaza, Suite 1925, Chicago, IL 60606; Gene Henneberry, President & CEO (312) 559-4801; Mike McCarthy, Senior Vice President Leasing, (312) 559-4803. SMBC Rail Services is a full-service operating lessor, invested in all tank and freight car types, offering a broad selection of equipment leasing and financing products for the North American rail market. SMBC Rail can structure a solution for all your rail equipment needs, short and long term, full-service or net leases, sale/leaseback, or portfolio acquisition. Contact us via www.smbcrail.com or sales@smbcrail.com.
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TEALINC, LTD.

1606 Rosebud Creek Road, Forsyth, MT 59327; Tel.: 406-347-5237; Fax: 406-347-5239; www.tealinc.com; Darell J. Luther, CEO, 406-347-5237 darell@tealinc.com; Julie Mink, President, 720-733-9922 julie@tealinc.com. Tealinc, Ltd. specializes in rail transportation solutions nationally and internationally. We are a rolling stock operating lessor and broker and we also provide marketing, transportation management and consulting services for car owners, shippers and suppliers within the rail industry. Our lease fleet consists of covered hoppers, open top hoppers, mill gondolas, flatcars, gondolas, etc. We have a combined 80 years of service and experience within the rail industry and have assisted both novice and experienced rail shippers best utilize the rail network they participate in.

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2525 N. Stemmons Freeway, Dallas, TX 75207. 1-800-631-4420. TrintyRail® provides access to the rail transportation businesses of Trinity Industries, Inc. With an owned and managed fleet of approximately 131,000 railcars, Trinity Industries Leasing Company (TILC) provides one of the largest railcar fleets in North America. In addition to comprehensive leasing and

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VTG RAIL INC.

103 West Vandalia, Suite 200, Edwardsville, IL 62025. Bryan Vaughan, Regional Vice Presi-dent Sales, 630-361-6745, Bryan.Vaughan@vtg.com. Lynn Hayungs, Regional Vice President, Sales, 956-630-2723 ext. 206, Lynn.Hayungs@vtg.com. VTG is a freight and tank railcar lessor offering operating leases and customer structured solutions. VTG also provides fleet management services for its customers and for other private railcar owners and operators. VTG is a customer service oriented leasing company that provides a best in class mix of service, operational and mechanical expertise at competitive lease terms. VTG invests in all freight car types.
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Wells Fargo Rail, 9377 W. Higgins Road, Suite 600, Rosemont, IL 60018; Telephone: 844-459-9664; Fax: 847-318-7588; Web: www.wellsfargo.com/rail. Email: RailAccountServices@wellsfargo.com. Wells Fargo Rail is the largest, most diverse rail equipment operating lessor in North America. Whatever you're transporting, we've got you covered with more than 175,000 railcars and 1,800 locomotives. Our team of experienced rail industry professionals is ready to listen to your needs and structure creative solutions to add value to your business.

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RAILSOLUTIONS, LLC

2593 Wexford-Bayne Road, Suite 205, Sewickley, PA 15143; 724-766-6699; Email: rblankemeyer@railsolutions-llc.com; Website: www.railsolutions-llc.com; Robert Blankemeyer, President. RailSolutions LLC provides a broad variety of railroad equipment-related consulting, technical and advisory services to financial institutions, railroads, shippers and fleet owners with a primary focus on equipment valuation and appraisal services. RailSolutions LLC offers two publications on a subscription basis, The Investors' Guide to Railroad Freight Cars and Locomotives and the RailSolutions Railroad Equipment Historical Database. Our firm draws on more than 45 years of railroad industry experience in railcar and locomotive equipment valuations supported by both a sound base of market data and advanced analytical techniques.
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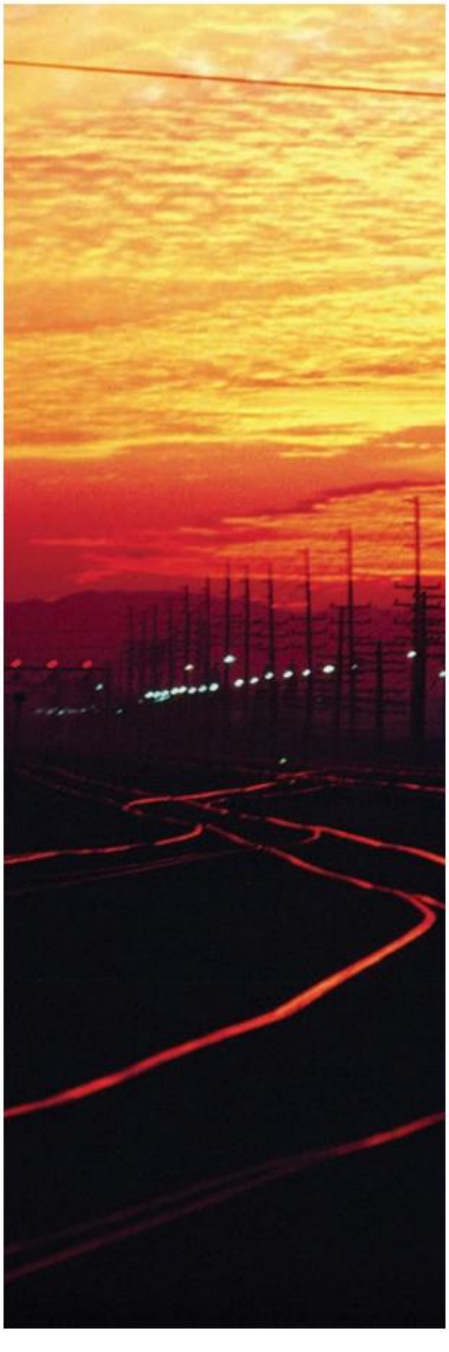
RR MERGERS & ACQUISITIONS

11 The Pines Court, Suite B, St. Louis, Missouri 63141; Tel: 314 878-1414; Fax: 314-878-1414; Robert Fowler, President, 314 878-1414 x227 Email: robert@rrmergers.com. Jack Sickles, Vice President, 314 878-1414x221 Email: jack@rrmergers.com. RR Mergers & Acquisitions has specialized in the sale of rail-focused companies for more than 15 years. Trusted professionals with long-standing relationships in the rail sector, RR Mergers interfaces with strategic and financial buyers finding the right buyer for a Company, to make the best deal happen. While maintaining confidentiality at all times, RR Mergers manages the total process of selling railroad industry suppliers, rail services companies and Short Line Railroads. RR Mergers provides advisory services to prepare the company for acquisition, developing a confidential information memorandum, negotiating term sheets, letters of intent and coordinating the due diligence process.

STRATEGIC RAIL FINANCE

1700 Sansom St., Suite 500, Philadelphia, PA 19103; (215)564-3122. Michael Sussman, President and CEO. SRF has served for 23 years as trusted advisor to Class I and short line railroads, rail shippers, public sector agencies, and industrial developers. The firm has brought capital, clarity, and velocity to infrastructure development projects in 38 states and Canadian provinces. SRF integrates capital from public programs and private sources with growth marketing strategies and management consulting to position executives toward short-term objectives and long-term opportunities.



TRAIN SAFETY ANALYSIS IS QUICKLY CHANGING

Technology Advancements Creating Safety Dividends

PST™
ENTERPRISE DETAILS DONE WELL

SOMETIMES IT SEEMS like lightning strikes and we see a significant jump in the capabilities of technology. Such is the case with Precision Train Builder™ (PTB), a suite of abilities that enables railroads to enhance safety using physically accurate simulation. This ability is leading to improvements in both accident analysis and train consist design. But, like most significant technology shifts, it's usually about many separate things being in the right place at the right time.

PS Technology (PST) has taken the embedded physics simulation within their locomotive simulator products and connected the dots into a broader picture of railroad safety. Here is where the nexus of technology has resulted in new abilities. The combination of railroad GIS track data, actual locomotive event recorder data, and robust computational analysis have come together to provide new insights about train behavior and safe operations.

The cornerstone of Precision Train Builder is PST's on-demand Event Recorder Analyzer. Used by several railroads, E•R Analyzer™ is a post-incident forensic tool that combines event recorder data and GIS track information from an actual train run and then processes it through its physics simulation. The results are highly customizable reports that graphically show in-train-forces to help determine what happened. The physics simulation is cumulative across the train and reveals in-train forces, but with car-by-car specifics. This diagnostic ability can show excesses in-train forces, even if trains were built within the rule sets of a railroads Train Management System (TMS). As a total product E•R Analyzer is a diagnostic tool, but one that leads to incident avoidance, due to knowledge that is gained, from post-event analysis.

Seeing the potential to expand this diagnostic ability, PST created Precision Train Builder. As compared to E•R Analyzer, PTB is focused on both prescriptive and predictive outcomes.

The first of these abilities is a TMS planning tool called PTB Validator. Validator is used as a means to test existing rulesets against physically simulated outcomes of a consist build. This provides the clarity of science to the train building process.

This new validator ability lets railroads check that trains built with TMS rules have a safety margin to reduce the likelihood of exceeding safe physical in-train forces. Using track data on the anticipated route plus the entered consist design, users are given a go/no-go decision before departure. Additionally, PTB Validator explores maximizing asset utilization which may include, train length, car placement and operational speeds. Validator can execute multiple iterations of consist designs. The simulation will flag instances where a given consist may be built within 100% compliance of the rules but still be forecasted to have physical issues such as stalls.

Another module is PTB Monitor, a real-time analysis tool for rail operations. There is active monitoring during multiple points in a train's journey with more simulations being run after each work event. This creates scientifically based opportunities to reduce the likelihood of inadvertent consist placements resulting in sub-optimal performance including derailments or near derailment causing conditions.

As a proactive tool, PTB Monitor includes the ability to provide alerts to the operating team about in-train force issues in real-time. For additional analysis, external data points are also integrated such as dimensional clearance, weather, track adhesion, wind, bulletins, and slow orders. The constant simulation monitor provides a focus on improved train handling, and reduced derailment by utilizing point-to-point scenario creation throughout the duration of the train run. PTB Monitor embeds and then utilizes historical and institutional knowledge in analysis to improve financial performance of train builds and runs.

Where does PTB go from here? That is a question PST keeps asking itself because there are so many other possibilities. In addition to safety, integration with business operation initiatives seems to be an area with significant potential.

But, fundamentally, PTB and E•R Analyzer are about safety improvements in railroad operations. "Now we can simply know things about train operations that we only guessed at before.", says PST President Seenu Chundru. "This means we can operate railroads better and safer than we ever have. Why wouldn't we want to do that?"

Read the past.
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// SYSTEM SAFETY

Industry 4.0 (also known as the Fourth Industrial Revolution) is a reality. Railroads, including their partners in the transportation supply chain, are at the beginning of their journey to establishing true end-to-end digital continuity. For example: Industrial Internet of Things (IIoT); Positive Train Control (PTC) and Enhanced Train Control (ETC); and AI (artificial intelligence)-based automation such as expanding autonomous inspection to include predictive analytics for track data. How do we know that these solutions and systems are safe and that there are no lurking issues? How do we know that the integration of multiple components from vendors, partners, and even from within meet safety objectives? How do we know if safety integrity is preserved after a change is made? How do we shift the paradigm where safety moves from a cost center to a value-added business driver? In Part I, we make the case for system safety as the necessary discipline for railroads to embed as they move forward in innovating and advancing in the 21st century.

For generations, the railroad industry has taken safety to heart and is justifiably proud of this. Safety engagement is one of the key means by which railroaders relate, watch out for and protect each other. However, there are historically unresolved safety issues that keep perpetuating. Derailments and collisions related to engineering infrastructure, mechanics of rolling stock and human factors are common examples.

Is the railroad industry in North America, and worldwide, going far enough in terms of safety in these modern times? The digital world continuously demands integration of systems and solutions, yet it is unforgiving to incomplete, inaccurate, incongruent and incohesive requirements, specifications, designs, implementations and operations.

In the U.S., federal law carried out by the Federal Railroad Administration (FRA) mandated Positive Train Control (PTC) as a means for rail transportation safety improvement, with all the decreed railroads, freight and passenger, to have PTC activated by the end of 2020. PTC deployment, touted as the largest IIoT initiative in North America, introduced a new technological disruption to railroading that included integration of many mission- and safety-critical systems. Yet system safety, as a formal practice, is in the very early stages in the rail industry and across the collective end-to-end transportation supply chain.

Progress Rail TALOS® attended autonomous freight train test at TTCI.

Both Canada (in 2015) and the U.S. (in 2020) wisely declared amendments and final rules to improve the safety culture in the railroad and transportation industries. Their current extent is focused on safety management systems, which are a

William C. Vantuono

SAFETY DOESN'T HAPPEN BY ACCIDENT

SYSTEM SAFETY

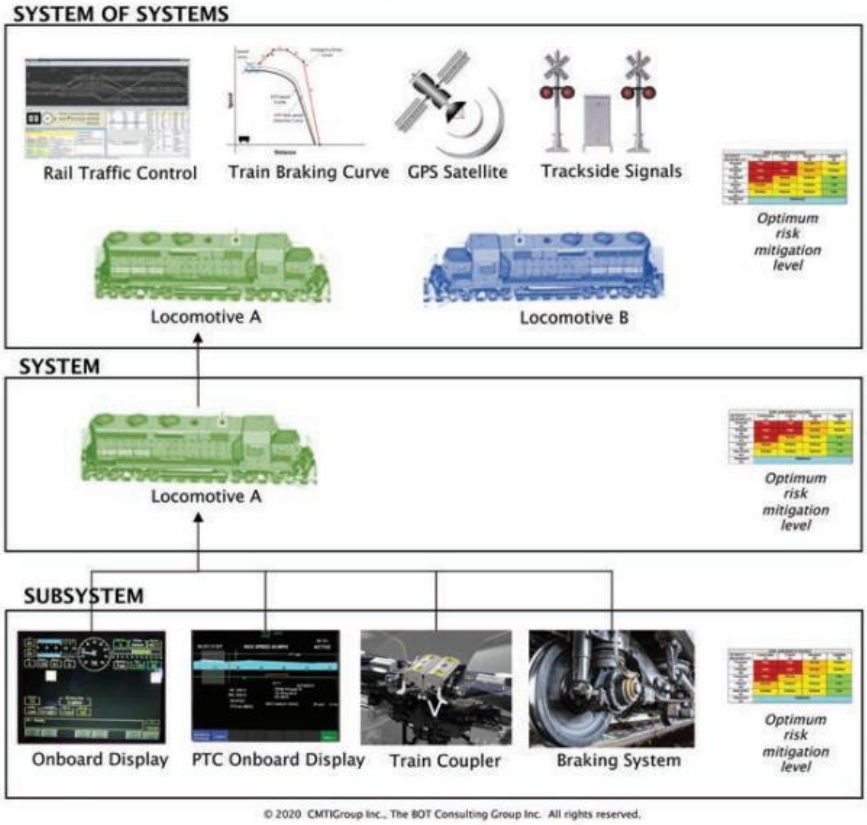
PART 1, THE CASE FOR SYSTEM SAFETY

BY SONIA BOT AND TONY ZENGA

necessary component. Although the need for a Risk Reduction Program is required in the freight industry, it needs to be implemented across the board to support a positive safety culture to embrace the digital transformation. This is something that has been in place in other safety-critical industries such as defense and aviation for several decades.

A new perspective is required, as demands for safety today and in the future are no longer satisfied with incremental extensions of existing work. Rather, innovative approaches, ranging from new safety conceptual models to solution approaches,

FIGURE 1



are needed when dealing with new technologies such as software and AI. A shift from traditional non-systems or piecemeal approaches to interoperable systems is required.

While the railroads are responsible for safeguarding and improving their safety performance, they are also required to rise to the challenge of following new regulations while running their businesses. A new perspective on system safety is required for all members of the transportation ecosystem, with a platform and philosophy for it. By using methodologies in systems and lean process engineering, as well as organizational behavior, system safety can be effectively embedded, with a means to reduce implementation risk, accelerate time-to-value realization, improve safety performance, and grow cultural and capability maturity at a healthy and sustainable pace. What is more, applying entrepreneurship and business precision approaches will enable the paradigm shift for safety to move from a business cost center to a value-added business driver.

Safety just for safety's sake is no longer viable. Overlaying and managing digital initiatives using standing safety practices is no longer sufficient and is too much for one to manage. Instead, system safety would drive business cases for automation and leverage to the next level of operational efficiencies and effectiveness. System safety as a mechanism allows the compounding complexity and increasing volume and speed of change imposed on the railroad industry, either by regulation or by internal growth or by competitors, to be managed from a safety perspective. As a result, customer service is provided more reliably, predictably, effectively, and, of course, safely. Overall, this is a high-gain approach for delivering sustainable financial results, while building reputational equity.

WHAT IS SYSTEM SAFETY?

Safety is an often-used term that is loaded with meaning and consequently littered with ambiguities. Fundamentally, safety is the condition of being safe from undergoing

or causing hurt, injury or loss.

The premise of system safety is one of synergy: A whole is more than the sum of its parts. System safety requires a risk-based strategy centered on identifying and analyzing hazards, and applying remedies using a systems-based approach. This differs from traditional safety strategies that rely on the results of accident investigations or epidemiological analysis. The systems-based approach to safety requires the application of scientific, technical and managerial skills to hazard identification, hazard analysis, and elimination, control or management of hazards throughout the lifecycle of the system. Hazards analysis is systematically done at many levels (for example, functional, operating, sustaining, requirements, system, subsystem and component) and where all levels are integrated for full end-to-end traceability.

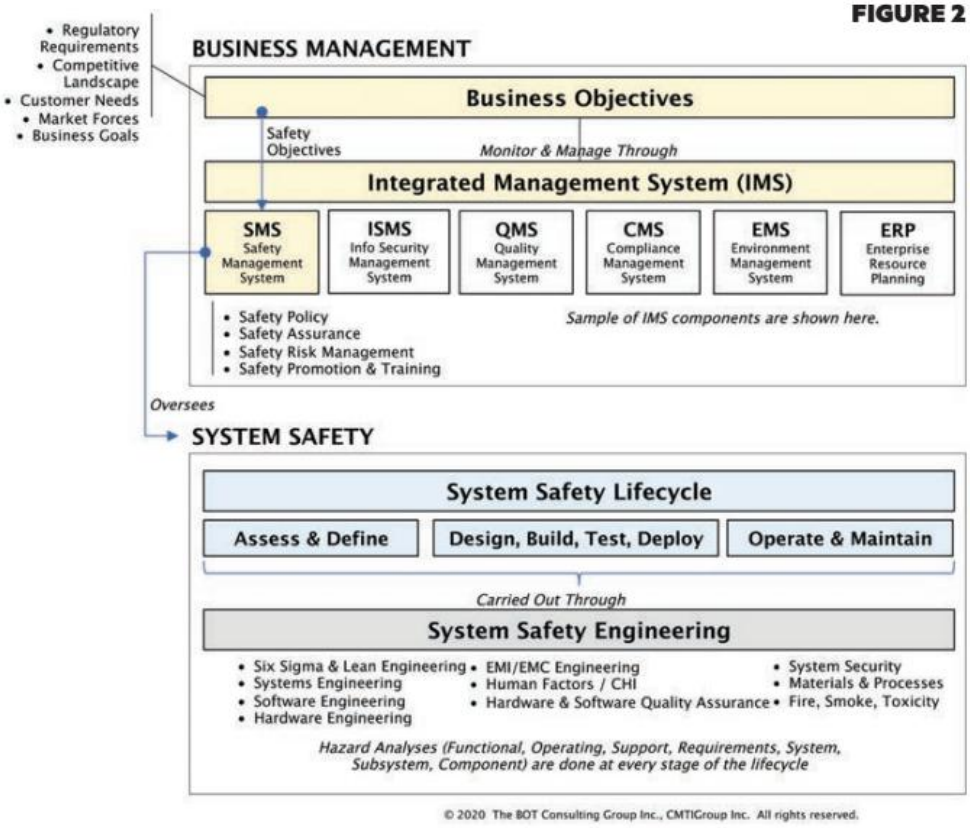
Most systems today are part of a "system of systems," even if they are not explicitly recognized as such. In a system of systems, a collection of task-oriented or dedicated systems combine their resources and capabilities to create a new, more complex system that offers more functionality and performance than the sum of its parts. PTC is one example.

Operationally, a railroad acts as a system of systems during its daily operations to bring together a mix of systems for operations to meet mission objectives. From a development and acquisition standpoint, however, railroads have focused on independent systems. Most transportation systems were created and then evolved without explicit systems engineering at the system of systems level.

From a system safety perspective, considerations need to be applied at the system of systems level. When it comes to interoperability, more emphasis on system of systems is needed, given the relationships among what were previously considered independent systems.

Figure 1 shows simplified system/subsystem/system of system relationships. Each system (for example, locomotive, trackside signals, GPS satellite, etc.) must not only operate individually to provide the needed functionalities, but also must interface with each other or be interoperable with several other systems. To achieve an acceptable level of safe interoperability, such systems must be engineered for safe operations and evaluated in the system of systems context. The same philosophy applies to subsystems that constitute a system. For example, a faulty coupler component failing to engage on a car at the subsystem level could result in a train system separation, which at the subsystem or train system level is not an immediate safety concern. However, in the system of systems context, the effect of the coupler failing to engage is catastrophic when a set of preconditions is satisfied. For example: The train is

FIGURE 2



climbing a grade, absence of spring brakes for emergency braking, or failure of associated rail procedural mitigations. The coupling failure could initiate the cars rolling and colliding with a stationary or moving train or result in a derailment.

The system safety goal is to eliminate or reduce the probability of mishaps at various levels of the relationship between elements, subsystem, system, and system of systems. As depicted in Figure 1, when two systems, (for example, Locomotive A and Locomotive B, or more) operate on a common rail network, it is the rail operator's duty to ensure that adequate train separation is maintained at all times. Similarly, it is the obligation of each system and subsystem supplier to ensure that their system or portion incorporates fail-safe design methods to ensure that acceptable levels of safety are part of the system design.

HOLISTIC SAFETY FRAMEWORK

Figure 2 lays out a holistic view of safety. This universal model can be applied to a

Union Pacific

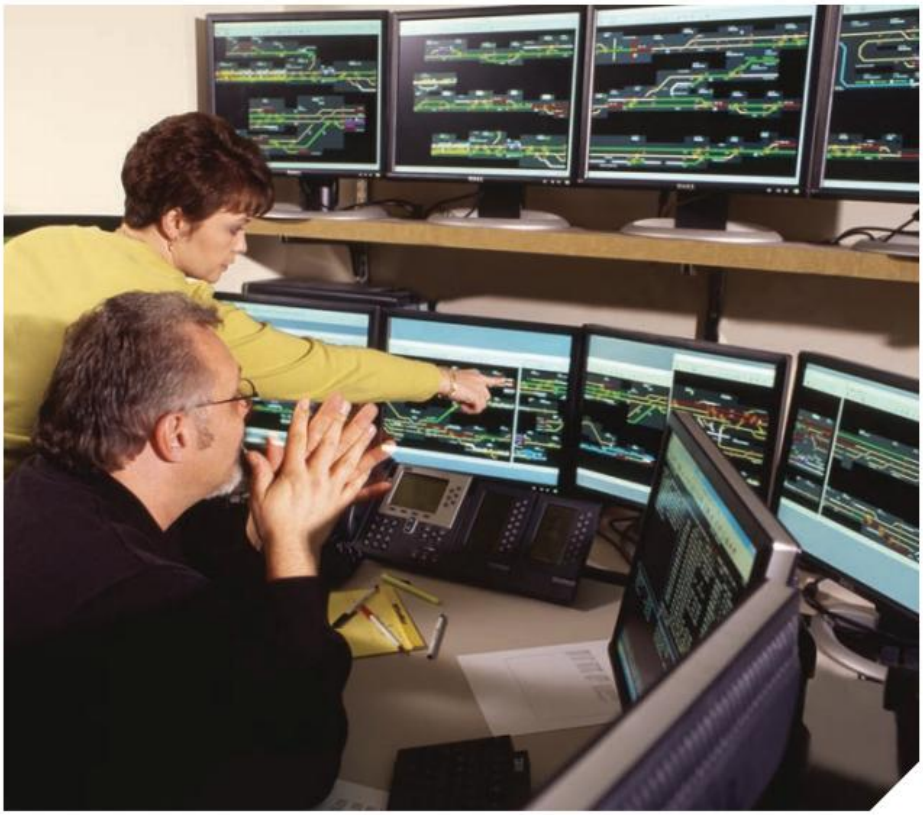
company, major business units within a company, and across an ecosystem of companies and partnerships.

From a business management perspective, safety objectives are defined by regulatory requirements, and shaped by various inputs such as the competitive landscape, customer needs, market forces and business goals. In Figure 2, the Safety Management System (SMS) is the platform for monitoring and managing the performance of the safety objectives. SMS is used in commuter rail and Canadian freight rail, and was introduced in 2020 by the FRA through its risk reduction program. Other industries such as aviation, petroleum, chemical and electricity generation also use SMS, or other such forms of process management control systems tailored to safety. Typically, companies (or business units, or ecosystems) with higher integration levels of management practices would also have an Integrated Management System (IMS) in place as shown in Figure 2. Rather than having individual management systems operating in silos (for example, safety, information security, quality, compliance, environment, enterprise resource planning, etc.), the company can be managed more effectively and efficiently using joined-up thinking, better aligned business objectives and KPIs, and simpler audit models. System safety performance is overseen by the SMS.

CURRENT STATUS OF RAIL SAFETY

North American railroads have recognized the importance of improving safety as far back as the 1880s, when a small group of railroad regulators, workers and managers began the campaign for the development of better brakes and couplers for freight cars, which the U.S. Congress finally responded to by passing the 1983 Safety Appliance Act. In May 2015, Transport Canada (TC) took measures to enhance the safety of Canadian railroads through the Transportation Modernization Act and amendments to the Railway Safety Act. In February 2020, the FRA issued the Risk Reduction Program Final Rule. Ongoing, U.S. railroads have implemented the first wave of PTC and are gearing up for the next waves, while Canada is undergoing the discernment process for ETC.

Even though regulators are establishing safety minimums, railroads are innovatively working at piecemeal safety measures (for example, autonomous track inspection, on-track safety procedures, personal protective equipment, PTC/ETC) for improving their respective safety performance. Individual railroads are looking after their interests, spending time and effort lobbying the FRA/TC for exceptions and trials. The political climate in the U.S. is litigious-based, whereas in Canada it allows for more forgiveness and lesson-learning. Nonetheless, there is opportunity for improvement



on all fronts to genuinely enhance railroad safety performance.

Setting aside the politically related challenges, freight railroads today are in the early stages of comprehensive system safety management, as mandated by regulators. Canadian railroads are currently engaged in their SMS implementations as of the TC amendment in 2018. The U.S., however, is just introducing SMS. Regardless, we caution the railroads not to solely rely on SMS for safety risk management, as it can provide a false sense of security.

As a demonstrated functional discipline, system safety is incomplete in the North American freight railroad industry.

NEW TECHNOLOGY DEMANDS SYSTEM SAFETY

As advanced technology becomes more and more prevalent, the urgency for integrating it into systems increases. When introducing new technologies, their integration with existing layered solutions, which include

Norfolk Southern

safety measures, becomes tricky. With the rapid speed of change, the influx of new things to learn and the unrelenting pressure to deliver more with less, current safety practices can become inadequate, and safety solutions often end up incomplete and not fully integrated.

Even though safety is, first and foremost, a priority, it needs more support in business plans. The temptation to only implement reactive fixes compounds the safety conundrum and adds confusion. Safety must be designed upfront and built into all layers of hardware, software, systems and processes (including real-time operations). The digital world is unforgiving to incomplete, inaccurate, incongruent and incohesive requirements, specifications, designs, implementations and operations.

These collaborations must include rail system operators (for example, rail traffic controllers, locomotive engineers, track maintainers, etc.) and system safety practitioners (for example, system safety engineers) jointly identifying safety-related operations and improvements as well as operational safety constraints. As well, railroads must work closely with their suppliers and contractors to ensure that the products and services they purchase meet system safety requirements when integrated into their own systems and operations. The safety improvements become derived safety functions for existing or newly defined systems. The safety functions replace existing procedural mitigation to achieve higher levels of safety and reduce the operator workload.

To prevent introducing safety-significant anomalies in current and future transportation systems, the system safety approach is the surest and lowest-risk path. Traditional safety approaches alone no longer meet the new demand.

Stay tuned: In Part II, we will present our approach on how to implement system safety as a value-added business driver.

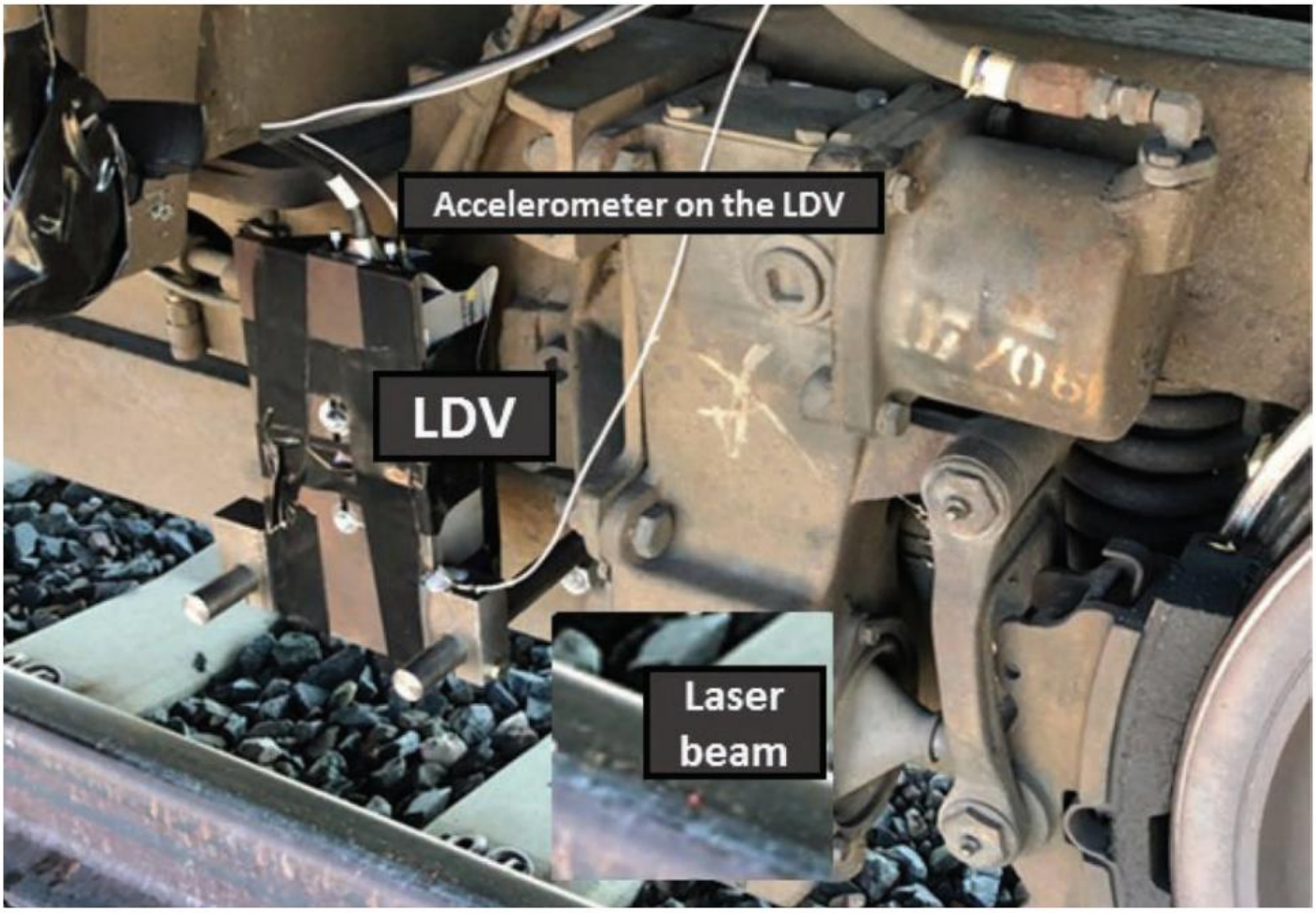
This article is based on the novella-sized white paper, "System Safety as a Value-Added Business Driver: The Evolution of Railroading in the Eras of Technology and Innovation." Whitepaper: The BOT Consulting Group Inc., CMTIGroup Inc., S.D. Bot, and T. Zenga, July 2020.

Sonia Bot

SONIA BOT, chief executive of The BOT Consulting Group, Inc., has played key roles in the inception and delivery of several strategic businesses and transformations in technology, media and telecommunications companies worldwide. By utilizing methodologies in entrepreneurship, business precision, Lean Six Sigma, systems and process engineering, and organizational behavior she's enabled organizations to deliver breakthrough results along with providing them a foundation to continue to excel. She was instrumental in PTC implementation on CN's U.S. lines. Her approaches on the evolution of railroading and transportation are game changers that drive innovation and competitive advantage for adopters in a changing industry. Sonia can be reached at sdbot@botgroupinc.com.

Tony Zenga

TONY ZENGA, owner of CMTI-Group, Inc., is an accomplished specialty engineering consultant with international experience in operational reliability and safety for mission critical systems. He has played key roles in the implementation of system safety engineering programs for aerospace, defence, high tech, mass transit and rail infrastructure projects worldwide. By leveraging on his design and development experience of large-scale safety-critical systems, combined with his systems engineering knowledge, he enables organizations to deploy their systems safely into field operation. As advisor to CN, he was instrumental in the development of the PTC system safety engineering safety case and the creation of the system safety engineering discipline. Tony can be reached at tzenga@cmtigroup.com.



USING AI *TO IMPROVE SAFETY*

Ingenuity and innovation have made rail one of the safest modes of transportation. Among the cutting-edge technologies now making their mark is artificial intelligence.

BY JAY P. BAILLARGEON, FRA OFFICE OF RESEARCH, DEVELOPMENT AND TECHNOLOGY – TRACK RESEARCH DIVISION

The U.S. Office of Science and Technology Policy defines AI (artificial intelligence) as technology that enables computers and other automated systems to perform tasks that have historically required human cognition and what we typically consider to be human decision-making abilities. The history of railroading is replete with advances in mechanical, civil, electrical and chemical engineering. In no small part, advances in AI and computer science are generating even more momentum and driving a new technological revolution expected to dramatically transform all fields of engineering and the future of railroading.

BUILDING THE AI FOUNDATION

Increasing automation of operations, inspections, equipment and safety processes are widely expected as new and emerging AI-based technology is used in railroading. In response to previous developments and anticipating new ones, the Federal Railroad Administration (FRA) is building the capacity to understand and assess the safety implications of new technology. Since the early 2000s, FRA's Track Research Division, in the Office of Research, Development and Technology (RD&T), has been actively engaged in AI research—including research into neural net applications, machine vision and machine-learning capabilities for complex analyses as well as new and innovative inspection technologies incorporating AI-based processing techniques. RD&T has been a key proponent of AI for nearly two decades and has

seen its efforts translate into viable technology with widespread implementation in the railroad industry.

For example, the FRA RD&T automated joint bar inspection tool, developed primarily between 2002 and 2009, epitomizes the agency's focus on leveraging AI tools and applications. In 2009, the technology was successfully commercialized and has since become a standard and widely accepted method for automatically inspecting joint bars. This system, which can be deployed on either a hi-rail vehicle or inspection car, takes illuminated images of the joint bar at speeds up to 60 mph and runs them through a series of complex machine-learning algorithms. The imagery is then processed to determine whether even minute hairline cracks are present. The images, along with detailed geolocation information, are then provided to railroad maintenance personnel for remediation.

RD&T will study other facets of AI over the next five years, including these two specific areas:

- **AI-based risk analysis**—in which a suite of technologies will be developed to increase safety and reduce human error by improving the speed, accuracy and consistency of routine inspection processes. The primary focus of this initiative will be the application of predictive analytics.
- **Expansion of autonomous inspection technologies**—so that key inspections of equipment or infrastructure occur seamlessly during routine operations, instead of as a separate, dedicated process.

While efforts to date have been focused primarily on track-related applications, RD&T is expanding the scope of AI-related research into other areas, such as highway-rail grade crossing safety enhancements and trespass deterrence and prevention.

AI-BASED PREDICTIVE ANALYTICS

Predictive analytics, in the context of track-related research, refers to the analysis and application of track measurement data. Such information is needed to build computational tools designed to accurately predict adverse track structure/substructure conditions. The primary goal of this research is to help railroads more easily identify high-risk track segments and, in turn, prevent unsafe conditions long before they become problematic by augmenting current inspection capabilities, optimizing inspection vehicle routing and enabling risk-based preventive maintenance approaches. Also, by incorporating innovative AI-based techniques such as machine learning, RD&T is exploring ways of automating the processing and reporting of analytical results to enable real-time decision-making in the future—getting relevant data-driven information to field personnel more quickly.

Predictive analytics requires a significant amount of data to create algorithms that accurately and reliably predict adverse conditions with a minimal false-positive rate. Fortunately, autonomous track geometry measurement systems (ATGMS) permit more frequent inspections during revenue service—without degrading operational efficiency. Along with the vast distances these systems cover each year, an equally substantial amount of raw data is collected that contain valuable insight into long-term trends. These data allow operators to monitor track geometry conditions as they develop over time, but the current process by which data is extrapolated can be labor intensive and time consuming. The increased speed of data processing now allows railroads to predict degradation rates, optimize maintenance efforts, and, in turn, prevent safety-critical issues from occurring.

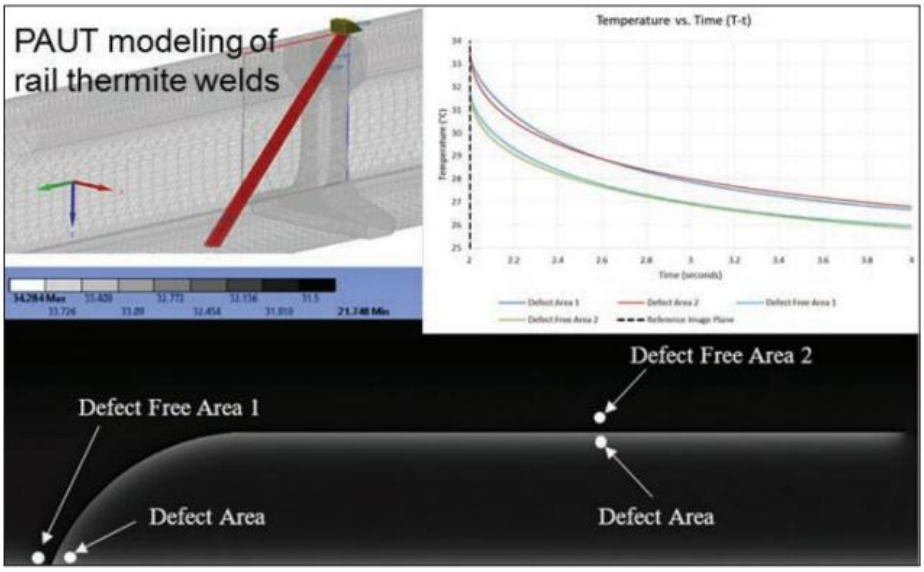
"The proper application of AI can create less operational risk and afford a safer environment. Continuous strengthening of the predictive algorithms associated with AI can deliver endless value toward eliminating variability, thus creating more productive capacity. Smarter railroading in the years ahead can be achieved by advancing use of AI technology."

— Federal Railroad Administrator Ron Batory

As part of a new research initiative, RD&T is developing computational strategies that will direct the automated management of recursive track geometry measurements gathered by ATGMS vehicles. Using raw data collected from the ATGMS fleet of a U.S. passenger railroad, a process is being developed that segments and aligns the track geometry measurements from multiple time-separated runs; identifies and processes peak-value deviations; and reports the appropriate severity level of the deviations as they relate to established maintenance and safety thresholds. This automated process will employ machine learning to streamline the steps taken to transfer actionable information from the ATGMS vehicle to the decision-maker responsible for maintenance and regulatory compliance. From here, the foundational elements of the research can be applied to other track geometry systems, both manned and autonomous, and establish a framework for other track-related datasets.

AUTOMATED INSPECTION/ MONITORING TECHNOLOGIES

Automated change detection is another area of interest for RD&T. Change detection is the ability to determine whether one or more changes have occurred in two or more identical images separated by time. The focus is on relevant changes to track structure that might suggest a safety-critical issue, as opposed to irrelevant, unimportant changes, such as a piece of trash that appears during a run, or minor disturbances to ballast. This is where AI comes in because algorithms can be used to properly process and align the images gathered from an inspection car or even an unmanned aerial system (UAS), and to highlight any changes that may have occurred, such as a missing fastener clip or a disintegrated crosstie. RD&T is actively engaged in multiple research projects aimed at further developing this technology, using not only traditional photographic images of the track, but also 3D laser-based triangulation techniques.



Beyond efforts to leverage and expand the use of AI for track and structures, RD&T is also conducting exploratory research in remote trespasser detection. AI-aided algorithms are helping to automatically process live video footage from both ground- and UAS-based systems to detect trespassers on railroad property. The application of AI allows for real-time processing and notification with minimal human supervision, while minimizing false alarms (e.g., animals passing by the camera), so law enforcement personnel may respond in a timely manner. Another project will study the effectiveness of using incidental video footage obtained from cameras along rail rights-of-way. In this case, researchers will explore using AI to automate detection from camera feeds.

THE FUTURE OF RAILROADING

With the use of AI and other technologies, there is great potential for railroads to further reduce the occurrence of high-consequence accidents and derailments altogether. To realize such a future for rail transportation, RD&T is focused on dedicated research initiatives aimed at Improving, Implementing and Inspiring:

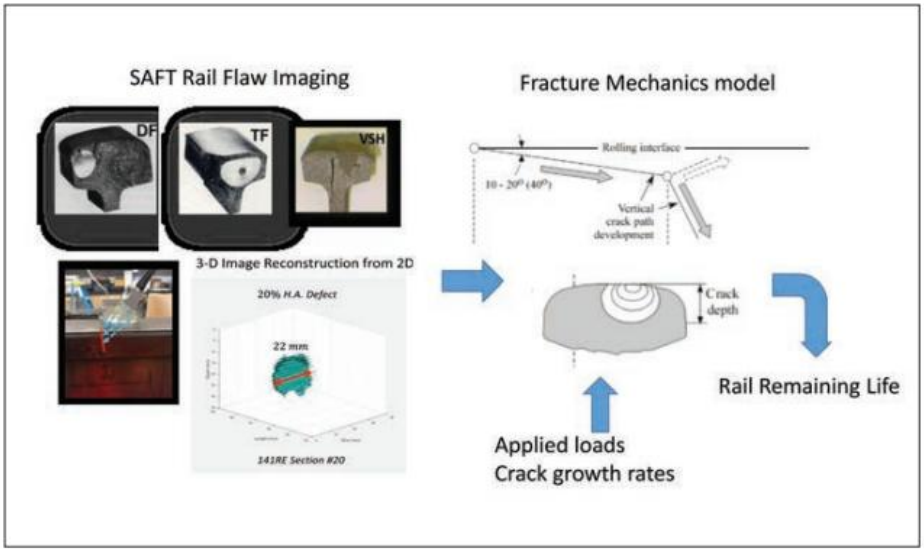
- **Improve:** High-quality inspection/measurement data is necessary to properly train AI, which results in a need for less time-consuming and more efficient inspection/measurement strategies (e.g., autonomous systems) and the development of new technologies to fill gaps in the data.
- **Implement:** FRA has a proven record of facilitating and hastening industry implementation of AI-enabled technologies. The agency will continue to sponsor AI research to address elusive safety issues facing the railroad industry now and in the future.
- **Inspire:** Continued advancements made possible by AI-enabled technologies in the railroad industry will only be possible through the recruitment and retention of recognized subject matter experts.

FRA will continue to explore the multitude of ways AI and other technologies can enhance railway safety. The agency is committed to fostering innovations essential to realizing a future in which accidents and derailments in the railroad industry are a distant memory.

ACKNOWLEDGMENTS

The author would like to acknowledge Francesco Bedini Jacobini, who is currently spearheading FRA's AI-related efforts in grade crossing safety and trespasser prevention. In addition, the author would like to acknowledge the support and guidance of Gary Carr, former Division Chief of the Track Research Division. Many contractors and subcontractors have also contributed to the success of research initiatives focused on applying AI for safety-enhancing technologies.

JAY P. BAILLARGEON leads the Predictive Analytics Program for the FRA Office of Research, Development and Technology – Track Research Division and is based at FRA's Transportation Technology Center in Pueblo, Colo. The Predictive Analytics Program focuses on the enhancement of railroad safety through innovative analytical strategies, including AI applications for track-related datasets. Jay serves on multiple interagency task forces related to data management and AI at the U.S. Department of Transportation, including the DOT AI Task Force in response to the Presidential Executive Order on AI. He is also a member of the Institute for Operations Research and the Management Sciences (INFORMS) Railway Applications Section, the American Society of Mechanical Engineers (ASME), and the American Railway Engineering and Maintenance-of-Way Association (AREMA).



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BKROR	217	7-31-19	RR Operating Rules and Practices	10.50	9.45
	218	7-31-19			
BKRRC	220	7-31-19	RR Communications	6.75	6.10
BKEND	221	7-31-19	Rear End Marking Device, Passenger, Commuter & Freight Trains	6.25	5.60
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Combined FRA Regulations

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BKCAD	40	4-23-19	Drug and Alcohol Regulations in	38.95	35.00
	219	7-31-19	the Workplace		
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Compliance Manuals

BKINFRA	Track and Rail and Infrastructure Integrity Compliance Manual - Volume II, Track Safety Standards - Part 213	38.00	34.00
BKTM	Technical Manual for Signal and Train Control Rules. - Includes Part 233, 234, 235, 236	49.95	44.95

Updates from the Federal Register *may be supplied in supplement form.*

FRA News:

There are no new proposals or final rules to report for this issue. Be sure to check back next month to see if there are any changes to FRA regulations.

Part 213: Track Safety Standards

49 Part 213, Subparts A-F. Classes of Track 1 through 5: Applies to track required to support passenger and freight equipment at lower speed ranges. Includes Defect Codes and Appendices A, B, and C to Part 213. Softcover. Spiral bound. Updated 7-31-19.

BKTSSAF Track Safety Standards **$10.95**

Order 50 or more and pay only $9.86 each

Part 214: Railroad Workplace Safety

The FRA's Railroad Workplace Safety standards address roadway workers and their work environments. Subparts A-General, B-Bridge Worker Safety Standards, C-Roadway Worker Protection, D-On-Track Roadway Maintenance, and Defect Codes for Part 214. Spiral bound. Updated 7-31-19

BKWRK Railroad Workplace Safety **$10.50**

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Bridge Safety Standards

FRA Part 237 establishes Federal safety requirements for railroad bridges. This rule requires track owners to implement bridge management programs, which include annual inspections of railroad bridges, and to audit the programs. Bridge Safety Standards Part 237 also requires track owners to know the safe load capacity of bridges and to conduct special inspections if the weather or other conditions warrant such inspections. Softcover. Spiral bound. Updated 7-31-19

BKBRIDGE Bridge Safety Standards **$7.95**

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Part 228: Passenger Train Employee Hours of Service; Recordkeeping and Reporting; Sleeping Quarters

49 CFR 228 for records, recordkeeping, and reporting of hours of duty of a railroad employee. Also covers the construction of employee sleeping quarters and health requirements for camp cars. Softcover. Spiral bound. Updated 7-31-19

BKHS Hours of Service of RR Employees **$12.50**

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Progress Rail's patented ADFF (Acoustical Direct Fixation Fastener) was created "to provide noise and vibration attenuation expected from high resilient DF units."

HOLD IT!

Gauge-holding capability, resiliency, noise reduction, ease of installation and maintenance, low life-cycle cost, safety: Railroads rely on fasteners with these qualities to perform under heavy traffic.

BY WILLIAM C. VANTUONO, EDITOR-IN-CHIEF

For as long as there have been rails sitting on crossties—the foundation of railbeds since the industry emerged in the early 19th century—there have been fasteners. Yet even after roughly 200 years, fastener technology is still evolving. The mainstays of this industry segment (other than for traditional cut spikes, still the dominant type because they've always done what they're intended for)—Howmet Fastening Systems, L.B. Foster, Lewis Bolt and Nut Co., Pandrol, Progress Rail and Vossloh North America, among others—continue to innovate.

MARKET CONDITIONS, LONG-TERM OUTLOOK

2020 has been a year of uncertainty for fastener demand in the transit industry. According to Sarah McBrayer, General Manager, Transit Products, L.B. Foster Co., "The transit market has declined in some areas of North America and increased or pulled forward work in other areas based on funding and track time impacts from COVID-19. Many of the negative effects are often highlighted, but we have seen some very positive impacts as well. Reduced ridership has allowed for increased access to perform maintenance on track systems and unease regarding funding has pulled work forward to ensure the funding remains available to complete scheduled projects. But L.B. Foster has also used time this year to internally focus on our new product development and R&D efforts."

On the freight side, "new railroad construction requiring new concrete ties has slowed," according to Progress Rail. "This had a natural impact on demand for elastic fasteners. Railroads have also deferred maintenance and certain capital projects, mainly due to PSR. However, with maintenance often staying within a certain cyclical range, many projects cannot be postponed any longer, and we should see more activity in the coming months. If a customer has a tie problem, it becomes a ballast problem. The cost then becomes exponentially higher."

On the transit side, "the U.S. government has invested heavily in new expansion projects due to an expected, long-term uptick in ridership, and we have been busy supplying customers with the fastening products they need for the past several years," Progress Rail says. "We see this continuing for the foreseeable future."

For many years, Progress Rail notes, "there was an emphasis to make products last longer. For example, at one time, rail

Progress Rail

was expected to last around three years. Now, with improvements, that life cycle has been lengthened to roughly six years. Consequently, demand for products that support installing that rail can slow down. The industry should come out of that most recent cycle in 2021, pending no other unforeseen challenges."

"Like many other manufacturers navigating the current market conditions due to COVID-19, our sales tend to remain flat, and in some cases, decline dependent upon the industry," says Howmet Fastening Systems. "Our sales to the railcar industry are directly tied to build rates across different manufacturers, and when shutdowns and reduced build rates occur, the demand decreases for our fasteners. But our Huck 360® lockbolt for track construction and maintenance has seen a gradual upward trend that does not seem to be affected by the current market conditions."

For transit products, Howmet is "continuing to introduce new products to the industry. We continue to grow within this market space both with legacy products and new products introduced. The rail market has always been one of our key markets, and the industry has always proven to be resilient. Looking to 2021 and beyond, the forecasts are encouraging. We are currently working with many large railroads and transit agencies on future track and bridge opportunities."

Due to the global pandemic, Lewis Bolt and Nut Co. "is currently seeing slightly less demand for both freight and transit rail products. We expect this trend to last through the end of 2020. Looking forward to 2021, there is still uncertainty, yet we feel that maintenance programs for the freight railroads could be similar to 2020."

WHAT CUSTOMERS WANT

"Customers have consistently requested corrosion resistance and ease of maintenance across multiple product lines used in transit systems," says Sarah McBrayer. "The L.B. Foster Transit Products engineering team has focused on developing new, high-performance coatings for various applications across transit systems to address these concerns. These coatings offer several performance enhancement features,

Lewis Bolt and Nut's G2 Evergrip Screw Spike.

Howmet Huck 360® lockbolt. The nut engages on the bolt grooves to make a high vibration resistant fastener.

including corrosion and rust control, extended life span in wet environments, debris and dirt resistance, and improved electrical isolation. Noise and vibration mitigation have also been a constant area of concern for our customers."

For Progress Rail, "Our transit and freight customers are always looking for well-priced, long-life products that are American-made and safe to use in the field."

Lewis Bolt and Nut clients "are requesting that we continue to innovate and design products that improve efficiencies, and lower the overall cost of ownership. The new Quick-Set® Hook Bolt System, as well as the brand new and improved G2® Evergrip, are examples. Many other new products are in the pipeline, and are soon to be released for in-service testing."

Howmet customers "are asking for safer and more innovative products. Innovation and safety have been key to our past successes and remain at the heart of our market strategy. We will continue to develop safer products at a lower cost, while solving current issues that are introduced by various joining methods."

WHAT'S NEW?

During the past year, L.B. Foster "has successfully completed qualification testing for our high resilient direct fixation suite of fasteners for use in special trackwork areas," says Sarah McBrayer. "These fasteners offer superior noise and vibration mitigation in special trackwork areas that results in dampened noise levels in residential and commercial areas and a more comfortable ride for passengers. With coordination between our Pittsburgh R&D and Atlanta Transit Products Engineering and Laboratory teams, and utilizing finite element analysis, state-of-the-art testing equipment and our depth of industry know how, we remain focused on the development of next-generation products and systems with improved performance characteristics based on customer demand to maintain our standing as an industry leader within the transit fastener market."

Progress Rail's patented ADFF (Acoustical Direct Fixation Fastener) was created "to provide noise and vibration attenuation expected from high resilient DF units, while matching the anchor bolt pattern and rail seat elevation of standard DF units. Until now, that has never been done. The acoustical performance has been verified by independent, recognized acoustical

Howmet

track experts, and we have been awarded multiple contracts to date. High attenuation DF products are a specialty of Progress Rail, and this product is a significant step forward in DF innovation and evolution."

On the freight side, Progress Rail developed an American-manufactured, long reach Safelok-type Elastic Fastener for a Class I recently, and the company "continues to provide that to the market for other customers." Additionally, Progress Rail has a joint venture with Schwihag to manufacture American-made E clips for transit and freight customers.

Lewis Bolt and Nut recently designed and developed and is currently manufacturing its new G2 Evergrip Screw Spike: "The new G2 has a significant increase in fatigue resistance along with new, tie-grabbing barbs designed to prevent backout. In this new and improved design, the barbs are located lower in the screw, allowing us to dramatically strengthen the screw spike in its most critical area, roughly two inches in the shank below the head of the screw spike. We take pride in continuous improvements to our facilities and manufacturing processes. We have recently added a new manufacturing building to increase capacity. Along with increasing capacity, we are always improving our manufacturing processes to be safer and more efficient by way of automation."

One of Howmet's more recent track products is the Huck 360® lockbolt: "The innovative shallow-groove design gives these fasteners more tensile and fatigue strength while providing 30% more surface area interference. The H360 Nut engages on the bolt grooves to make a high vibration resistant fastener. They are easily installed with standard tools and provide the confidence known with Huck."

In some parts of the world, rail fastening system theft creates significant safety and security problems. Pandrol has developed engineered theft-resistant fastening systems that make it very difficult to remove clips without special tools. The company's Anti-Theft system incorporates e2000 series clips and is known as the eAT2000 fastening.

L.B. Foster Co. offers vulcanized rubber-bonded direct-fixation fastener technology for the transit industry.

"Once the clip has been installed, a notch on the clip's center leg interlocks with a matching protrusion that is cast inside the housing on the shoulder," Pandrol explains. "This mechanism is very difficult to see in the installed assembly, so that it is difficult for thieves to figure out how to remove the clip. They won't come out, but it's not obvious why. Clip extraction is extremely

L.B. Foster

difficult unless performed by use of a special extraction tool, which makes it very difficult for an unauthorized person to remove the product from the track. The eAT2000 uses high wear resistant materials in the insulating components that ensure longevity. It also offers a high level of creep resistance, involves no threaded components that can strip or corrode, and it avoids the use of plastic dowels in the tie."

For ballasted concrete ties, Vossloh North America offers the W System series, described as "a line of highly elastic fastening systems specifically developed to meet the rigorous standards of North American railroads. The shoulders of the concrete tie provide stability to the track and fastening system that allow for the transfer of forces generated by traffic. This highly elastic system absorbs vibrations, and avoids structure-borne noise caused by a rolling train."

Slab tracks require direct-fixation fastening systems that must meet special requirements to deflect forces generated by a rolling train. Vossloh's DFF series products "provide a single support point in slab track with a screw-dowel combination for anchoring, and are equipped with Vossloh's patented Cellentic rail pad, which is made of a highly elastic elastomer that provides the essential flexibility required in direct fixation fastening systems. The DFF 21 features a reinforced base plate with a larger surface area. The DFF 300 UTS (Urban Transit Systems) is designed to dampen vibration and mitigate noise, which is a significant benefit in the urban transit environment."

R&D EFFORTS

Progress Rail has developed the DF (Direct Fixation) Block, which has a patent pending. "Instead of providing the direct fixation assembly, which is the rubber molded assembly that sits on a slab or plinth, we deliver the DF fastener attached to a reinforced, precast block," the company says. "The anchor bolts are torqued to recommended levels so contractors do not have to handle bolts, inserts, washers or adjustment plates. The DF Block's installation removes the need for coring rebar stirrups into the invert, removes the need for placing rebar and forms to create plinths, and eliminates the need for a post concrete pour lift to fix voids created by air or water trapped under the units. This substantially reduces the amount of time needed for construction, as well as improves safety and quality by omitting multiple steps in material handling and labor previously required. The DF Block is lighter weight and more cost effective than similar products on the market and allows for routine vertical and lateral adjustment if required. This product and procedure is catching on rapidly and has been favorably received by transit authorities, contractors and consultants."

"R&D has always been the core to our success," notes Howmet. "As we continue to study new applications for track, bridge, car, locomotive and other markets, we can take what we learn during the development stages and translate that across different markets and introduce viable solutions to common fastening problems."

Norfolk Southern

MOTES: A NEW APPROACH TO EQUIPMENT HEALTH MONITORING

What if it's possible to continually monitor rail vehicle health?

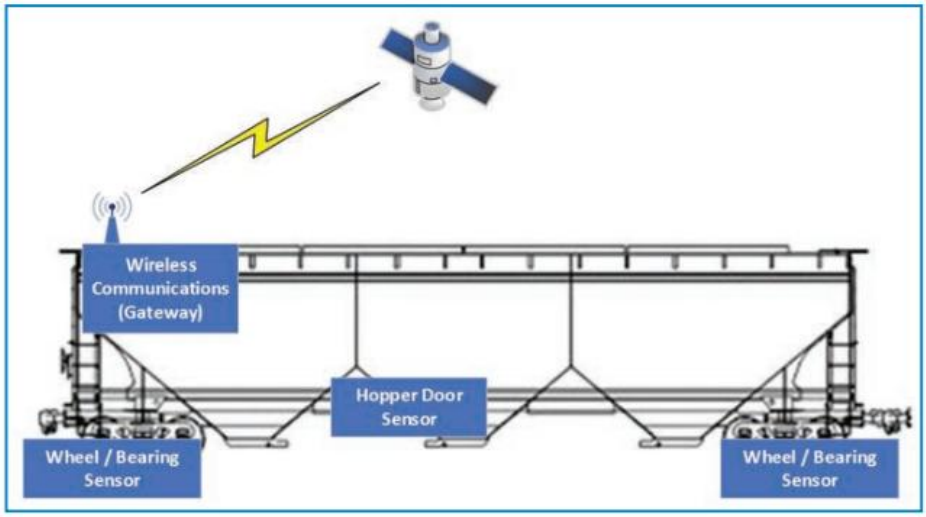
BY NATHAN STOEHR, PRINCIPAL INVESTIGATOR, TRANSPORTATION TECHNOLOGY CENTER, INC.

The railroad industry has been monitoring various aspects of rail vehicle health for decades using wayside detectors. These detectors have improved the operational safety and efficiency of the North American rail network, but there are drawbacks: Wayside detectors must be strategically placed to maximize traffic coverage, for example. What if, rather than getting an "inspection" once every eventual passing of a wayside detector, it was possible to continually monitor rail vehicle health in operations?

Enter "Motes," an abbreviation for Remote Onboard Sensors. Motes are small, self-contained sensor and communications devices affixed to a railcar component. They allow for continual, near-real-time collection and processing of data regarding critical components of a rail vehicle such as roller bearings and wheels. This data is off-boarded to the vehicle owner and may be used to prioritize maintenance, conduct trending of component health, and provide alerts to train operators regarding components that have failed, or are likely to fail, so that action can be taken.

There are two primary technical challenges associated with Motes technologies: power and communications. Motes must provide their own power in such a way to avoid an unacceptable maintenance burden on the car owner or operating railroad. In response to this requirement, suppliers have developed some rather novel approaches to overcome this problem. From the inclusion of small solar panels to energy harvesting to the use of low-power devices coupled to high-energy-density batteries (such as lithium ion), Motes suppliers continue to innovate to overcome the challenge of self-contained, long-lasting power.

Data collected by Motes devices is only



Motes are self-contained sensor and communications devices affixed to a railcar component. They allow for continual, near-real-time data collection and processing.

Motes do not fit easily into the established industry method of data sharing. A totally new architecture must be developed.

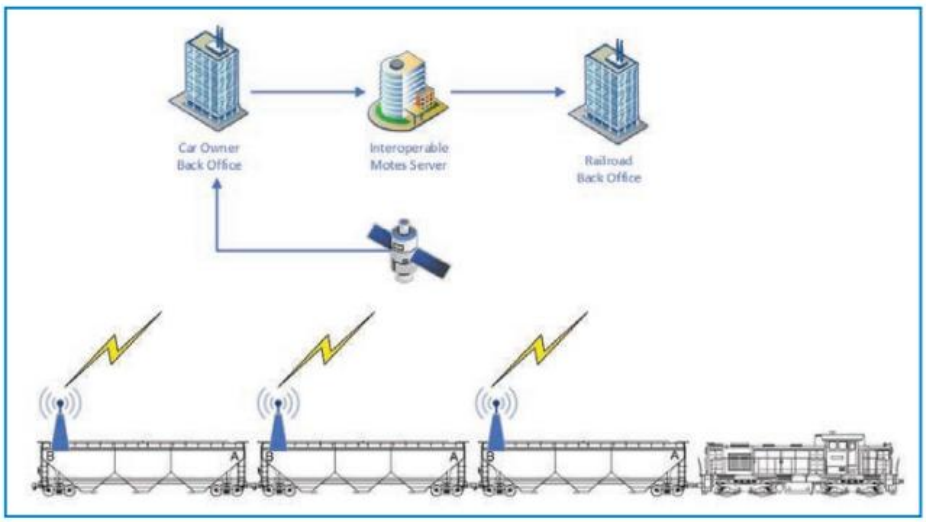
of value if that data is able to be communicated to the end user in a reasonable time frame. For example, Motes that are monitoring roller bearing temperature must be able to quickly provide data indicating a bearing is in danger of overheating to either the train crew or the railroad back office so that action can be taken quickly. To accomplish this, Motes developers are exploring various methods of wireless communications. From onboard cellular to long-range wide-area networks, developers are working to provide reliable, low-power consumption and integrated communications with their products.

For several years, the Association of American Railroads (AAR) Railway Electronics Standards Committee (RESC), supported by Transportation Technology Center, Inc. (TTCI) and members of several other AAR committees, has been working to develop a set of industry standards for an Interoperable Motes System (IMS). However, in addition to the technical challenges mentioned, there are additional challenges that exist in developing standards for a Motes system that can be implemented and used across the industry.

Motes do not fit easily into the established industry method of data sharing. Wayside detector data is typically collected by the detector owner and shared at the industry level. The transmission of data from detector to industry systems is well-defined. Motes, however, offer a particular challenge as the "detector" (i.e., the Motes) may not be owned by the operating railroad. An entirely new data transmission and sharing architecture must be developed to allow car owners and Motes suppliers to share Motes data with the industry.

The Motes Technical Advisory Group has defined a new architecture that allows Motes data to be shared and consumed at the industry level. This new architecture provides flexibility in Motes deployment, allowing car owners to choose the Motes technology that best fits their business needs while also ensuring industry interoperability. Additionally, this new architecture allows Motes suppliers to continue to innovate while providing component health information that can be shared across the industry.

While Motes are not a "new" technology or concept, they do represent a new approach to data collection and sharing at the industry level. The potential for continual health monitoring of rail vehicles offers car owners and carriers alike the opportunity to enhance safety, efficiency of operations, and prioritization of maintenance. To get there, the rail industry will need to continue to encourage innovation and integration of new technologies into the current system of standards.



Motes developers are working to provide reliable, low-power consumption and integrated communications with their products.

RICH DALTON
Virginia Railway Express

HIGH PROFILE: Rich Dalton, who has spent the past 11 years with the Virginia Railway Express (VRE) as Deputy CEO and Chief Operating Officer and as Acting CEO since November 2019, has been appointed CEO. The Northern Virginia Transportation Commission and Potomac and Rappahannock Transportation Commission, the two governing bodies that oversee VRE, named Dalton as CEO, affirming the VRE Operations Board's recommendation. Dalton, an experienced rail operations veteran, led VRE's multi-year effort to implement PTC. Prior to joining VRE, Dalton spent 19 years with locomotive manufacturer MPI (Wabtec subsidiary MotivePower lndustries). He is a military veteran, having served as a petty officer in the U.S. Navy. Dalton holds a bachelor's and master's degree in business administration from Sam Houston State University. "I am excited to lead VRE as we execute our strategic objectives for safety, complete customer satisfaction, prudent fiscal management, system growth and a healthy corporate culture," said Dalton. "VRE is comprised of a world-class staff, and we will continue to work closely with our valued stakeholders and other partners to provide a world-class service." A *Rail Group On Air* podcast interview with Rich Dalton sponsored by the Commuter Rail Coalition can accessed at https://www.railwayage.com/category/podcasts/.

Reading & Northern Railroad (RBMN) has named **Eric Peters** as Vice President Transportation and Safety. Reporting to Executive Vice President Operations Tyler Glass, Peters will succeed Thomas Cook, who retires later this year. Peters joins Reading & Northern from Norfolk Southern, which he joined as a Management Trainee after college. During his 14 years at NS, Peters rose through the ranks, and was ultimately named NS's Harrisburg Division Superintendent earlier this year. "RBMN's interchanges with NS all take place within the Harrisburg Division, giving Peters a good perspective of our operation and business," RBMN noted.

Dennis H. "Denny" Miller, Vice Chairman of **Railroad Development Corp. (RDC)** affiliate **Iowa Interstate Railroad (IAIS)**, retired Sept. 30, 2020, after a 47-year railroading career. Miller held various positions within IAIS, among them Vice President Customer Services, VP Operations, Executive VP-CEO, President, and most recently Vice Chairman. He also served on several committees with the American Short Line and Regional Railroad Association (ASLRRA) and was a 15-year board member with the Association of American Railroads (AAR). Miller started his career in 1973 with the Chicago, Rock Island and Pacific in Cedar Rapids, Iowa, as Wire Chief and Operator. In 1975, he joined the Peoria & Pekin Union Railroad (P&PU) in Peoria, Ill., as a Locomotive Engineer, followed by promotions to Trainmaster and Road Foreman of Engines. While at the P&PU, he taught Locomotive Engineer and Rules Training for the Illinois Central Gulf Railroad in Paducah, Ky. In 1984, when IAIS was formed, Miller joined as Director of Information Systems and developed a computer system that was used on the IAIS and numerous railroads. One system, which computerized the issuance of track warrants, replaced manual train sheets as a dispatching method. Marketed by IAIS subsidiary Rail Traffic Control, it was sold to numerous railroads in the U.S. as well as Latin America and Africa.

Janet Gonzalez Tudor is the new Transportation Operational Resiliency Director at **HDR.** She will support clients' long-term resiliency and organizational health. "There is plenty of need in the organizational resiliency space, with future pandemic proactive planning, weather-related infrastructure hardening, and in the sphere of social impact data-driven analysis and risk mitigation," Gonzalez Tudor said. "I know these are all challenges we can help our clients solve to protect community well-being in the short term and quality of life for many years to come." A 12-year HDR veteran, Gonzalez Tudor has expertise in transportation infrastructure program management and early project planning and design oversight.

OCTOBER 27-28, 2020
VIRTUAL RAILROAD ENVIRONMENTAL SEMINAR

Presented by the University of Illinois Urbana-Champaign, the 2020 Virtual Railroad Environmental Seminar (vRRES) is a virtual event featuring two half-days of technical presentations covering Compliance & Permitting; Ecological Protection & Conservation; Energy, Emissions & Air Quality; Environmental Data Collection & Applications; Environmental Management; Environmental Response; Remediation; Risk & Liability Management; Stormwater & Wastewater; and Sustainability, Climate Resilience & Engagement *https://rrec.railtec.illinois.edu/exhibitor-sponsor/*

DECEMBER 16, 2020
2020 BIG DATA IN RAILROAD MAINTENANCE PLANNING VIRTUAL CONFERENCE

Presented by the University of Delaware Newark Campus, the 2020 Big Data in Railroad Maintenance Planning Conference is intended to expand on previous years' conferences and introduce new and emerging analysis techniques, and to show how they can be applied to the large volume of inspection data collected by railways to improve their planning of the critical capital and maintenance programs. But due to the ongoing coronavirus issues, the 2020 Conference will be held virtually. This was not an easy decision, but the University of Delaware has cancelled all on-campus conferences and meetings in the interest of health and safety. The conference organizers and sponsors hope that you will join us in the virtual mode. Contact Dr. Allan Zarembski (dramz@udel.edu) for more information.

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AL, KY,
Jon Chalon
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Fax: (212) 633-1863
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Fax: (212) 633-1863
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Fax: (212) 633-1863
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Michael Boyle
International Area Sales Manager
Nils Michael Boyle
Dorfstrasse 70, 6393 St. Ulrich,
Austria.
+011436767089872
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ITALY, ITALIAN-SPEAKING SWITZERLAND
Dr. Fabio Potesta
Media Point & Communications SRL
Corte Lambruschini
Corso Buenos Aires 8
V Piano, Genoa, Italy 16129
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JAPAN
Katsuhiro Ishii
Ace Media Service, Inc.
12-6 4-Chome,
Nishiiko, Adachi-Ku
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Japan
+81-3-5691-3335
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RAILWAY AGE

Staggers Act Lessons Remain Relevant in 2020

This month marks the 40th anniversary of the passage of the 1980 Staggers Rail Act. It is an anniversary well worth emphasizing to the growing number of people who were not then in the industry and have little connection to that history. This landmark legislation literally saved the nation's railroads from near total collapse. By the mid-1970s, many Class I railroads were in or near bankruptcy. Deferred maintenance was growing exponentially, and the "standing derailment" phenomenon had come to symbolize the sad state of the industry.

In many respects, the Staggers Act is also the parent of the short line industry as we know it today. The economic freedoms and regulatory flexibility embodied in that Act allowed Class I railroads to sell light-density branch lines to local entrepreneurs rather than abandon them. The results were quite remarkable: Short lines have grown from 8,000 miles of track in 1980 to 50,000 miles today. They operate in 49 states, and in 30 states, they operate a quarter or more of the state's total freight rail network.

In saving the Class I industry, the Staggers Act preserved America's privately owned national railroad network. In creating the modern-day short line industry, the Act ensured that huge areas of rural and small town America would stay connected to that national network; that critical infrastructure would be preserved and improved; and that tens of thousands of employees would be gainfully employed in a robust segment of the industry.

Staggers jump-started today's short line industry, and I am proud to say that short line railroaders grabbed that opportunity and made the most of it. Together, they represent a diverse and dynamic collection of small businesses that have moved well beyond the traditional short lines of America's railroad lore. They are creative and agile companies that make wise use of the often-limited resources available to them. They employ a skilled, productive workforce and place considerable emphasis on training that workforce to be as safe as possible. They are aggressive marketers that fight as hard for single-carload business as they do for unit trains. They possess an entrepreneurial spirit that drives their success.

I can cite hundreds of examples of this entrepreneurial spirit, but here is one of my favorites. Watco Companies is a prominent short line railroad holding company headquartered in Kansas. In 1983, three years after the Staggers Act passed, Dick Webb, the father of the current Executive Chairman of Watco, was a unionized car repairman at the Kansas City Southern. Sensing the promising changes in the railroad landscape, he took out a $25,000 bank loan to begin a rail switching operation in DeRidder, La., which began Watco Companies. Today, Watco operates 5,139 miles of short line track, employs 4,459 people and moves more than 750,000 carloads annually across railroad track that was largely headed for abandonment. It is a great American success story made possible in no small measure by the Staggers Act.

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Hopefully, we will learn from history. A look back at Staggers provides us several important lessons that bear repeating in today's circumstances.

First, Staggers abruptly changed the way railroads did business. Marketing, pricing and service had to be reinvented and implemented quickly. It was very different from the public health crisis we face today, but like today it required a wholesale adoption of new practices, policies and customer relationships. Happily, short lines today have stepped up to this challenge during the COVID-19 pandemic. The result has been largely uninterrupted service for our customers, a disciplined approach to allocating reduced revenue, and a fierce commitment to protecting the health of our workforce. But to avoid the fate of many small businesses that will close their doors permanently in today's circumstances, we need to continue to adapt and perfect our responses to this crisis.

Second, Staggers is an example of government at its best. And here, at the risk of preaching, is a history lesson from which I hope our current elected officials can learn. The Staggers debate involved complicated economic and regulatory arguments and strong differences of opinion among experts and politicians alike. Some in the railroad industry itself opposed the legislation, and there was a fierce debate in Congress. Yet in the end, Democrats and Republicans produced a bipartisan bill that made fundamental changes to address a serious national problem. They worked hard at working it out. We need that today more than ever.

Third, Staggers Act advocates were successful in large measure because the situation on the ground was so dire. But that institutional memory fades every day. Today, there are only 10 members of Congress who were in office in 1980. It is incumbent on the railroad industry itself to keep the historical perspective alive, and always be educating our elected officials on the importance of policies that promote what has become the most successful private freight rail system in the world. It is a difficult and time-consuming task, but a necessary one to be sure.

CHUCK BAKER
President
ASLRRA

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