COAL TRAIN -- PART 1
A REPORTER AT LARGE

By John McPhee

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"C" was for coal train, "TS" for power in the Tennessee Valley, and "BT" for Black Thunder Mine. CTSBT was the proper name of the train, in the way that Broadway Limited, Burlington Zephyr, Super Chief, and Florida East Coast Tamiami Champion were once the names of other trains. Five Florida East Coast Tamiami Champions could not have filled a track beside CTSBT, which was seven thousand four hundred and eighty-five feet long, on this January morning in Marysville, Kansas, and was actually running shorter than most coal trains. There were a hundred and thirty-three aluminum gondolas (hoppers) and five diesel-electric locomotives -- three in the rear, two of them deadhead. Replacing another crew, Paul Fitzpatrick and Scott Davis climbed into the lead unit, after sending me up the ladder before them. We had slept at the Oak Tree Inn, a motel under contract with Union Pacific, in rooms that Paul Fitzpatrick described as "darker than the inside of a football." The rooms had been quiet, too, heavily armored against sound and light so that train crews could sleep during any part of a day. For us, the protection had not much mattered. The company's call from Omaha -- as always, ninety minutes before reporting time -- had come at 5:05 a.m.

Heading north and northwest, we were soon going up the grade to cross the divide between the Big Blue and Little Blue rivers. Overnight, heavy ground fog had frozen in the trees, had frozen on every weed, wire, and bush, so that -- two weeks after Christmas -- Kansas appeared to have been sprayed white for Christmas. From horizon to horizon, the raking light of the sun shot forth through the ice. Fields were confectionery with thin snow. Our eyes were fifteen feet above the tracks and more than that above the surrounding country. We got up to forty miles per hour ascending the grade.

The train could go that fast because it was so light. It was empty. The five locomotives and the mile-and-a-half length notwithstanding, the entire rig weighed less than three thousand tons. And now Scott Davis, the engineer, said, "I'm going to air 'em out, Paul."

And Paul Fitzpatrick, the conductor, looked through his track warrants to see what restrictions may have been set up ahead. Then he said, "O.K., buddy, blow the dust out of 'em." Not that there was much coal dust left in those empties as we topped out at sixty going down to the Little Blue.

Winds that a train stirs up are not in the conversation with winds that can stir up a train. "If you're pulling empties, a north wind can take you from fifty miles per hour to eighteen," Scott said. In places like Kansas, Nebraska, and Wyoming, stiff winds have stalled trains. To wreck a train, you don't need a tornado. In Utah, between Salt Lake City and Ogden, winds coming out of the Wasatch canyons and crossing the tracks of the Union Pacific have knocked down empty ballast trains, empty coal trains, and double-stacked-container "intermodal" trains -- events known collectively as "blowovers." In the Laramie Range, the Wyoming wind will shoot up a slope and lift a train from below.

"Tailwind, you get a little better speed, a side wind will slow you down," Scott said. From behind the cab windows of a diesel-electric locomotive, wind is difficult to assess. It can be blowing hard and you don't really see it, let alone feel it. "You're making fifty, then you're struggling to make forty-seven. You think, What's the reason? Wind? Or some problem with the train. Your curiosity is wondering why." Passing through towns, Scott looks for flags. He looks for wind socks at airports. But mainly he looks for the sweep of weeds in the ditches, for the legible motions in trees, and, if the weather is dry, for the speed of moving dust. We came to the

state line and left Kansas for Nebraska.

Paul said, “Your intelligence goes up ten points when you cross that line. Back there, you go barefoot, screw your cousin, and try to steal something.”

Paul and Scott are from North Platte, Nebraska, where Paul was born. Scott was born in Ogallala, fifty miles west. In the language of the railroad, their “turn” is North Platte to Marysville and back. They make the run at least ninety times a year -- now and again, but randomly, together. They know every siding, every crossing, every movable-point frog, every rising and descending grade. Train crews don’t just go off in all distances and directions, like the pilots of corporate jets. Train crews work locally on memorized track and terrain. To get a coal train from, say, northeast Wyoming to central Georgia, you would need at least eleven different crews. The central figure in such an odyssey is not an engineer, a conductor, a dispatcher, a trainmaster -- the multiple, replaceable, and redundant human beings -- but the coal train itself, which, power and payload, end to end, will be integral all the way from mine to destination, no matter who is in or around it, or whose tracks it is running on.

Paul’s thumbnail sketch of Kansans was in a category with his profile of ranchers in Wyoming, another of the six states that frame Nebraska. He described a public hearing at which a Wyoming official outlined a proposed program for the sterilization of coyotes. A rancher lifted his hand, and said, “We don’t want to fuck the coyotes, we want to get rid of them.”

We heard the screech of wheels slipping on the morning frost. The sand light came on in front of Scott. He depressed a plunger, releasing sand. We saw an eagle where Paul had seen a bobcat in summer. We ate smoked trout, the result of a fishing trip that Paul and Scott had made together. We ate an excellent piquant meat loaf that Scott had brought from home. And we ate reconstructed turkey breast in Subway sandwiches, sheepishly contributed by me. They mentioned approaching landmarks as we entered the blocks in which the landmarks would appear: an Indian burial mound, other humps that had covered ammunition during the Second World War, an immense cottonwood at Mile 188 (a redtail was sitting in it), Rosie’s Crossing (an unprotected farm crossing). “She raises hell if you block it.”

All through the morning, we met loaded coal trains -- on Track 2, coming the other way. Five in the first two hours. Seven miles of coal. In the loaded coal train CNAMR, we had come down the day before from North Platte to Marysville, two hundred and fifty miles. CNAMR was on its way from North Antelope Mine, in the Powder River Basin of Wyoming, to a power plant on the Meramec River, a Mississippi tributary close to St. Louis. In Union Pacific hieroglyphs, the destination always comes last. Our CTSBT would fill up at Black Thunder Mine and emerge as CBTTS.

In the cab of a coal train, imagine the difference if the coal is there behind you. Trains that carry automobiles, mixed-cargo “manifest” trains, and intermodal container trains can weigh as little as four thousand tons. CNAMR weighed nineteen thousand tons. When loaded coal trains lengthen out to a mile and three quarters, they can weigh as much as twenty-three thousand tons. Nothing heavier rolls on rails. Diesel power on its own could scarcely budge that kind of weight. The diesel engines inside locomotives are there to generate electrical power. Separate electric motors turn each of the six axles. To move the throttle to Notch 1 and start up such a thing is to wait for perceptible motion. Soon after Notch 2, the pressure of acceleration comes into your chair and begins to run up your back. Move the throttle to Notch 3, and you may feel that you are driving the North American Plate.

Paul said, “It’s a touch.”

Scott said, “You feel the train in the seat of your pants.”

After Notch 4, even your underwear can feel

the train attenuate. By Notch 5, you are beginning to develop an interest in whatever might be happening a couple of miles ahead. Notch 8 and you are flat out -- minding the loaded speed limit, fifty miles an hour -- and thinking ahead at least one county. Below Notch 1 are two neutral stages -- called Set Up and Idle -- and below them are the eight notches of the dynamic brakes. Across the dynamics, you can feel the coal pressing on your back, feel the train condense. There could be an off-the-wall analogy to a twenty-speed bicycle but it does not immediately come to mind. Beside the track from time to time, you see a small post with a black X on it -- seemingly no larger than a playing card. It signifies your proximity to a grade crossing -- any kind of grade crossing. A farm crossing with no signs. A signed crossing from the era of Stop Look & Listen. A crossing armed with blinking lights. A crossing armed with blinking lights and automatic gates. A whistle-guard crossing that plays a recording that sounds like a train. In the two hundred and fifty miles of the North Platte-Marysville turn, there are a hundred and forty-one X's beside the track, a hundred and forty-one grade crossings. If you are driving a train past them, at each X you depress on the console before you a metal mushroom that would not be out of place in a pinball machine. As it sinks into the console under the butt of your hand, the locomotive produces its classic sound. Or, as the clarinetist Skip Livingston e-mailed the tubist Tom Spain, "I've been listening carefully. The trains differ -- different locomotives have different pitches to their horns. But I did hear one while I was moving snow on Sunday morning, and I was able to get to the piano before I lost the notes. They were A sharp, E, and F sharp below middle C, which made it sound like an F-sharp-7 chord (minus the C sharp). The instruments that would come closest to the sound would probably be trombones."

Passing an X, you first play one long chord on the mushroom. Then you repeat it. Then you tap a short toot. Then, if you are virtuoso, you play a final long chord that begins to fade exactly when you nose over the crossing. With so much to do, your hands are almost always touching something on the console. But if you let fifteen seconds go by while you do nothing at all, the alerter will let out a full-scale pentatonic scream. The alerter is the modern version of the "dead man's pedal." The old engineers had to keep down that pedal or their trains would screech to a halt. Now the alerter screeches, and goes on screeching like a smoke detector, until you come to and force it to shut up. The alerter has its own mushroom.

Paul sat on the left -- conducting. He had his own speedometer, his own mushroom for the horn. He had his thick sheaf of papers full of orders and warrants. He wore a beige baseball cap with red lettering that said "Cornhuskers." Lanky and limber, spectacled and scholarly, he was fifty-seven, and under the cap he hadn't much hair. Scott, far right, looked down into computer screens and up at cab signals, which reproduce inside the locomotive the signals outside, along the track, and are more than helpful in mist and fog. He was fifty-four -- and, as it happened, five feet four -- and under his red University of Nebraska ball cap was a receding brush cut. Their two seats were like upholstered thrones, as was a third, between and behind them. They had refrigeration, bottled water, and -- a few steps forward and down toward the front door -- a hand-cranked toilet of the type that is found on private vessels. No toilet paper in the toilet. No sink. No mirror. This was not the yacht Britannia. Toilet paper is in individual crew kits supplied at terminals by the company.

The space that contained us was as warm as an office. For Scott and Paul, it hadn't always been so. In older locomotives on days like these -- fifteen degrees below freezing -- Paul had soaked paper towels in water and lined the door jamb with them so they would stiffen up and prevent the gelid atmosphere from taking over the cab. Paul and Scott had had much to do with the conditions of the

workplace, and the pay, the hours, the rotations of the pool. In this district, Paul was the chairman of the United Transportation Union and, until recently, Scott had been the chairman of the Brotherhood of Locomotive Engineers and Trainmen. Crews are paid by the trip. After you finish a trip and "tie up" on a computer, your place in the rotation starts at the bottom and rises through the pool, the collective term for turns in the district. The smaller the pool, the readier the work, clearly -- but perhaps so ready that you are not adequately rested before your next company call. So there is paradox in the pool, augmenting the heavy tensions between labor and management that date from the nineteenth century. Scott's brotherhood of engineers is the oldest union in the country. "Management's strategy is divide and conquer," Paul remarked, and changed the subject to plan their next fishing trip. Scott has a twenty-foot Crestliner 202 Tournament, with two live wells, a 175-horse Evinrude, a 15-horse Evinrude kicker, and an electric motor as well. In Kansas City two years back, Paul bought Scott a T-shirt that said "Union fish strike more."

Scott took a dip of Levi Garrett. Paul said, "I've only got one bad habit, and that's working on the U.P."

Paul's grandfathers were engineers. One went west from North Platte. The other went east from North Platte. Paul's father was a conductor. After two years in college, Paul "hired out on the railroad," but was soon drafted and sent to Vietnam. Later, he was a switchman, then a yardmaster, and then "came out on the road as a brakeman," and was promoted to conductor in 1976. Scott Davis's great-grandfather was a fireman who "got hurt and became a physician." Scott's father was a building contractor who moved where work required. As a result, Scott went to three high schools -- in Ogallala, Stapleton, and Hyannis.

Paul: "He was voted the most popular sophomore three years in a row."

Scott joined the Union Pacific when he was twenty-three. He dug ditches on a signal gang, climbed poles, and "became a fireman just when the coal thing was starting." As an engineer, he took his first train by himself to Scottsbluff, on Thanksgiving, 1976. He "waited all day for B.N.S.F. to bring coal." For Thanksgiving dinner, he ate day-old rolls.

The coal thing would change their lives -- their workplace, their leisure time, their relative prosperity. From mines near the center of America, the coal thing would revolutionize American railroads, slow the spread of creeping desuetude, reverse -- to a large extent -- their antiquation. Before the end of the twentieth century, it would all but jam solid the busiest trackage. It was the direct economic result of the Clean Air Act of 1970. The immense coal reserves of northeastern Wyoming had been no secret to anybody, of course, least of all to geologists. While a good coal seam in Pennsylvania might be seven feet thick, drill cores and seismology had long shown coal beds a hundred feet thick in the Fort Union formation of Wyoming. There was a small mine from the era of steam locomotives, but on a larger scale no one was interested in this vast domain of coal, because there was comparatively little heat in it. In British thermal units, it was thirty per cent poorer than Appalachian bituminous coal. So the open range above the Powder River coal was not further opened. Ranchland ran to the horizon in an absence of artificial light. That part of Wyoming -- in its vegetation, wildlife, and vacant beauty -- had been well characterized in 1960 by the establishment there of a national grassland.

Beyond the detriments of Powder River Basin coal was the signal fact that it was as much as five times lower in sulfur than Appalachian coal. With the Clean Air Act, power plants were required to scrub sulfur out or burn low-sulfur coal. The five hundred power plants that use coal to light, heat, cool, and compute fifty-two per cent of just about everything in the United States were suddenly swiveling their attention to Powder River

coal. A combination of companies built the Orin Line -- the longest new rail line in the United States since the nineteen-thirties. At various sites along the Orin Line, large machines removed a hundred feet of overburden to begin an invasion of the planet unprecedented in scale. Belle Ayr, Black Thunder, North Antelope, Jacobs Ranch -- in fewer than twenty years, mines of the Powder River Basin were the largest coal mines in the history of the world.

Coal trains go into the Powder River Basin like tent caterpillars up a tree. The Orin Line is not much more than a hundred miles long, but sixty-five loaded coal trains -- collectively, a hundred miles of rolling coal -- come down it on an average day. Sixty-five empties go into the mines, and sixty-five loads emerge. They go to Texas, Arkansas, Louisiana, Mississippi, Alabama, and Georgia; they go to Michigan, Wisconsin, Minnesota, and everywhere between. They are unit trains -- each a so-called "set," each on its way (with few exceptions) to one specific power plant.

CTSBT, having come up through Alexandria, Belvidere, Carleton, Davenport, Edgar, Fairfield, Glenvil, and Hastings -- alphabetical Nebraskan railroad towns -- was now descending among the farms of Hayland Hill, nearing the Platte River. Paul said, "In Nebraska, they bury a farmer only three feet under."

I said, "O.K., why?"

With an air of stating the obvious, Paul said, "So he can still get a hand out."

Scott said, "A wealthy farmer has two mailboxes."

Beyond the broad and braided Platte was Gibbon Junction, where the two-track line from Marysville met the U.P.'s Triple-Track Main. Like the on-ramp of a freeway, the lesser tracks went through a long curve to make an acute angle with the main. Reading signals, Scott had gone down from notch to notch through the dynamics, and was now drifting, as he put it -- creeping slowly around the curve until his nose was in the angle, where he stopped. Parked there was a Dodge Grand Caravan -- Texas S53ZNT -- with a man in it who was taking pictures. The Triple-Track Main -- Gibbon Junction through North Platte to O'Fallons, Nebraska -- is the most heavily used freight line in the world. Gibbon Junction joins southern traffic to central traffic running east and west. Since the blending of tracks there occurs in fewer than six acres, it is the sort of place where espionage leading to sabotage could be particularly effective. This apparently trespassing man, on a bitter-cold January morning, had left a grade crossing, driven on ballast beside the tracks, and squeezed his Grand Caravan into the narrowest part of the junction V, where his lens was on us. While we sat and waited for an eastbound coal train to go by on its way to Council Bluffs, the van backed across the double tracks and into virgin snow, where the camera returned to action.

Since the eleventh of September, 2001, scenes like that have made certain people extremely nervous, but not Paul or Scott. "These train buffs, they'll do anything," Paul said. "I've had them driving down the highway taking pictures of the train." Throwbacks to the nineteenth century, train watchers, known in England as train spotters, are people who go on planned outings to look at trains. They are sometimes described as a dying breed, but the Reaper evidently is not impatient. In the United States currently, there are well over a hundred thousand train watchers, a national subculture whose antique passion is accompanied by a knowledge of railroading that often has greater breadth and depth than the sophistication of most people who work for railroads. Where tracks are, they are; but they tend to cluster. At Tower 55, in Fort Worth, where the Union Pacific crosses the Burlington Northern Santa Fe, a guy was seen making notes. In no time, the F.B.I. showed up and confiscated his notebook. Never mind

that he was only a train watcher taking time off from his job as a police dispatcher.

A Wyoming-coal train is not a common sight in New England. Run one into New Hampshire for a test burn at Bow, on the Merrimack River, and word of its coming will quickly spread. Think of it. Three B.N.S.F. diesel-electrics in distributed power coming through the mending wall. A mile and a half of Powder River coal. Train watchers will meet it in western New York and follow it all the way in like bait fish escorting a whale. My cousin John, in Northern California, is a train watcher. He says he's "going training" and he disappears. When he gets out there, he knows what he is looking at.

Some years ago, I was at a kitchen party in the home of Willy Bemis, in Amherst, Massachusetts. The room was full of biologists, full of shoptalk, beer, wine, the shouts of children, the contributions of a barking dog. Willy is a world-renowned anatomist of living and fossil fishes, and these were his graduate students and colleagues at the University of Massachusetts, chatting fish, while off in a corner where a source of incidental music might have been was a TV monitor with a video in it showing nothing but slowly moving trains -- whole trains, coal trains, intermodal, manifest, autorack American trains. When seven thousand feet of train had lumbered across the screen, the screen was entered by another train. I thought I was looking at a screen saver, but it was a quantum less lively. If Andy Warhol had rotated the Empire State Building ninety degrees, he could have approached the mesmerism of those endless trains. Willy, who has since taken up a distinguished professorship at Cornell, knows almost as much about trains as he does about fish.

The Andy Warhol of those trains in Willy's kitchen was Dick Eisfeller, of Greenland, New Hampshire, a train watcher who long ago turned pro and has made nearly two hundred videos, many of them longer than Hollywood feature films. Beside selected tracks, he films, without sleep, every train that moves past him for twenty-four consecutive hours. Completing his editing at home, he dims the rumbling sound track from time to time and tells you in a soft monotone what is going by, what its destination is, and how it relates to the national plexus of rail freight. He is not without competition, but while others show two locomotives, four boxcars, and six giddy gorges, Eisfeller is uninterested in scenery, and he alone consistently shows whole trains on one stretch of track across twenty-four hours and comments on every train. "Others sell thousands, I sell hundreds" is the way in which he summarizes his market niche. Willy Bemis says that among the train videomakers Dick Eisfeller is "probably the most knowledgeable, the most interested in railroad operations. He has an almost scientific approach, a mission to document things. He's interested in the business of the railroad. He knows where a train is coming from and where it is going, and whether it is daily or weekly, and whether it is on time. He knows what is in the cars. He knows the context of other trains on the same tracks."

In me, there was nothing of the train watcher, train spotter, train buff, or rail fan until there came a day when Willy Bemis (about to move, and cleaning out his house) sent me his collection of Eisfeller films. In twenty-one hours of stupefied absorption, I watched whole trains in the "Kansas funnel," whole trains on the Orin Line, whole trains in Nebraska on the Triple-Track Main. A very large percentage were coal trains, half a light-year of coal trains, bright aluminum coal trains, the coal convex in each car, like rounded tablespoons of black sugar. The title of one of Eisfeller's films was "24 Hours at Gibbon Junction."

Eisfeller is a chemist with patents on coatings that make your car look metallic where it is actually plastic. "The key ingredient is indium. If you evaporate it in a vacuum on a plastic surface, it forms little islands, so if you coat it with clear plastic it doesn't corrode." He worked for Textron until 1994, when he was downsized for being, in his

word, outspoken. He had sold his first video a year earlier, and decided to go into the field full time. He had been a rail fan since childhood. In Chadwick, Illinois, Burlington Zephyrs went through his grandparents' farm. In his twenties, he "started chasing trains" and "collecting paper" -- timetables, schedules, dispatcher sheets, consists. (Accented on the first syllable, "consists" is a railroad term for what a train is carrying.) Eisfeller goes into railroad yards, opens Dumpsters, and rummages through them for consists. He knows people in railroad companies who give him lineups -- lists of trains expected at a given point within a specified number of hours. In his laptop, he has a topographic atlas. He has grade profiles. He has a scanner, on which he listens to engineers and conductors talking to dispatchers. He generally knows when he has time to move from one site to another. When he is beside a track and a train is coming, he often knows what train it is.

When he happened to be filming in Pennsylvania not long ago, I went out near Hershey to watch. Across twenty-four hours, he set up his tripod at ten places in seven communities, mainly in Myerstown, where, with a lumberyard's permission, he spent the night. He had awakened at 4 A.M. to drive down from New Hampshire, and now, in a typical working moment long after dark, Norfolk Southern No. 500 was approaching eastbound with "a hundred and fifteen tons of coal." A hundred yards east of Eisfeller, a horse-drawn Amish buggy clattered across the tracks on Railroad Street just before the gates went down. Like a fisherman starting his outboard motor, Eisfeller yanked a cord, turning on his generator. Suddenly, three thousand watts of halogen light sent a ball of day across the tracks. Eisfeller ran to his digital camcorder with dual mikes and nineteen-power zoom.

Consider the engineer, approaching this unexpected nova. Already, he was pushing on his horn, the grade crossing fewer than twenty seconds away. And now his locomotive was about to go up in a cloud of halogen light. Eisfeller shined a flashlight on the camcorder by way of explanation. "Let's face it," he said. "I'm doing a weird thing out here."

He never acquaints railroads with his plans or asks them for permission to do what he does, preferring not to defy their denials. He sometimes calls on local police and lets them know what he is up to. He shoots from public parking lots and state and municipal parks, as well as from private land. Engineers now and again report him to their dispatchers. On western trips, he has been confronted four times by dicks of Union Pacific.

The air was shivering cold, but he was wearing a cotton shirt and an open windbreaker, with no apparent interest in its function. Bald, bluejeaned, wearing white running shoes, he had a round face, an amiable mustache, a significant corporation. He drives everywhere, even to Wyoming. With his theatrical lights, his camcorder, and that hundred-and-thirty-pound generator, he is not rich in alternatives. His 1999 Windstar had a hundred and sixty thousand miles on it, a malfunctioning heater, and failed interior lighting. Camcording, he has stayed awake as long as three days and two nights. On interstates between filmings, he goes into rest stops and sleeps in the Windstar sitting up. "I'd be a good case study in sleep deprivation," he told me. "I've had people knock on my car thinking I'm dead. One of the times when I was most dead was on the U.P. Triple-Track. I try not to push myself."

Gibbon was another kind of junction for me. Arriving there, CTSBT crossed the Platte River just about where -- years earlier -- I had collected a bagful of stream-rounded pebbles whose bedrock sources turned out to be in the Rocky Mountains, as much as five hundred miles from Gibbon. The pebbles set me off on a project in forensic geology, which led to Ronald Rawalt, a mineralogist and paleontologist who is also a special agent with the F.B.I. He met with me in Omaha and described some of the cases in which his

geological sense of what came from where had led him to the solution of heinous crimes, including the murder of a policeman in Pennsylvania and the murder of a D.E.A. agent in Mexico. Rawalt's home was, as it still is, in North Platte -- the ne-plus-ultra railroad town, site of the largest railroad yard in the world -- and Rawalt, unsurprisingly, knows almost as much about trains as he does about rocks. Now, long after I collected the pebbles, my base in Nebraska was in Rawalt's home. had tried for some time to find a way to travel in coal trains, but the quest had not gone well. After what seemed like fifty-five dozen unreturned messages, I made the breakthrough discovery that Burlington Northern Santa Fe and Union Pacific were not in competition with New Jersey Transit. I thought of Ron Rawalt, in North Platte, and sent him a note about the situation, saying, in effect, that I was in a kind of maze, walking back and forth, and getting no help from the hedge leaves. A few days later, Rawalt and I were in downtown North Platte having breakfast with Scott Davis, Paul Fitzpatrick, and John Hasenauer, the local secretary-treasurer of the United Transportation Union.

Rawalt's F.B.I. work rarely involves rail traffic, but instances have come up when he has had to stop trains. Near Scottsbluff once, he came upon a tractor-trailer stalled on a grade crossing with two coal trains approaching from opposite directions. The truck driver was desperately trying to pry open a signal box. Rawalt called Union Pacific's Harriman Dispatching Center, in Omaha, and Harriman stopped both trains. If this had occurred where cell phones were nonfunctional, Rawalt might have effected certain connections on his own that would "red-board the whole system," shutting down the Union Pacific for tens if not hundreds of miles. But a simpler way to stop a train, he said, is "to strap a torpedo to the ball of a rail." A torpedo is an explosive briquette.

Acting on a tipoff one morning, he drove down Route 30, the highway beside the Triple-Track Main, looking over a manifest train for signs of a "top-ten fugitive" who was a serial murderer known to ride freights. The engine number was the one he had been given. He saw a figure in a boxcar. He called the Harriman Dispatching Center and was advised that if he wanted the train to pull up right beside him the train would heed "emergency vehicle instructions." To wit: "Place a fireball on top of the car and stick your thumb down outside the window." A fireball is a red dome light. Rawalt had one and he turned it on. He stuck his hand out the window, thumb down. The train sounded suddenly like an orchestra warming up. Rawalt took the fugitive off the train. "He was armed with a knife, not a gun. He was not the fugitive murderer. But we ran him, and he was wanted out of Texas. There was a felony warrant for his arrest."

Felons are few among the transients on rolling trains, who travel from freight yard to freight yard, lily pad to lily pad. "They get off as the train slows down. Then they move to the other end of the yard. These guys carry schedules. There are more of them than there were in the nineteen-thirties."

Because of transients, freight cars that carry automobiles have become even more shuttered than freight cars that carry cattle and hogs. Railroads transfer two-thirds of new automobiles, and today's autorack cars appear to be made of steel venetian blinds. Somehow hoboes squeeze into them nonetheless. They like to ride the trains inside the automobiles. Each one has a couple of gallons of gas in it, because automobiles are driven on and off trains under their own power. Transients, settling in for a trip, turn on the automobiles' air-conditioners in summer, heaters in winter. When an automobile runs out of gas, the transient moves to another. If the railroad responds by removing the keys and shipping them in tamper-proof bundles, the hoboes respond by defecating and urinating in the automobiles, breaking windshields, and knifing upholstery. In winter, hoboes seeking warmth on coal trains bury themselves in coal.

Railroad police are “commissioned,” and they have arrest powers. When they are not busting autorack squatters, they are sometimes in pursuit of the people they describe as graffiti vandals, and whom others regard as Renaissance artists. The billowing cumulus of graffiti color reaches only partway up the sides of boxcars, hoppers, and gondolas, because that is as far as the artists effectively can reach. They are careful to mask out or otherwise avoid the reporting marks on the sides of freight cars (letters and numbers of identification), because they know that the reporting marks will quickly be restencilled if graffiti paint obscures them, and the art will not survive. They are proud of what they do. They stand admiring it as they are arrested. While I was in a rail-yard office one day, a company bulletin scrolled across a screen announcing that railroad police in Sacramento had at last arrested a graffiti vandal named Crooks.

On CNAMR and CTSBT, when we went through speed-restricted zones -- bumping and rocking if there were problems in the track -- we came eventually to a green metal flag. It marked the end of the zone but not of the speed restriction. The engineer had reached the green flag but his last car had a mile and a half to go. Scott set a counter at seventy-five hundred, to count down in feet. When it reached zero, it went off like a microwave. The counter was once a human being riding in a caboose. The human being had a walkie-talkie, and he would say to the engineer, “We’ve got the green flag!” Those were his last words. While graffiti bloom and hoboes persevere, the caboose has been replaced on the end of the train by a small red box full of wires and chips. orking cabooses do exist. If you set up a tent at Gibbon Junction and spend the summer, you might see one. Typically, they had a conductor, an assistant conductor, and several brakemen in them -- the conductors handling paper waybills, the brakemen now and again walking beside the train to look for hot bearings or equipment that was dragging. The older cabooses were made of wood and had coal-burning stoves, which were wonderfully warm. Advanced technology came in the form of oil stoves, which were not wonderfully warm, and crews threw baggies full of diesel fuel into the burning oil, hastening the demise of the caboose. A pair of trains would give each other “roll bys” -- crewmen in each caboose inspecting the other train. If a train had a problem, it stopped. Crewmen walked forward and fixed the problem. The engineer then pulled the caboose up to the crewmen. Now, in addition to Scott, the entire crew is Paul. If there is trouble, Paul walks back to it, and then back from it, as much as three miles, maybe in deep snow, while Scott waits, while stockholders wait, while Alan Greenspan waits, and Sisyphus is working on the railroad. Yet the electronic detectors that have replaced the crews in the cabooses see, hear, and feel more than the crews could. Ten, fifteen miles apart, the detectors are everywhere along the tracks. They enter the cabs of locomotives as cavernous virtual voices reporting what they find, reporting what they do not find, and offering reassurance. They look and listen for dragging equipment, out-of-round wheels, hot journal bearings, excessively high or shifting loads. The presence of flat spots will show up quickly on the wheel-impact load detector. An electronic-evaluation car with lasers and ultrasonics can inspect the track itself at fifty miles per hour. Collectively, railroads promote these features as “health monitoring.”

William C. Vantuono, the editor of Railway Age, says that a unit train, such as a coal train, with no local switching work, could run without a conductor. So long, Paul. Scott becomes a crew of one, and even one-man crews may soon be a fading custom. In some rail yards, you find working locomotives with no one in them. Ron Rawalt casually predicts that “trains will before long be going coast to coast under remote control with no crewmen at all on board.” Needless to say, these foreshadowings have not gone unnoticed by

the United Transportation Union and the Brotherhood of Locomotive Engineers. Just step into a yard office among the gathered engineers and conductors and you will soon hear something like this: “Kids barely know how to throw a switch and pull a pin and make a train up, and they’re running these R.C.L.s. We lost fifty engineers’ jobs when they went to remote control. A guy with two years’ experience is running remote control, replacing an engineer with twenty years’ experience.” Scott Davis, reviewing the subject, did not show much alarm. He said, “The railroad wants to go on one-man-only. They’re not going to get that.”

Meanwhile, the multiplication of coal trains and the accompanying rise of the intermodal stack train have brought congestion to the rail network and slowed down traffic in ways that robots might to some extent relieve. By federal law, train crews work a maximum of twelve hours. If their time runs out, they are “dead on the law,” and they must absolutely stop the train and get off, the difference notwithstanding if they are out in the middle of the Great Salt Lake Desert or two miles from home. While more and more trains compete for track space, the crews’ hours are a constant in equations full of variables. When time runs out and the result is a “dead train,” trains behind it are affected, and trains behind them, until -- as Dick Eisfeller once found -- ”U.P. eastbounds trying to get into Chicago are backed up halfway across Iowa.” He once referred to Burlington Northern Santa Fe as “the land of the standing coal train,” and, employing a phrase of wide use in the industry, said of Union Pacific, “U.P. stands for Unlimited Parking. Parked trains are almost anywhere, waiting for new crews. The situation can go on for days or weeks.” When train crews die, they are usually near a highway, and vans go out to get them. In Nebraska, they are picked up by armadillos. Armadillo Express is the name of an independent service company that has achieved prosperity picking crews off stranded trains. Nationwide, there are a dozen such companies. Not infrequently, they carry fresh crews as little as a mile from railroad yards to bring in dead trains. Those fresh crews are called dogcatchers.

The most hyperactive dogcatchers are in North Platte, because North Platte’s Bailey Yard, at nearly three thousand acres, is not only the largest railroad yard in the world but also among the most crowded. Trains waiting for admission to Bailey die where they wait. When Paul and Scott pulled CTSBT into North Platte to tie up from their turn, eighteen miles of coal trains (twelve units) were already inside the yard, and half a dozen eastbounds were lined up waiting to come in. Crewless locomotives were rearranging autorack trains and varied blocks of manifest trains. The wye was busy, and the balloon track -- places where cars and locomotives are turned around. Two tank cars, poised on top of the East Hump, in silhouette looked like carpenter ants. Coyotes live in Bailey Yard. Wild geese overwinter at its water-table lakes. When you get down from your train, a van picks you up and drives you, say, two miles to the yard office, where your own car is waiting, sometimes covered with snow. Annually, about three hundred million gross tons of freight pass through Bailey Yard, where public grade crossings were eliminated years ago. Five streets of North Platte are on elevated causeways over the yard. Train watchers from many parts of the world make pilgrimages to the elevated causeways. If their skin is dark, they were obviously sent by Osama bin Laden. Informants call the F.B.I.

The main purpose of the yard is to classify freight cars in the way that UPS and FedEx sort packages in Louisville and Memphis. The robot locomotives shove manifest trains up small parabolic hills -- the East Hump, the West Hump -- where single cars or small groups of cars are set free at the summits to roll downhill into groupings of parallel tracks which are called bowls but in plan view resemble the strings of harps. The West Bowl has fifty tracks, the East Bowl sixty-four. Each gravity-powered “cut” of cars rolls into the

bowl below and stops on a track where other cars with a similar destination are assembling as a new train. This may not represent a frontier of technology, but it is a distinct advance over “flat switching,” the traditional technique of pulling the pin from a coupling, then shoving the whole train until it reaches a certain speed, then slamming on the brakes so that whatever has been uncoupled leaps free, rolls on overland, and is switched onto a designated track.

The yardmasters of Bailey work in glassy polygonal structures that look like airport control towers. Scott Davis took me into the West Hump Tower, where his yardmaster brother, Marty, was nearing the end of a shift. On the top deck, Marty sat alone in a very spacious room with a panoptic view, while two others worked in a similar space one flight down. Outside on the hump, a pinner was pulling pins and simultaneously operating, from an electronic device slung on his chest, the robot locomotive that was pushing trains up the hump. Inside the tower, one of the men on the lower floor sat before a computer screen and talked to the pinner through outdoor loudspeakers. On his screen, he could read the destinies of the cars on the hump, and he was telling the pinner where to pull pins to make cuts. As cars rolled off downhill, the computer was throwing switches all over the West Bowl, but if the computer were to overlook something it could be upstaged manually by the other man on the lower floor, who sat before a desklike surface covered with levers that operate switches. Marty Davis, yardmaster, alone on the floor above, seemed watchful, like a coach observing the calls of his offensive and defensive coordinators. At the shift change, Marty was replaced by Gib Larsen, who closely resembled King Lear. His hair was a sort of robe -- a floor-length white robe. As we left the tower, Scott said, “He’s into mountain-man stuff. He has buckskin pants, buckskin shirts. He goes to Rendezvous days in Ogallala, where he throws axes.”

In the crew room in the yard office, computers were lined up as if it were a public library. Arriving for work, engineers and conductors log in for orders there; and after their turns they tie up on the computers before they go home. When Paul and Scott had picked up their printouts for CNAMR, the crew room was jammed with dogcatchers. Trains were dying left and right, in part as a result of the freezing weather. Mary Hanna and Carol Townsend were not there. They and two hundred and fifty men were the District 2 engineers. The district’s conductors were all men. There were not a few speckled beards, and mustaches large enough to resemble the lower halves of crossing signs. Most of the crewmen were clean-shaven guys in ball caps. Everyone wore hard-toed six-inch boots. While the crew room was actually a management-driven processing pen, it had the hubbub of a union hall.

As Scott’s and Paul’s time ticked, we waited three hours before we were driven to CNAMR, which was parked in a fuelling pit. What an ambitious word -- ”pit” -- for a place to put something seventy-five hundred feet long. There were loaded coal trains on either side of CNAMR. We climbed into the lead locomotive, and waited for the completion of air tests, fuelling, mechanical inspection. A hundred yards ahead were a blue flag and a device on the track that would derail the train if it were to move forward while the flag was present and authorization was not.

Finally, a radioed voice came into the cab: “Five-eight-six-four east to the east run. Through yardmaster. Over.”

Scott said, “Five-eight-six-four east out.”

He also said, “We got a lunar, Paul,” referring to a signal that at last had something positive to suggest. The releasing of the air brakes began at the two ends, and moved toward the middle. The train’s very long integral air tube was like the air sac of a rope fish. At 12:54 P.M., we were actually moving -- five miles per hour -- and Scott set the counter, saying, “So I’ll know I’m off that pit and can get up to yard speed.” He was up to twelve when a

yellow light put him down. He set the dynamic brakes. Bumpily, the hoppers compressed. We stopped.

An hour later, we had not moved an additional inch. Beside us was a Z train -- an intermodal meant for fast travel, but its status for the moment was no higher than it would have been had its name begun with C. Eventually, the towering double-stacked boxes stirred, and Paul said, “This shooter’s starting to pull.” In time, we followed the shooter, slowly, through the east end of the yard. Over a fence to our left was Central Nebraska Packing, where horses, until recently, were prepared for human consumption, and are now processed for zoos. Over a fence on our right, some healthy-looking palominos were grazing through snow, enchanted surely that a coal train lay between them and the house across the way. So far, it had not done us a lot of good to be drawn by thirteen thousand horses. An hour and a half after we began to move out of the fuel pit, we were still in Bailey Yard. But now we got a flashing green. We swung right over a movable-point frog and onto the Triple-Track Main. Scott said, “14:20. We’re out!”

(This is the first part of a two-part article.)

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COAL TRAIN -- PART 2
A REPORTER AT LARGE

By John McPhee

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(An armadillo is a van sent out on highways to replace train crews whose regulated hours of service have run out. Dick Eisfeller makes and sells Warholian movies of freight trains. Scott Davis is an engineer, Paul Fitzpatrick a conductor. Their routine “turn” is between North Platte, Nebraska, and Marysville, Kansas, on the Union Pacific Railroad. A manifest train has varied types of cars and cargoes. An intermodal train carries containers, often double-stacked. “Consist” is a railroad term for what a train is carrying. Bailey Yard, in North Platte, is the largest railroad yard in the world. On a January morning, Davis and Fitzpatrick are about to leave Bailey Yard in CNAMR, a nineteen-thousand-ton coal train, on its way east from the Powder River Basin of Wyoming, locus of the largest coal mines on earth.)

Over the hundred and eight miles between Bailey Yard and Gibbon Junction, Nebraska, more than two hundred miles of freight trains are in motion every day. While the advent of the Powder River coal trains has doubled the volume, it has more or less quadrupled the viscosity. The hot intermodals, the high-priority perishable services -- the shooters -- are not what they used to be. Commonly, they average eighteen miles an hour on the Triple-Track Main.

We met coal trains, Q trains (“westbound hot shots”), coal trains, autotrains, rock trains, grain trains, coal trains, Z trains, manifest trains. A sixty-sixhundred-foot stack train coming almost straight at you seems like a city about to collapse. At least a third of the trains were empty, not only the westbound coal trains returning to the Powder River Basin but autotrains, rock trains, grain trains, and ballast trains -- all going back to somewhere for more. We went by twenty miles of motionless trains, waiting to get into North Platte, queued up on a plain so open and vast that we went over farm grade crossings that had no lights or gates, just the big wooden X of Stop Look & Listen. We passed lone grain elevators that resembled the United Nations building and were so large that they had their own switch engines.

From North Platte to Gibbon Junction, we descended seven hundred and forty feet, an average grade of .113 per cent -- a slope much too subtle to be seen by the human eye. The descent continued at the same average rate all the way to Marysville, which is fifteen hundred and ninety-nine feet lower than North Platte. The significant grades

along the way -- Hayland Hill, Hastings Hill, the divide between the Big Blue and Little Blue -- reminded me of fish in a river. I couldn't see them. Scott could. I would not have known they were there had Scott not made remarks from time to time about "coming up into these hills" or "pulling a pretty good grade." I could feel grades, surely -- feel the uphill deceleration of nineteen thousand tons, feel the release when they were over a summit and rolling free -- but even on the named hills the track looked, to me, essentially level. If you ride a bicycle, you know when you are going uphill, even where the gradient is so slight that your eye doesn't pick it up. In a nineteen-thousand-ton train, your physical perception of grade is much the same as it would be if you were on a twenty-pound bicycle -- especially if your name is Scott Davis.

Run a coal train out of the Powder River Basin and down to Kansas and Arkansas and across the South into Georgia. The steepest grade you encounter is 1.5 per cent, on track that to the eye seems close to level. You can discern that it is going up or down, but it will not remind you of Crested Butte. It will seem less steep than the East Pacific Rise. Yet a loaded coal train running wide open in Notch 8 can attack a 1.5-per-cent grade and soon be beaten down under ten miles an hour. The steepest mainline railroad grade in the United States is Saluda Hill, coming off the Blue Ridge of North Carolina at five per cent -- a thousand vertical feet in four miles. It is not presently used. To get up it, trains were cut into thirds. To get down it, Dick Eisfeller says, "they were extremely careful, put it that way." The base of the hill is called Slaughter Pen Cut. In the Hudson Highlands, of New York, the Mt. Beacon Incline Railway, also out of service now, went up a grade of sixty-five per cent, lifting passengers fifteen hundred feet to views of the Hudson River. I rode up the Mt. Beacon Incline Railway once and was able to discern the angle. In a litany of comparative grades, Mt. Beacon doesn't really count. The locomotive was made by the Otis Elevator Company. The steepest surviving mainline grade is near four per cent -- at Raton Pass, in the Sangre de Cristo Mountains, between Colorado and New Mexico. Glorieta Pass, near Santa Fe, is 3.0. In California, the steepest grades in the Sierra Nevada reach 2.4 -- a grade that can be expressed as a one-mile ramp to the roof of a twelve-story building, nothing more. In the so-called Punch Bowl below Cajon Pass, in the San Bernardino Mountains -- entrance to the Los Angeles Basin and once the route of the Super Chief -- there are three tracks, with grades, respectively, of 2.2, 2.2, and 3.0. The routes of the heavy coal trains rarely include grades much over one per cent. The roadbeds may look flat, but the difference in steepness between 1.2 and 1.5 can be prohibitive.

Whatever the route, somewhere between origin and destination there is going to be a ruling grade -- the one that is more challenging than any other. Trains are made up to meet ruling grades -- barely. If you need thirteen hundred horsepower to get up your ruling grade, you'll be given three AC4400 locomotives. Many summits are marked by metallic yellow flags with black triangles on them. If something slips, or you lose an engine and you don't make it past a yellow flag, call an armadillo.

Direct-current diesel-electric locomotives are fine for hauling autotrains, intermodal containers, and sugar beets, but alternating current is the better way to move the weight of coal. A.C. traction motors -- the result of a newer technology -- can handle more current and pull more loaded coal cars. In the D.C. days of the twentieth century, railroads ran trains with as many as five locomotives. Now, with A.C. traction motors, trains of the same gross tonnage and on the same routes can be driven by three. A coal train is so heavy that it should be limited to a hundred cars if the locomotives are only on the front end, because with greater length and added tonnage the couplers between cars will start to break; the train literally tears itself apart. In

the middle nineteen-nineties, slave locomotives under computer-coordinated radio control were added in the middle or at the rear of trains, to push in synchronization with the pull from the front, taking pressure off the couplers. That is when coal trains grew in length to a mile and a half. The pull-and-push method, integrally operated by the engineer, is known as distributed power. A few exceptional coal trains are two miles long.

When something linear is draped across a great deal of landscape, it will be required to go uphill and downhill simultaneously if it tries to move at all. It crosses a summit, and its front begins descending while the rest is still climbing. If it is a coal train and there is a restricted-speed zone down ahead, many thousands of tons will strain the dynamic brakes while many thousands of other tons still need a great deal of applied power. Between North Platte, Nebraska, and Marysville, Kansas, a scene exactly fitting that description was a two-mile eastbound rise that led to an overpass where Union Pacific crossed the Burlington Northern Santa Fe in Hastings, Nebraska. The restricted-speed zone was half a mile down the far side. Scott had to deal with the antithetical stresses of the "train action" by continuing to apply positive power and simultaneously introducing what manuals call "brake propagation." This was possible only with distributed power, and he had long since "thrown the fence," desynchronizing the locomotives at the two ends of the train. The computer screen in front of him that related to power was now split by a vertical bar between the data of the front locomotives and the data from the rear unit, which was still pushing while the lead units were down in the dynamic brakes.

This was a place where a train could "get knuckles" (break couplers), and U.P. trains, in fact, had got six knuckles on Hastings Hill since Christmas. This is Scott's description of what was happening now: "You have to be within one throttle notch up or down with head -- for example, two dynamic on the head end would allow throttle 1, 2, or 3 on the DP. It is not against the rules to be in dynamic brake 8 on the DP and 2 on the head end, but common sense will tell you that there is a possibility of pulling your train in two. There's a twenty-five-mile-an-hour slow order at Kicks Road, which is only about half a mile from the top of this hill. In order to get a hundred-and-thirty-three-car loaded coal train -- nineteen thousand tons, DPU -- over the hill without breaking in two, what you need to do is you need to have the rear DP unit shoving in about Notch 1, and you need to control the slack with the lead two DPs in dynamic, and you'll have to hold that train back at fifty-mile-an-hour until you reach the bottom, and then you need to be shoving with the DP in the eighth run to push the slack against the head end in order to come over that hill at twenty-five-mile-an-hour and keep the slack bunched in so it doesn't break in two."

It didn't.

By 7 p.m., with our headlight drilling darkness, CNAMR was going fast enough to explode a rooster, feathers everywhere, like a shower of sparks. A "rooster" in this context was a cock pheasant, which flew nose-to-nose into a thirty-eight-million-pound coal train. Minutes later, on the microwave radio, we heard a westbound train report to the dispatcher that the train in front of us, an eastbound manifest, was throwing real sparks from its twenty-seventh car from the rear. Signals flashed yellow. The train in front of us was ten miles down the track, and to Paul and Scott its situation brought a single thought: If we get stuck behind this manifest, our time will run out and our own train will die. Scott began moving the throttle down through the notches and into the dynamics. Within twenty-five hundred yards, he had brought CNAMR to a complete stop. If he had crept along, drifting, as he could have under the flashing yellow signals, he might have crept into a block so close to the stricken train that the dispatcher would not be able to get him around it. So Scott was preserving distance. The dispatcher was in Omaha -- a hundred

and twelve miles away, measured with a string -- but he was in charge of all signals, all switches, and all movement of trains in many tens of miles before and behind us.

The signal structures over the tracks loomed black and nearly invisible now, but their lights had taken on a planetary brilliance -- green, flashing yellow, yellow, red, and lunar (the high white that tells you you can creep past red). These same colors, stretched into long horizontal lines, were lighting up a wall in Omaha as if it were the wall of a disco. Trains in Arizona, California, Missouri, and Colorado were also running in patterns expressed on this wall, and on the wall opposite -- the two sides of a narrow, tunnel-like room three hundred feet long. Iowa, Nebraska, Wyoming, Utah -- in all, about nineteen thousand miles of the Union Pacific were under control from within these walls, in the space known to the company as the Harriman Dispatching Center and to the people who work there as "the bunker."

It looks like one -- theatrically dark, below grade, the caverned core of a two-story building, and reinforced with such redundant masonry that it is rated to withstand "the force of a telephone pole hitting it at a hundred and eighty miles per hour," an assertion that in this part of the country is not immune from testing. The bunker calls to mind Mission Control in Houston, but even louder is the echo of those old films about the Strategic Air Command zapping the hell out of the Soviet Union from a deeply inhumed command center in Omaha. Four hundred dispatchers work at Harriman, about sixty at any given time. They wear ball caps that say things like "Dad to the Bone." Fingers on keyboards, feet on radio pedals, earphones under the caps, they sit at consoles in partitioned cubicles looking down into as many as eight computer screens and up at the colored lines -- the sometimes flashing bands -- on the walls. The lines are tracks, and some of the colors are rolling trains. If a paid inmate or a college student were to be brought here to undergo clinical psychological testing, he'd be babbling in the street in thirty minutes. Dispatchers have left Harriman to go into air-traffic control, imagining a simpler life. In the words of John Reininger, a supervisor in the bunker, "Air-traffic controllers have the great luxury of another dimension. Air-traffic controllers find this more complicated. We'd like to have a train change its altitude to get over another train -- it won't work."

A raised axial platform, supervisory in nature, is flanked on either side by a hundred yards of dispatchers, sitting in their cubicles, about five feet lower. Each is separated by clear partitions from neighbors left and right, whose territories are adjacent and average three hundred miles. Crew-change points will often coincide with the edges of dispatchers' territories. In rear projection, the polychromatic representation of the railroad on the wall directly ahead of each dispatcher depicts what is going on in the dispatcher's territory, and a glance to the left or the right shows the traffic that is approaching. If something is flashing, it needs attention; and something is generally a train, for which the dispatcher is clearing the way. In Reininger's words, "He owns the track, so to speak."

The multiple lines of color representing trains and tracks are not everywhere parallel. Where tracks converge, as at Gibbon Junction, the lines assume swastika patterns and the wall resembles a Navajo blanket. Where a stretch of track is occupied by a train, it is lighted bright red. Where a stretch of track has nothing on it and will not have for a while, it is white. A computer is thinking about it. Green track is clear for imminent use. Brown is for manual mode, computer uninvited. A computer has planned a train's experiences two or three hours ahead of the train. The dispatcher watches the plan as it unfolds, and overrides it if necessary, whereupon the relevant stretch of track on the wall turns brown. Malfunctioning switches appear as vertical blue rectangles, like small postage stamps. Specific symbols represent specific trains. Small arrows show plotted directions. Small "H"s represent switch heaters. Such is

the detail that on the axial platform a supervisor lifts a pair of binoculars to look over a dispatcher's shoulder and scan the rear-projection wall fifteen feet in front of her. Dispatchers at Harriman have spent entire careers on one stretch of track. If a coal train is making a very long trip from mine to plant, as many as a dozen dispatchers will see it through. Dispatchers have in their hands the safety not only of train crews but also of track workers, not to mention the surrounding public. After twelve weeks of classes, they are trained on the job for about three months. It takes them five years to become really efficient. Above each dispatcher's cubicle is a red strobe light set on a shaft like a torch. If a crisis develops in a dispatcher's territory, the red light begins to flash so that everyone in the general area will see it if the dispatcher is off peeing.

Some television directors look at fewer monitors than dispatchers do. Dispatchers' screens in the bunker can display data from trackside sensors and scanners. They chart winds and flash floods. Any emergency situation will cause a window describing it to pop up on a screen. As snow falls anywhere in Harriman's nineteen thousand miles, switch heaters are turned on from Harriman.

Under Centralized Traffic Control, you can run a train on any track in any direction. You can run three trains side by side all headed west on the Triple-Track Main. Where the trackage is wired for C.T.C., signals are all two-sided. I remember riding in a Metroliner in Maryland and standing in the front of the front car, where -- through two windows -- I could see the track ahead. Over the engineer's shoulder, I could see, lit up, a digital readout of the train's speed. The engineer was wearing a tie. There were four tracks. Gradually, the Metroliner had drifted to its left and now it was flying south at the left-hand extreme, on what is customarily a northbound track, at a hundred and eleven miles an hour. A pickup in front of us ran a gated crossing. We missed the pickup. On down the far-left track, we were soon looking directly into the headlight of a locomotive. We kept going. Somewhat shy of the headlight, the Metroliner slipped over to the next track, and shot past the other train. Centralized Traffic Control.

Under C.T.C., the dispatcher at his console controls all movement, and can set all signals and throw all switches. The system involves microwave towers, satellites, and fibre optics (strung along the tracks like the nineteenth century's telegraph wires). Train orders and track warrants used to be presented on actual paper given to the crew. Where they needed to, they stopped the train, walked ahead, threw switches by hand, and made signals with their arms in varied configurations, like football referees. A fist to the forehead was trainspeak for headlight. If you cupped both hands over your breasts, you were talking about a tank car. As with hand-swung red lanterns, all that was replaced by the block-signal system, which remains in operation in a lot of terrain. Blocks average two miles. If something is stalled four blocks ahead of you, you go from green to flashing yellow to yellow to red. Under block signals, a fast train coming up behind a slow train has no alternative but to slow up and follow. Under C.T.C., a fast train can go around a slow train. Trackage still exists that has neither C.T.C. nor a block-signal system. The term for it is "dark territory." In dark territory, all instructions -- even train orders -- are verbal via microwave radio. Coal trains on the old Rock Island branch between Fairbury and Hallam, Nebraska, are in dark territory. They must receive a track warrant by radio from the bunker, and must give the track warrant back to the dispatcher when they leave dark territory. The town of Hallam not long ago was utterly destroyed by a tornado. All that was left was the power plant, at the dead end of dark territory.

In 1969, I went to Campbell County, Wyoming, with Floyd Elgin Dominy, who -- decades earlier -- had started his career there as a county agent advising ranchers, who were fighting severe and sustained drought, to build small dams and impound water in stock

ponds. Dominy had risen to become U.S. Commissioner of Reclamation, the agency in the Department of the Interior which impounds water for as much as two hundred miles behind such constructions as Glen Canyon Dam, Grand Coulee Dam, Flaming Gorge Dam, Hoover Dam. Proudly, he drove the swelling grasslands of the high, dry range, while I scribbled airy notes about the "wide, expansive landscape, the beguiling patterns of perspective, the unending buttes, flat or nippled, spaced out to the horizon like stone chessmen." The grasses stirred under the wind and the range seemed uninhabited farther than the eye could see, but the ranchers in 1969 were still tucked into the draws, and their cattle were drinking from a thousand ponds. Dominy had lived in a stone dugout with his wife and infant daughter. For heat and cooking, they had a coal-burning stove. Dominy dug the coal himself out of a hillside.

The Orin Line, known locally as the Coal Line, is in Campbell and Converse counties, Wyoming. It was cut through Thunder Basin National Grassland and now includes among its branches the branch to Black Thunder Mine. Where people like Dominy dug, by hand, coal that no one else much wanted, draglines the size of naval ships are exposing it now. On CTSBT, I mentioned that I meant to revisit Campbell County some day soon, to go where CTSBT goes, and to see the Powder River Basin (of which Thunder Basin is a part) as it has come to appear in the twenty-first century. Scott, who drives more than a million tons of coal from North Platte to Marysville per year, said he had never seen the source of the coal and had long been curious to go there. What was I doing "the day after tomorrow?" We could drive up to the Coal Line in his car and maybe catch a train into a mine. The mine turns in the southern Powder River Basin begin and end at Bill, Wyoming, and that was no big deal or distance from North Platte -- not much over three hundred miles.

In his Suburban, we were barely nine miles from his home when we approached the tracks at Birdwood, the west end of Bailey Yard. Lights flashed, gates dropped in front of us, and we watched the arriving headlight of a coal train. "Son of a bitch!" Scott complained. In no great hurry, the mile and a half of train went by, then a second son of a bitch came along before the first one cleared.

We went northwest on roads that were almost always close to tracks. Scott never looked at a map or paid much attention to road signs, but -- to see where he was -- he looked routinely at railroad mileposts. At another grade crossing, another coal train stopped us. We entered Wyoming in a freezing rain. In the B.N.S.F. yard at Guernsey were ten parallel coal trains. Through the rain, we saw sunlight on snow of the Laramie Range. Before long, the rain against our windshield turned into snow. North of Lightning Creek, the pump jacks of oil fields dotted the range. Bill had a regional school in a double-wide trailer, four kids in the school. As if Bill were pretending that it was not the only town in four thousand square miles, the school, the post office, the general store, and Dry Creek Community Hall were closely clustered. The post office, 82631, was boarded up, the Zip Code defunct. The town's resident population was one -- the storekeeper. Sitting in Bill's railroad yard as we arrived were eight miles of coal trains.

Scott arranged for us to deadhead on CCTBT, coming from St. Clair, Michigan, and going to Black Thunder Mine. The train was scheduled to leave Bill at seven-forty in the morning, with David L. Morgan, conductor, and Eric M. Renstrom, engineer. At seven-forty in the morning, we had all been waiting in the crew locker room for upward of an hour, but no call was forthcoming for CCTBT. An hour later, there had still been no call for CCTBT, or for any other train. About a dozen crewmen were waiting, gathering the minutes of their twelve hours. The dialogue might have been coming off a circular tape:

"Fucking CRZ -- can't remember shit."

“Today is National Pick-on-Tom Day.”

“Shit. I can take it.”

“Fucking CRZ -- can’t remember shit.”

There was writing over a urinal in the grouting of a cinder-block wall: “Republicans Like to Cornhole Each Others + Wives + Chickens.” Some of the guys wore chains on their boots to deal with winter. There was a lot of Mephistophelian facial hair -- the caterpillar sideburns, the full beard, the mustache as bilateral semaphore.

Dave Morgan said, “Welcome to the Coal Line. Meaning you wait, and wait. Daytime dispatchers are a pain in the ass.” And he laughed. Then, referring to the day’s traffic, he added, “We’ve got about a hundred trains in here as we speak.” And he laughed. Dave was a big guy, handsome -- six-three -- with a cavernous voice; and the laugh was explosive, like a chain saw starting up. The saw had a problem in its fuel line, always choking out as abruptly as it started, as if he threw a switch in mid-yok. He wore jeans, a jean jacket. His thick brown hair was parted near the middle. He said he had waited in the locker room as much as eleven hours and thirty minutes to be called to a train.

Mary Ellen Sherwin, an engineer, came into the room. She had waited from 9:50 p.m. until 1:50 a.m. the night before, and had then driven a train to and from Belle Ayr Mine. Sixty-six years old with long white hair, she wore jeans, a jean jacket, and under her jacket a V-neck cotton sweater with horizontal grays and whites like the broadened stripes of a railroad hat from the days of steam. Addressing Dave Morgan, she remarked, “You asshole.”

Dave replied, “That’s Mister Asshole to you.”

She said, “Where are you going?”

He said, “Thunder.”

She had grown up on a ranch northeast of Bill, and now lived in Douglas, thirty-five miles south. She left for home.

When she had gone, Dave said, “They don’t make enough jeweller’s rouge to polish off her edges.”

After four hours, a crewman spoke of “waiting on the railroad, all the livelong day.” At ten-fifty-seven, the address system finally mentioned Dave’s and Eric’s train. Three minutes later, we were in the cab. At eleven-fifteen, we moved, into a whiteout fog.

If you would like to torture someone, either drip water on him for thirty-six hours or take him up the Coal Line. Eric stopped at a red signal where the yard tracks of Bill met the main roadbed. On a turn of ninety miles, we had travelled a train-length, a mile and a half. The dispatchers who were controlling the movements of every train on the line were in B.N.S.F.’s dispatching center in Fort Worth, Texas. Ours spoke often and even hopefully to Eric and Dave, but there was nothing she could do. The line belonged jointly to the two largest railroads in America, and so many coal trains from so many places were there to collect the coal that the congestion had gone critical and the line was arteriosclerotic. Not that we could see the other trains. For ninety minutes, we stared forward at two red dots in fog.

Dave Morgan said, “As long as we don’t see something going by us going into Thunder, we’re O.K.” Each train is a “slot.” Mine to mine on the Orin Line, railroads work out loading slots, like airlines sharing an airport. At twelve-fifty-eight, a light turned yellow and we moved. Looking up at the signal, Dave said, “You got to have faith that that son of a bitch ain’t lying to you, ha-haha-h . . .” and we slid onto the main, heading north up the leftmost of the three tracks under Centralized Traffic Control. And soon we were flying, or so it seemed, crossing the Dry Fork of the Cheyenne at twenty miles an hour.

The virtual voice of a trackside scanner addressed the interior of the cab, saying, “No dee fex. Temm purr ah choor fiff teen duh grees.” The fog densened. A headlight suddenly appeared in it and we were meeting a coal train coming down from Caballo, a

small mine by Powder River standards, yet larger than every mine in the East. The train had made fifty-seven miles in ten and a half hours, but it was speeding up some and went by us in nine minutes.

The roadbed was visible enough, and Scott Davis remarked that we were looking at a state-of-the-art railroad -- triple track with crossovers, concrete ties, the ballast so neatly bevelled that it looked like a new driveway. Wood ties are still in use elsewhere, and are more flexible, but concrete ties are what you want if you are annually running over them four hundred million gross tons of coal trains. (Not readily visible was the great quantity of coal dust that had filled in the ballast and, in months to come, would cause a couple of derailments by impeding the drainage of unusual rains.)

At one-thirty, we were stopped again, for what turned out to be ninety minutes. We had gone seven miles. “Fluidity” is perhaps the most hallowed word in railroad operations. The Santa Monica Freeway between Sepulveda and La Cienega is more fluid than the Orin Line between Bill and Belle Ayr. Think of Bay Bridge traffc backed up to Sacramento, think bumper-to-bumper backward from the New Jersey Palisades to the Mississippi River. Dave and Eric, sitting back, had their legs draped across their consoles. I had to look over their toes to stare, and stare, and stare at the red signals, in every moment wanting and expecting them to turn. With C.T.C., the fog was only a symbolic factor. Dave said, “It feels like we’re all alone out here but we’ve probably got sixty to seventy trains on the tracks up ahead. This is what it’s like on the Coal Line. At least they didn’t fix you up with nothing bogus. Ha-ha-ha-h . . .”

Eric went out the rear door of the cab and along the catwalk to the second unit, where he picked up a TV dinner he was cooking in the heat between the turbo and the main engine block. Until recently a conductor, Eric was a new engineer. With a full helmet of light-brown hair, fine features, alert eyes, he resembled the film idol Robert Redford but was better-looking. As he ate, he said, slowly and quietly, “I still have to learn how to get a handle on the stress side of it, trying to find a happy medium between caring too much and too little.”

“We’re parked,” Dave said, his voice less optimistic than the trackside scanner’s. Turning to the economics of the situation, he added, “We’re really nothing. We’re pretty much the plankton of the whole picture. Ha-ha.”

An empty beaner drifted by -- EMHKBTM -- on its way from Tennessee to Black Thunder Mine. In other words, something was going by us going into Thunder. A beaner is a B.N.S.F. train. “E” for empty, in its B.N.S.F. seven-letter name. Beaners kept appearing: CCAMSLP, on its way from Caballo Mine to Smithers Lake, in Texas; ECEBATM, returning to Antelope Mine from a plant in southern Illinois that no longer uses Illinois coal. B.N.S.F. is made up of the collective remains of the Chicago, Burlington & Quincy Railroad, the Great Northern Railway, and the Atchison, Topeka and Santa Fe. A fallen flag is a railroad that no longer exists. In the eye of the beholder is whether B.N.S.F. is a streamlined modern enterprise or a bouquet of fallen flags. Either way, it is America’s second-longest railroad, and its recumbent flags also include Spokane, Portland and Seattle; Northern Pacific; and St. Louis-San Francisco, the old Frisco line.

If you develop a monopoly on the railroads in Monopoly, you are holding four fallen flags. Since the breakup of Conrail, in 1999, most of the old Eastern railroads are parts of Norfolk Southern or parts of CSX. Illinois Central is a fallen flag. It is part of Canadian National. These train mergers are like bluefish wars. Southern Pacific, which nearly merged with the Santa Fe, was consumed by Union Pacific in 1996. The modern Union Pacific is actually a consolidation of eight or ten railroads -- a network, and more like a communications grid than a straight-line railroad. Its

antiquarium of fallen flags also includes the Missouri Pacific, the Western Pacific, the Missouri-Kansas-Texas Railroad (Katy line), and the Chicago & North Western, which was struggling to build the Orin Line when U.P. came along with its mouth wide open. As Paul Fitzpatrick had summarized all this, “The U.P. went from a family-type company to a military-type company with the mergers, but we finally got them to think a little bit like what we think they should.”

Around 3 p.m., a loaded U.P. coal train, coming down from the Antelope Mine, went by us on the middle track. Of the two red dots we were staring at, one above the other, the upper one related to the track we were on. The lower one was there to indicate a diversion route. The lower one turned yellow but resembled gold. After Eric put the throttle in Notch 1, we actually moved, crossing over from Track 3 to Track 2.

Traced from a map, the Coal Line has the raceme structure of a bluebell or a lily of the valley, as dainty an image as nature can provide for a stem whose flowers are coal mines. Black Thunder Junction, 5:45 p.m., nineteen degrees, dark, snowing.

Eight miles into Black Thunder, the branch line ended in a great loop, where the long train would pass through a loading silo while swinging around to go back the other way. Going into Thunder, we approached a switch that was closed but should have been open. What to do? Leaving the cab, Dave said, “I go over and flop the switch. This is known as a one-eyed crossover.”

Crossed over, we soon stopped, as ordered, near a footbridge, before going over a scale. The snow was heavy now, like bugs filling up our headlight beam, but through the swarm we could see the silo, as large as a twenty-five-story office building, sheathed in light. Eric took the lead locomotive over the scale at 1.5 miles per hour, then went up to 3.5 for the rest of the train. Reading the tare weights on a screen in the cab, Dave said, “This is a pretty consistent consist.” While the hoppers behind us were crossing the scale, we went under a conveyor belt that was carrying coal from a remote pit into the silo complex. The belt was three miles long. From nearer pits, coal was being brought in by haul trucks too large to share the name with anything else called a truck. Their tires looked the way bagels would look to a virus. Black Thunder was working four pits, and the whole spread of it was far too extensive to be comprehended from a train, but Scott Davis and I had driven around the basin after we arrived.

The mines were mapped in blocks: “West Overburden. Middle Overburden. East Overburden. Coal.” The pits were excavated canyons. They were a couple of hundred feet deep and two and three miles long. The walking draglines gnawing at the overburden needed tall rigid masts to help support their four-chord booms. They were eight stories tall and weighed four hundred tons. Their booms were hundreds of feet long. Like the locomotives that would haul the coal away, the walking draglines required electric power. Their walk was a saurian heave, an exponential lurch, friction smoke rising from the ground around them. As they walked-dug-walked-dug their way up the coal seams, their tails dragged along behind them. The tails were cables six inches thick delivering electrical power made with coal to draglines digging coal. We saw three D11 bulldozers shoving overburden to the edge of a canyon and over the side, going back for more overburden, and returning to the lip, always stopping a foot or two short of a two-hundred-foot plunge.

Scott said, “I thought railroads were dangerous, but, man, these coal mines are really dangerous.” In the presence of nineteen-thousand-ton trains, three-hundred-ton haul trucks, and hundred-ton bulldozers moving on unstable ground, blasts are routine and rocks fall like bombs.

“Those big trucks could back over a pickup and not even know it,” Scott said.

The pickups knew it. They carried whip antennas twenty feet high with bright-red lights at the top.

The faces of the canyon walls were for the most part jet black -- beds of coal eight to ten stories thick. With distance westward toward the Bighorns, the seams go deeper under the overburden. In fifty more years of westward digging and filling, the seams may be too deep to mine, at least in the way that they are mined now. At that point, the Powder River Basin will still contain -- at the rate of sixty loaded coal trains a day -- enough coal for two hundred years. It began as peat in Paleocene bogs about sixty million years before the present.

We had seen old ranch buildings falling into the ground, and a few cattle standing up. A sign: "Livestock at Large." Windmills were still pumping water for cattle. To the horizons, there were no trees. Deer and antelope were everywhere at play, much too young to care what had happened to the range.

About six months before the present, I read Kim Stanley Robinson's "Red Mars," a heralded work of science fiction that describes the colonization and mineral exploitation of the fourth planet. Robinson's characters excavate Mars with backhoes, front-end loaders, tractors, graders, and "one John Deere/Volvo Martian bulldozer, hydrazine-powered, thermally protected, semiautonomous, fully programmable." There are "giant dump trucks . . . full of black boulders."

" 'Monsters like this are all over the planet,' he said to Nadia. . . . 'Cutting, scraping, digging, filling . . .' "

The monsters are "equipped to be teleoperated from indoor stations, their decision algorithms handling the details," while human operators peer at screens.

" 'Watch your screens, you lazy bastards!' "

Colonials from "rich northern countries" mine the Great Escarpment and "the island mesas of Nilosyrtis." One of their pits is "a kilometer in diameter, seven kilometers deep." They use the "Allied hydraulic impact hammer," and they "drill cased holes through large boulders" with the Sandvik Tubex boring machine.

"The train to Burroughs carried mostly freight, thirty narrow cars of it . . . running over a superconducting magnetic piste." Between Earth and Mars, strings of orbiting vehicles, also called trains, come and go in "a continuous procession" run by "a large force of local traffic controllers."

And now CCTBT was about to turn into CBTCT. Its nose was close to the silo. It was moving steadily at .4 miles per hour. Scott Davis and I went out of the cab and back along the catwalk in the noise and the snow, stepping over to the second unit, and continuing along its catwalk to the far end, because the second unit was facing backward. We got into the cab there and watched. Next to us was the first of a hundred and thirty-four empty hoppers. The looming silo was something like a grain elevator, reaching out with great arms to the crushers that supplied it. Moving inside, the lead locomotives passed three control booths, whose bay windows were not entirely black with dust. As the first hopper drew abreast of a booth, a pair of steel sheets was lowered from above, coffering the interior of the car in the way that a dentist places baffles around a tooth he's about to fill. Then coal dropped, explosively, between the sheets. A hundred and fifteen measured tons fell into the gondola in one second. A six-kiloton cloud shot up into the silo's black interior. Under the crash of coal, the aluminum gondola staggered, wrenched downward, and looked as if it might flatten. From above, the baffles were lifted. The coal in the hopper was maybe five feet above the rims, a calculated fluff that would settle down. At .4 miles per hour, the second gondola was now in position. The baffles came down, and the coal fell. Crunch, cloud, and the next car was in position. Emerging from the silo on a slight curve, we watched twenty cars totter in the dust under

the weight of falling coal before the interior of the silo passed out of sight, with more than a mile of gondolas to follow.

We were scarcely eastbound off the loop when Dave's and Eric's time, under the hours-of-service law, ran out. Eric stopped the loaded coal train. We all descended. A fresh crew got on, and the van that had brought them carried us away, past a very large sign that said:

THUNDER BASIN COAL COMPANY

Welcome to

BLACK THUNDER MINEDon't get caught inthe web of unsafe acts

In the Powder River Basin, a congestion of trains may be tedious while you're in it, the railroading seemingly inefficient, but that is just an illusion lit up in red signals. The place is not as organized as an anthill, no; but it is something like one. From the mines along the Orin Line, twenty-three thousand coal trains annually emerge -- that is, about thirty-four thousand miles of rolling coal, going off as units to become carbon dioxide, sulfur dioxide, nitrous oxide, water, ash, and heat, and to air-condition a population so needful of comfort that the demand for the coal is greater in summer than in winter.

Here is one example chosen not at random but for its distance and size: Coming and going, loaded and empty, thirty-five sets -- thirty-five dedicated unit coal trains -- are in almost perpetual motion between the Powder River Basin and Georgia's Plant Scherer, twenty miles from Macon. There is a loop at each end, eighteen hundred miles between. Owned by a consortium led by Georgia Power, Plant Scherer, in megawatts produced, is the largest coal-fired power plant in the Western Hemisphere. It pays more than anyone else for the transportation of Powder River coal, and not long ago B.N.S.F. snatched the contract from Union Pacific.

Trains with names like CBTMMHS go down to Guernsey and then cross Nebraska and drop through Missouri to the Ozarks, where they test tonnage versus horsepower on 1.5-per-cent grades. B.N.S.F. had to lengthen its sidings and fix up its track for the coal trains, as did Norfolk Southern, which absorbs the trains at Memphis. New crews take their turns from Memphis to Sheffield, and Sheffield to Chattanooga, and Chattanooga to Atlanta's Inman Yard. The run from Inman and back to Inman via Lamar County is known inside the trains as the Scherer turn.

By the grade crossing in Juliette, Georgia, a fried-green-tomato sandwich is as good as it is famous at the Whistle Stop Cafe. On a freezing winter day, when the temperatures in Georgia were not much milder than they were in Wyoming, I had a fried-green-tomato sandwich for lunch with my longtime friend Sam Candler, of Sharpsburg, Georgia, and Joe Fulford, a Norfolk Southern trainmaster, and Adam Crate, whose title was Road Foreman of Engines.

Close to the Ocmulgee River, Juliette is a hamlet in the pinewoods -- a cluster of houses near the grade crossing by the trackside cafe. In the early nineteen-nineties, the town flashed with borrowed vividness after Hollywood used it as an on-location set for a memoir that included a steam locomotive coming through the pines and killing a young man whose foot had been caught and wedged in the rails near the Whistle Stop Cafe, which looks to this day as it did in the movie.

I was still enjoying my fried-green species of BLT when the nose of a locomotive appeared in a window and stopped. Its presence in this place was no less incongruous than the appearance of Chief Red Cloud at New York's Cooper Union to deliver an address in Sioux. Instead of a modest Norfolk Southern locomotive, there from the mountain West on this antebellum single track sat Burlington Northern Santa Fe 5639, color of reddish wheat, with seven thousand feet of coal behind it in the trees. Lee Stuckey was the engineer, Brian Nix the conductor -- Inman to Inman, the Scherer turn. On a yellow slip

above Lee Stuckey's head were the initials of Black Thunder Mine.

Over wooden ties, we went down through the loblollies in a narrow series of S curves, the trees so tight to the train that on this clear day visibility from the cab did not extend much farther than it had in the fog in Wyoming. More forest curves eventually led to a long left where we could look back at the beginnings of CBTMMHS's hundred and twenty-four cars. Then, to our left, we passed a long yard with five parallel tracks, where five coal trains could, if necessary, be parked, or "staged," waiting to advance and drop their coal at Plant Scherer. That should have suggested the dimensions of the scene to follow, but the significance of the yard did not really register with me, and the surprise was near total when we bent around a long curve and the dense curtain of pines seemed to open theatrically from left to right, revealing a loop of track at least a mile in circumference around an infield filled with a million tons of coal (earthmovers and bulldozers crawling like insects on the coal), and, on the far side of the loop, a trestle forty feet in the air and eight hundred feet long, and behind the trestle a pair of rectangular buildings a quarter of a mile over the ground and close to three hundred feet high but dwarfed beneath the overbearing immensity of four hyperbolic cooling towers that came into view one at a time, their broad flared rims five hundred feet above the ground, and two smokestacks a thousand feet high, reaching above the scene like minarets. It was an electrical Xanadu in homage to a craven need, its battlements emitting cumuli of steam.

After being switched to the right at the top of the loop, we started around it counterclockwise. Coal trains are so heavy that they are routed through the loop in alternate directions, to distribute the assault on the track. In the infield to our left were five hundred acres of Campbell County, Wyoming, fifty feet deep -- the million-ton reserve known at Plant Scherer as the "pile." CBTMMHS circumscribed the pile until -- close by Plant Scherer -- it stopped at the head of the unloading trestle, which extended before it between rows of bright lights. This train had left Wyoming five days ago. Plant Scherer would burn everything in it in less than eight hours.

Sam and I descended from the cab, the better to watch the unloading. Like the New Jersey Turnpike high over the Meadowlands, the trestle was supported on concrete croquet wickets that divided the space below it into twenty-one bays. Between yellow railings, the red-orange locomotive began to move onto the trestle, followed by stainless hoppers heaped with coal. Bin doors opened in the bottom of the first car, and, in three or four seconds, down through the trestle fell a hundred and fifteen tons of coal. The sound was nearly as explosive as the sound of the filling had been in Wyoming. At some plants, coal cars are rolled over -- literally flipped on swivel couplings -- but such rotary dumping, spectacular as it may be, is too slow for a place like Plant Scherer, which Jeremy Taylor, an authority on coal trains, has called "the most efficient unloading operation in the country," with its trestle, its electric contact points, its compressed-air opening of the hopper doors. The train was moving at three miles an hour, and the cars were unloading like sticks of bombs. The coal was mounding in the bays. As each load began to drop, a geyser of dust shot upward from the car. Down in the bays, the dust coming off the fallen coal spread out in a thick black cloud. There were sprayers to diminish the dust but the sprayers were frozen. Sam had radically changed. His face had blackened. His beard was much younger. Now the locomotive stopped hard to shake up frozen coal. In the bays of the trestle, mountains quickly grew, and big yellow Cats did what they could to smooth them. As coal floods the bays, it can fill them high enough to derail the train. After the locomotive had gone far past the end of the trestle, the cars kept coming and the geysers kept rising. The uncontrollable dust far below had the look of an occurring

disaster, the spreading clouds dark and flat as if they were derived from incendiary bombs.

Plant Scherer can unload a coal train in thirty minutes but seldom does. If Plant Scherer takes more than four hours to unload a coal train, it pays Norfolk Southern a demurrage fee. Norfolk Southern, for its part, has seventy hours to get the train from the Mississippi River to Plant Scherer and back, or Norfolk Southern pays a demurrage fee. Cars may have to be set out because of freezing -- hopper doors frozen, the coal in solid blocks like frozen peas.

Coal under the trestle in forty-foot dunes soon filled all twenty-one bays. Sprinklers were finally thawed. A rainbow hung in a drifting black cloud. Like a chambered nautilus, the train had come back upon itself and was now completely annular. At the far side of the great loop, the lead locomotive was all but touching the hoppers that were still arriving.

Under the trestle, a chute was carrying the coal off to be crushed and then pulverized and then mixed with air for immediate burning, in the way that an automobile engine mixes air with gasoline and explodes the vapor. Pulverization helps make it possible to burn the coal at a temperature low enough to limit nitrous oxide, and the fireballs don't get much hotter than three thousand degrees. The heat, of course, boils water -- eighty-one million gallons of Ocmulgee River water a day -- in boilers twenty-five stories tall. Steam from the boiling water turns four generators lined up in a single room a quarter of a mile long.

Damon Woodson, a mechanical engineer at Plant Scherer who had worked in a nuclear power plant, said, "I never really understood nuclear until I came here." That million-ton pile on reserve in the train loop was equivalent to one truckful of mined uranium, he said. "The way to go is nuclear if you want to have power. To get a million BTUs, fuel oil costs nine dollars, natural gas six dollars, coal a dollar-eighty-five, nuclear fifty cents. We'll see how it all turns out."

Plant Scherer burns nearly thirteen hundred coal trains a year -- two thousand miles of coal cars, twelve million tons of the bedrock of Wyoming. It unloads, on average, three and a half coal trains a day. On a wall inside the plant are pictures of yellow finches, turkey vultures, and other local wildlife on Plant Scherer's twelve thousand acres of land. Asked why Plant Scherer needs twelve thousand acres (six miles by three miles), Woodson answered readily, "Because we are thinking of expanding."

(This is the second part of a two-part article.)