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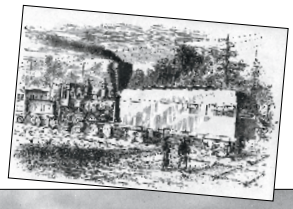
"There comes a time when locomotives are more important than guns."

—*German General Erich Ludendorff, 1918*

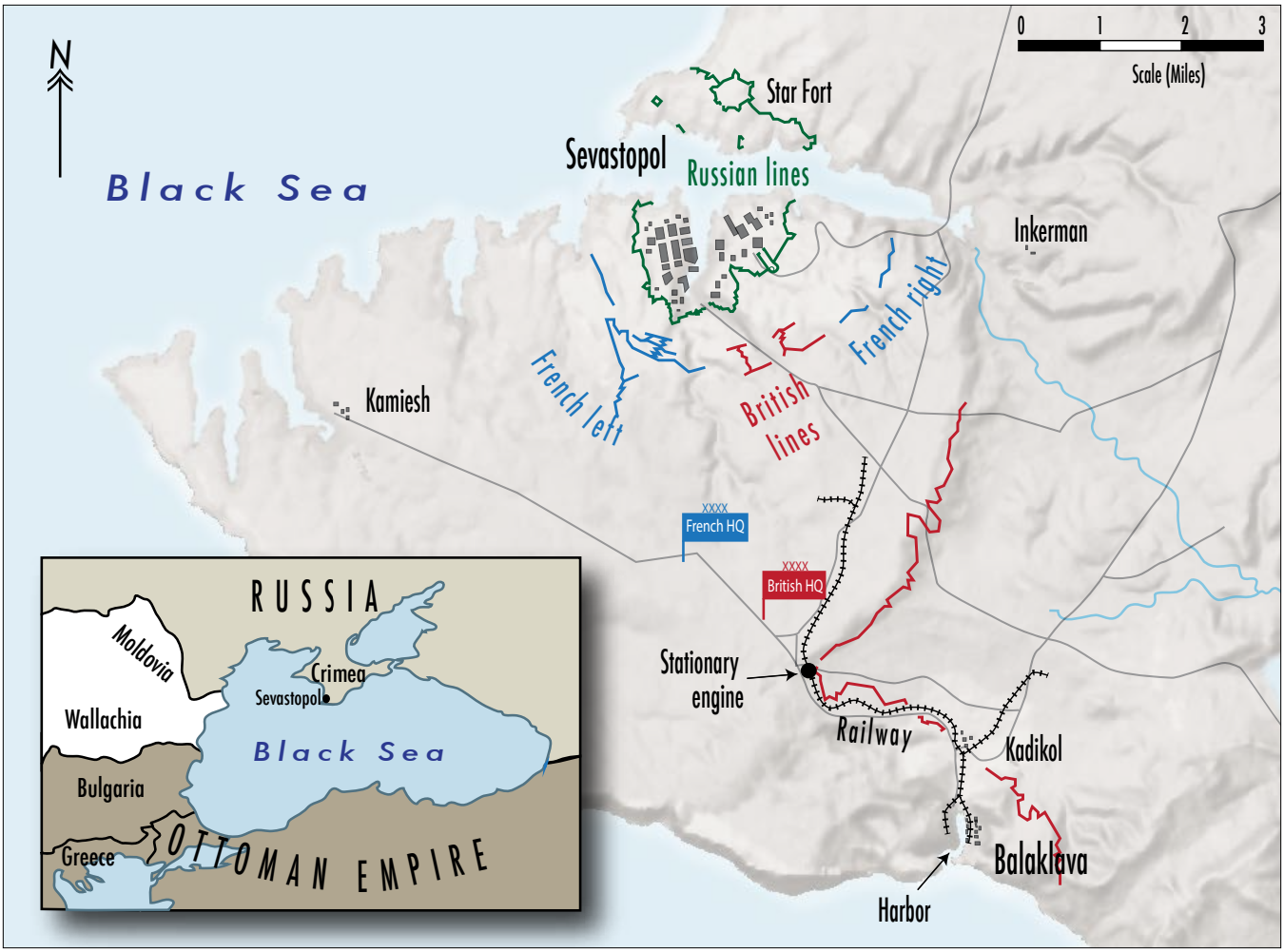


CHAPTER ONE

Railroads Redefine Warfare

During the Union occupation of Atlanta in 1864, a variety of rail equipment can be seen at the remains of the roundhouse. *Library of Congress*

From the primitive 19th century iron horse to the thundering diesels of today, railroads have played an important part in enabling, changing, and sometimes inciting warfare. The industrial revolution brought about vast progress in technology and manufacturing capacity. New technology spilled over to the military where weapons became mass produced and grew in destructive power. Likewise, railroads expanded with industry and the military in size, sophistication, and number to support the burgeoning mechanization of society.



During the siege of Sevastopol (1855–56), the Grand Crimean Central Railway ran from the port at Balaklava to the siege lines.

The expanding railroads enabled nations to quickly mobilize equipment and millions of soldiers, leading to the two most destructive wars the world has known. Even after World War II, railroads continued to play a key role in supporting nations as they regrettably engaged in smaller, periodic conflicts.

This book provides an overview of how railroads served in America's wars and shows how to design and build an operating model railroad using this information. These layouts combine model railroad activities with military history and the increased operating intensity associated with warfare. The purpose of this book is to better understand the role of railroads in warfare and offer a tribute that honors the service of the people that ran them.

The iron horse goes to war

The fledgling American railroad system first supported a war effort in 1846 by helping transport American army and navy volunteers from recruitment centers to points of debarkation for the Mexican-American War. At that time, the United States had roughly 4,000 track miles arranged in many short, disjointed segments, so the railroads' contribution to the war effort was minor.

The first use of railways to directly support a military operation occurred not in America, but in the Crimean War between Russia and a French-British-Turkish alliance. In 1855, the British built the Grand Crimean Central Railway, a rather grandiose name for a railroad that stretched about 14 miles from the port at Balaklava to the siege lines of Sevastopol.

The line, built over a period of a few weeks, utilized steam-powered locomotives to move cars from the relatively flat waterfront to the base of a plateau. There, a steam-powered cable hoist took over because the locomotives could not handle the steep grade. At the top, horses drew the cars to the appropriate depots. In addition to hauling military supplies, the railroad provided evacuation of the sick and injured, which some argue was the first use of a hospital train.

By the mid-19th century, the expanding rail network in Europe enabled the French to rapidly deploy more than 100,000 men in 1858 to support the Italians in the Second Italian War of Independence against the Austrians. While this was the first major deployment of troops by rail, railroads did not dominate the conflict.

During the American Civil War (1861–1865), railroads began to predominate military planning and operations. In July 1861, Confederate reinforcements arrived by rail in time to turn the tide of the first battle at Bull Run. Railroads continued to play

6

These African-Americans working on the Nashville & Chattanooga near Murfreesboro, Tenn., are probably former slaves who escaped to Union lines. *Library of Congress*

7

Al Mueller's HO scale layout depicts the Orange and Alexandria near Atlee, Va. He has extensively modified Mantua *General* locomotives to improve their appearance and operation. Here, one of his modified locomotives, the *Warrenton*, pulls some passenger cars.

8

This HO model depicts the USMRR car ferry terminal in Alexandria. I built the model for the Lyceum Museum in Alexandria, and it is part of their permanent collection.

McCallum was, at the time, the general superintendent of the Erie Railroad and was well placed to organize the various rail lines coming under the Union army jurisdiction.

The 42-year-old Haupt was a West Point graduate with distinguished experience in both teaching engineering as well as building portions of the Pennsylvania Railroad in his home state and the Hoosac tunnel in Massachusetts.

Haupt arrived in Alexandria, Va., to take command of the USMRR in time to support General McDowell's campaign to advance on Richmond down the RF&P railroad as part of the 1862 Peninsula Campaign.

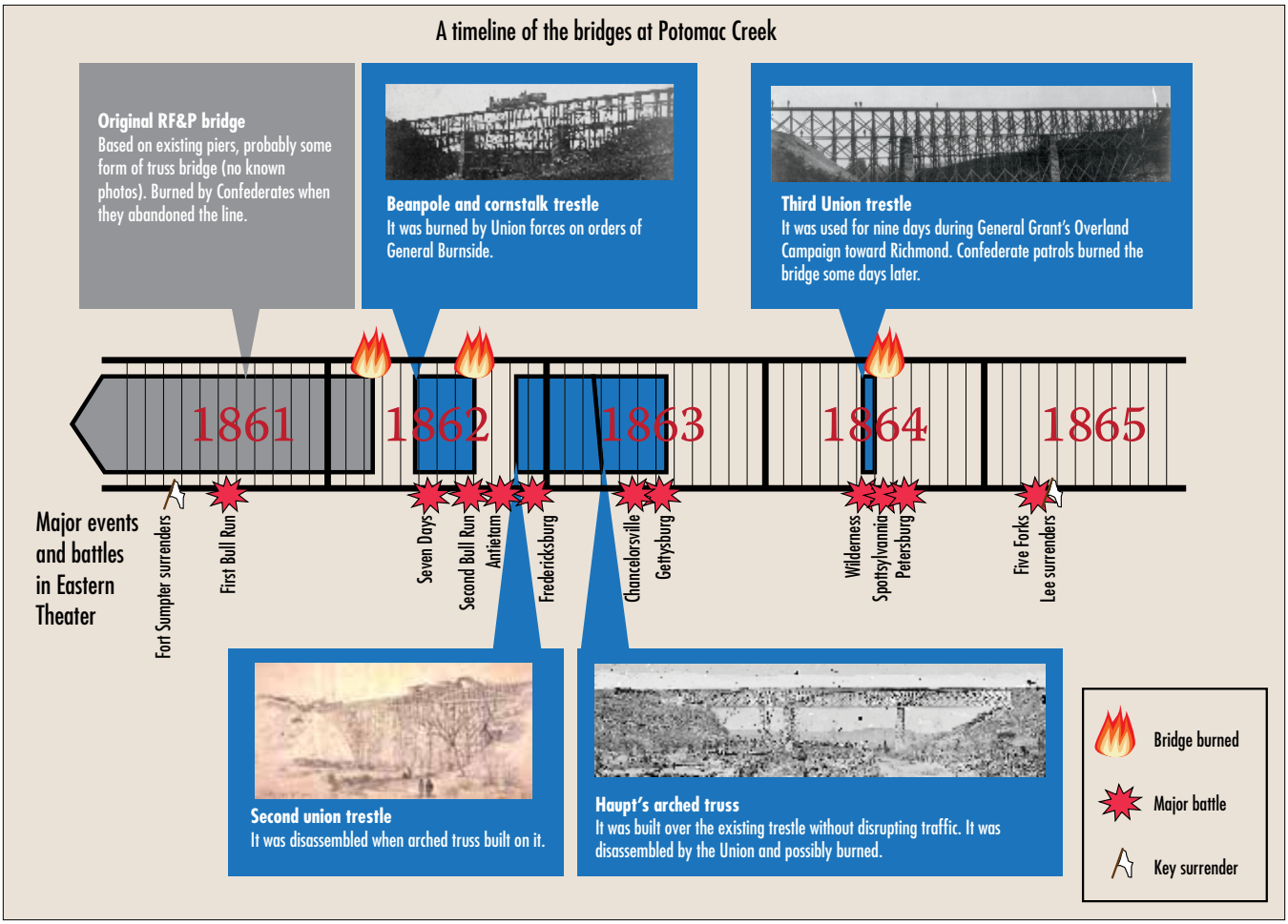
Haupt recruited an assortment of frontier woodsmen, skilled craftsman, and freed slaves to create a railroad construction corps that achieved amazing engineering and railroad building feats, **6**. One of his first notable achievements was the reconstruction of the bridge over Potomac Creek. The original bridge took three years to build. Haupt and his men rebuilt the 400-foot-long and 100-foot-tall trestle in less than a week. Abraham Lincoln, amazed upon seeing the bridge, commented, "That man Haupt has built a bridge

Haupt's Rules

1. No military officers were to interfere in the running of trains.
2. Supplies would be sent forward only as needed.
3. Trains reaching the front were to be unloaded immediately by anyone available. Officers who refused to cooperate faced dismissal.
4. Where telegraph communications were unavailable, trains would run according to a rigid schedule. All trains departed on schedule, fully loaded or not. Extra trains would pick up the slack.
5. On lines where the absence of sidings prevented opposing trains from passing each other, convoys of five or six trains would travel as a group. Each convoy delivered its cargo and returned to base before the next convoy started out.

9

A three-barge, empty railroad car ferry is anchored off the main wharf at Aquia Landing. Side-wheel paddle steamers and screw-propelled tugs can be seen behind the ferry. Several boxcars on the dock await loading onto the ferry. *Library of Congress*



This timeline shows the different bridges that existed over Potomac Creek during the Civil War.

A "puddle jumper" steamboat is under construction at the Union shipyard at McCook's Landing. The marine ways can be pulled up the bank using the capstan just visible on the left side.

This string of cabooses is shown at the Nashville & Chattanooga Nashville terminal in 1864. The cabooses are converted house cars. They were one of the four types of cars used during the war. *National Archives*

construction material. There were four main types of cars: boxcars (also called house cars), flatcars, way cars (also called conductors cars or cabooses), and passenger cars, **15**. While seemingly limited compared to dizzying array of modern freight cars, there is sufficient variety in the boxcars and flats to keep a modeler busy. There are many kits available in most scales, though N scale now has a good selection of ready-to-run cars from Micro-Trains.

One of the most vexing problems relates to freight car colors. Although we have thousands of high resolution black and white photos from the Civil War, there are no color photos. We must rely on paintings and written descriptions for color information. A train of freight cars at any given time during the war would have been pretty diverse. It was a mix of many different things—cars both freshly painted and worn out, blocks of cars in the colors of the closest shop, captured cars in the colors of their own roads, and cars painted in the colors of the roads they were purchased from. (Demand for cars just after the beginning of the war allowed many railroads to sell off their old stock, so a car painted in 1855 or 1858 might be seeing its last days on a military train.)

Freight cars were many colors in the 1850s and '60s—straw yellow, mustard, drab, slate gray (called slate color), mineral reds, brown, red, and other hues. The Western & Atlantic used slate blue cars with white lettering, while the Baltimore & Susquehanna (Northern Central) had dark brown cars. The Philadelphia, Wilmington & Baltimore ran light yellow cars with tan roofs, red wheels, and black hardware. Four-wheel coal jimmies from the same time were painted black.

To couple the cars, the railroads in the Civil War used various forms of links and pins. These notorious devices were extremely hazardous to use because they required the brakemen to stand between the cars as they coupled up. If the engineer misjudged the distance, a brakeman could easily be injured or killed. Modeling and operating link-and-pin couplers is practical in O scale. I use them on McCook's Landing and on the Aquia Line layout with magnetic wands to extract the pins. Most modelers in smaller scales opt for knuckle couplers.

The brakes on Civil War-era cars used a relatively simple mechanism on just one truck. I installed working brakes on some of O scale cars. Like on the prototype, you turn the brake wheel on the car body and the brakes lock. More than a novelty, this increases the tasks for the operators and makes two-man crews more interesting as well as realistic.

Building stub switches

Stub switches are a signature item of Civil War-era railroads, and I installed two stub switches on McCook's Landing.

Model stub switches are easier to fabricate than lap switches as the points and stock rails do not need extensive and finicky filing. The stubs can be simply cut to length with a rail nipper. The frogs are made the same way as a lap switch.

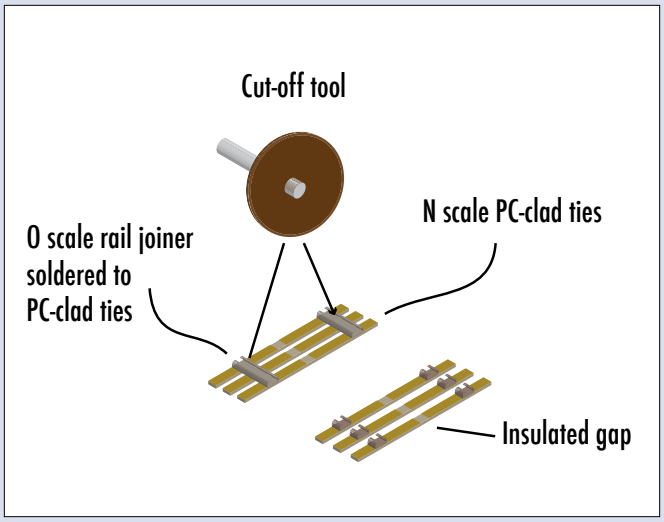
The most troublesome aspect of making a model stub switch is setting the limits of the stub's throw. Most model switch mechanisms rely on resistance of the stock rails to contain the movement of the points. In a model stub switch, you must devise, add, and adjust physical stops to limit the stub throw.

In O scale, the situation is much simpler as Alkem Scale Models makes scale-sized switch stands with exactly the required throw. No tricky stops of mechanisms are required. As in the prototype, the model switch stand governs the stub throw.

The bridles are the rods that hold the moving rails in gauge. I made model bridles using N scale PC ties and rail joiners. Each set of rail joiners can make three bridles. I solder three at a time. Then I used a cutoff disk to trim the rail joiner flush with the PC tie. By using N scale ties, the bridles are close to scale size.

With the bridles installed on the rails, I soldered the throw rod from a preassembled switch stand. Then I spiked the switch stand in place. A dab of two-minute epoxy helps secure the switch stand to the tie.

Once the switch stand is in place, I spike the fixed ends of the stub to match the throw of the rails secured to the switch stands.



Moving men and matériel was a major function of railroads during World War I. After these U.S. Marines arrived in France by ship, they boarded a train that would take them to camp for training. *Library of Congress*

In this 1918 photo showing an example of trench warfare, American soldiers "go over the top." *Library of Congress*

By the time the United States got involved in the war, both the Allies and Germans had created an extensive network of standard and narrow gauge rail lines to supply the immense logistic needs of the armies, **1**. It was during World War I that the primary tonnage demand shifted from forage to ammunition. The wagons, trucks, lorries, and dirt roads of the time were inadequate to support the million-man armies and tens of thousands of cannons deployed in a highly concentrated area. Only the railroads could satisfy this logistic demand.

The trenches of WWI are the most well-known aspect of the conflict, **2**. On the Western Front, the defensive works extended approximately 470 miles in a continuous line from the Belgian coast to the Swiss border, except in the Vosges Mountains of Alsace-Lorraine, where there were fewer trenches due to the mountains.

With the multiple lines arranged in a saw-toothed or crenelated pattern, the total length of the trenches was enough to circle twice around the Earth. From 1914–1918, the Western Front could have been the largest city on Earth in population with 6.1 million fighting men and an area of 3,760 square miles. The English presence alone in Belgium (Flanders) and France equaled the population of London at the time but with less housing, transportation, utilities, and sanitation that such a city requires.

Given the enormity of the trench network, it is not surprising an extensive standard and narrow gauge rail network grew to support this military "city." Existing standard gauge lines fed the ever-changing narrow gauge lines, but several new standard gauge lines had to be built to meet needs beyond what the prewar civilian network could handle.

The trench railroads of WWI grew in a few years' time from practically nothing to possibly the greatest network of narrow gauge rail lines ever built. The Allies alone had about 5,592 miles of narrow gauge track on the Western Front, **3**. The Germans had a comparable system called *heeresfeldbahn*. There were also narrow

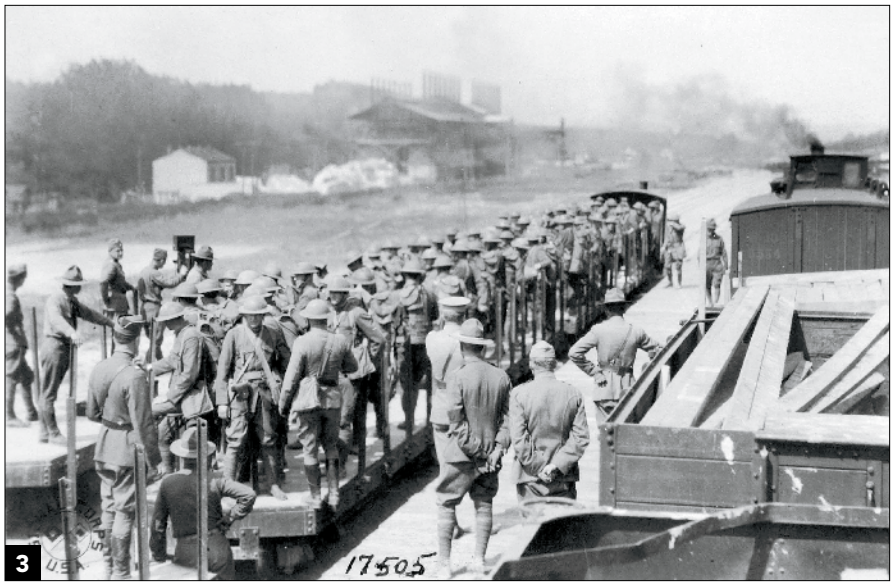
gauge lines used in other areas of the world, including Poland, Russia, Austria, Italy, and parts of Africa and the Middle East.

The Germans, French, Austrians, and Russians were first to adopt narrow gauge lines in support of their operations, choosing 60cm as their track gauge. The British were slow to adopt them. They believed the trench phase of fighting was temporary and that mobile warfare would return, making narrow gauge lines to support the trenches unnecessary. After the costly campaigns of 1916 did little to break the stalemate, the British changed their approach and widely adopted light railways to support their armies in the trenches.

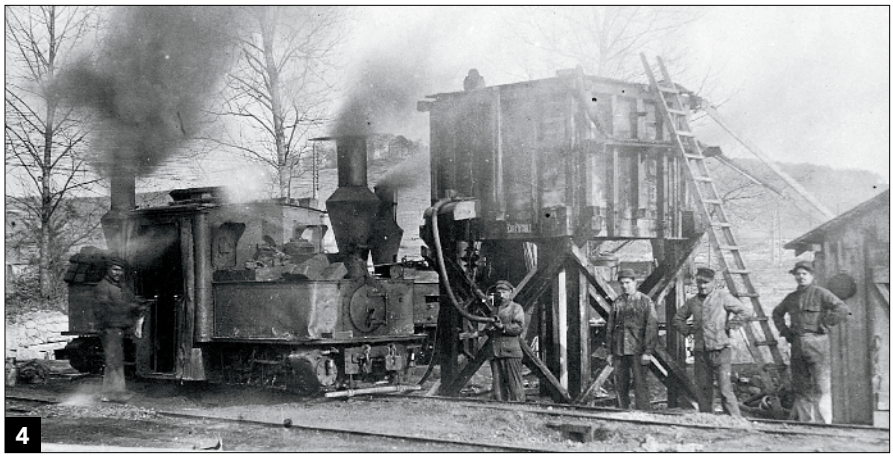
The light railways relied on a variety of tiny steam and gas mechanical engines to pull equally tiny railcars, **4**. While the light steam engines were relatively reliable and powerful, they could not be used near the front lines where steam and smoke from their boilers would draw enemy fire. Instead, even smaller gas mechanical engines would haul a few cars at a time to the front line depots, **5**. Trains hauled by steam-powered light railway engines with cargo from standard gauge lines would have to make an intermediate stop. There they would swap power from steam to gas mechanical engines and redistribute cars for additional deliveries to the front line depots. In some cases, the final delivery over the last hundred yards or so was done with human-powered tramways.

French and British industries were unable to supply all of the equipment needed by the Allies. American industry helped fill the gap. Baldwin, Alco, and other manufacturing companies provided more than 500 locomotives and thousands of cars of rolling stock to the Allies. Because the warring sides used compatible equipment, it was not uncommon for military railroads to use captured equipment. This makes an interesting hodgepodge of equipment to select from in choosing a railroad to model.

The light railways used rail ranging from 16 to 25 pounds per yard, with



3 The U.S. Army Signal Corps films the transfer of troops from standard to light railways near Sorcy, France, in July 1918. The soldiers will ride on light railway flatcars to the front. *Signal Corps, National Archives*



4 Shown at the French light railway water stop near Dombasle in the U.S. Army sector, some of the double firebox Pechot-Bourdon locomotives were built by Baldwin in Philadelphia in 1916 for the French. *National Archives*

5 The Moseley Railway Trust restored this Simplex gas mechanical engine and several wagons. The engine shown here was aptly nicknamed "Tin Turtle." The soldiers on the wagon are modern-day reenactors. *Gareth Roberts*

6

This diorama by Rameesh Bishop illustrates a typical scene at the forward railhead depicted in the track plan. *Ramesh Bishop*

7

Commercial kits for 1/96 scale LSTs are readily available and can easily be used on an HO layout. This radio-controlled model depicts a typical LST loaded with vehicles. Modifying it as a rail car ferry would not be difficult. The model was built by Tom Foller.

Railroad reconstruction was hard pressed to keep up with the speed of the Allied advance, but the Army engineers lived up to their motto *Essayons* (French for "Let us try") and tried their best. On August 17, after many delays, the first of a scheduled 32 trains bearing supplies for the Third Army arrived at Le Mans, a major yard southwest of Paris.

The big terminal at Le Mans had been almost completely demolished by air raids. One roundhouse was completely destroyed, the other badly damaged, and the machine shop about two-thirds demolished. In addition, tracks were torn up and locomotives damaged. However, enemy destruction of rail lines, bridges, and equipment was about half as much as was expected. Destruction by the Allied air forces had a more disastrous effect on the Allied logistic capabilities than the enemy's operations.

Most of the route restored to operation thus far was single track, and there was virtually no signal system. Without a working signal system, train crews flagged trains during darkness using flashlights, cigarette lighters, and even lighted cigarettes.

With single-track lines and heavy traffic, it was not long before congestion developed. Meanwhile, a shortage of empty freight cars developed, even though much French rolling stock was captured intact, because combat units were slow to unload cars in the forward depots—a lesson they should have learned from the Civil War and Haupt's Rules (see page 20).

Beyond the Seine, the entire railway picture was considerably brighter. For one thing, a much more extensive network existed to the northeast, including many of the main French lines, and it had been kept in much better repair. More importantly, the railways in that area were not as badly damaged by air attacks or hastily retreating Germans.

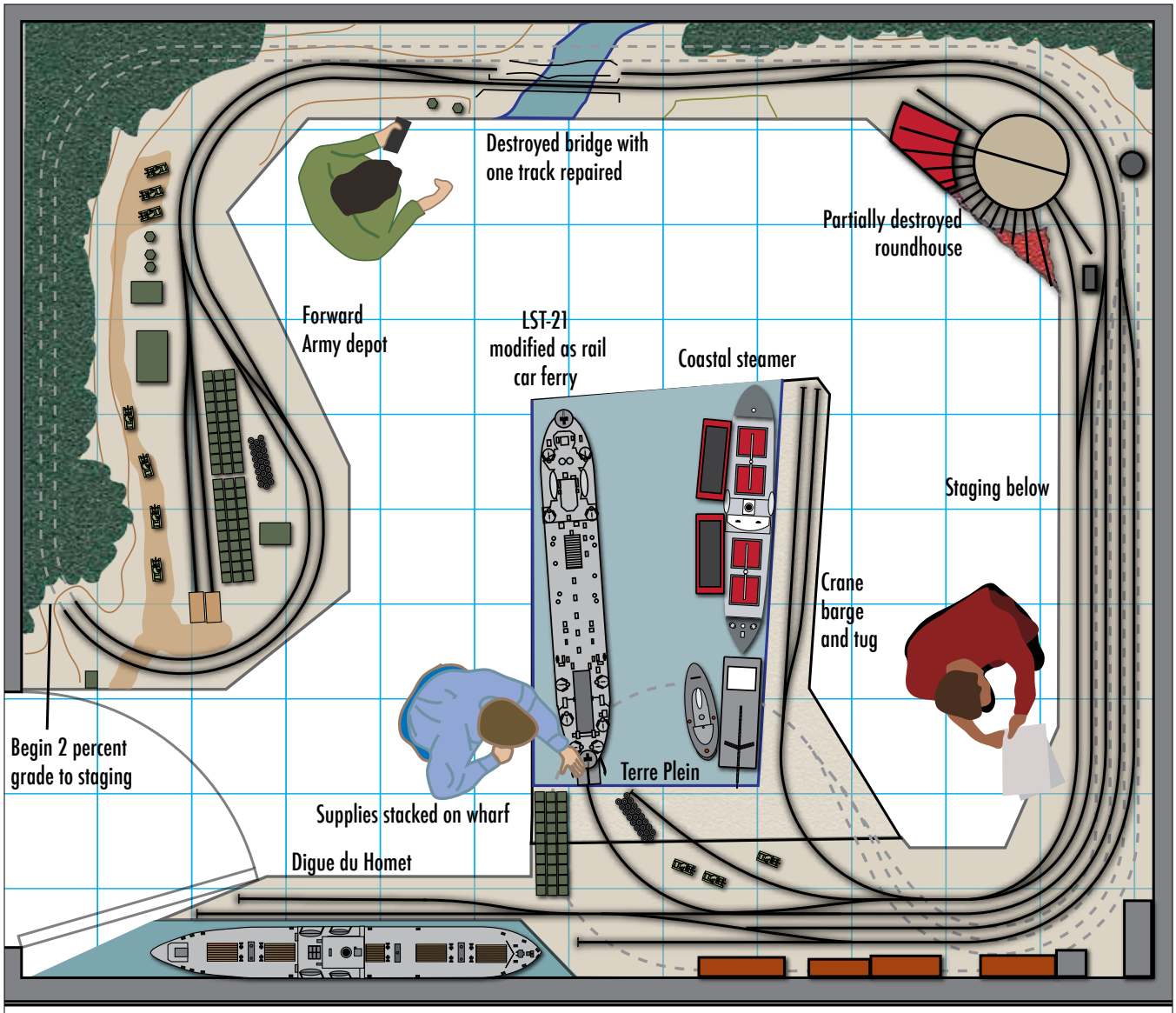
By the end of September, the Allies had rebuilt around 3,400 miles of track and more than 40 bridges. Tracks were open as far as Liege in the north and to Verdun and Toul in the south.

This progress was reflected in the increasing tonnages forwarded by rail. As of August 1, cumulative rail shipments had totaled only 1 million ton-miles. A month later, the total had risen to 12.5 million, and by mid-September, shipments were averaging nearly 2 million ton-miles per day.

Though the railways assumed a greater and greater portion of long-distance hauling, motor transportation was still important. The seemingly insatiable demands of the growing Allied armies exceeded all transportation resources. In mid-September, bottlenecks in the Paris area and shortages of rolling stock still constituted serious limiting factors, and the railways were only beginning to come into their own as the principal long-distance carriers. Eventually, the Allied offensive stalled at the frontier of Germany while logistics caught up.

The Cherbourg layout

The layout depicts Cherbourg in October 1944, when the port was in near full operation; although, many facilities were functioning with temporary repairs and LSTs were



Cherbourg Harbor

Locale: Normandy, France
Date Modeled: October 1944
Prototype: 728th and 729th U.S. Military Railway Operating Battalions
Scale: HO
Overall size: 10' x 12'

Minimum radius: 18" gauge
Turnouts: No. 6, some curved
Track code: 83 standard

The ships are modeled at 1/96th scale using commercial kits

ferrying railroad equipment to France. The layout uses the same 10 x 12 room found in other plans in the book.

The actual Cherbourg harbor is nearly 1,500 acres, so this plan is necessarily compressed and shows just a small portion. Still it captures the operational essence of the port.

The layout is a point-to-loop style plan. The port occupies the point, while the loop represents the front-line depots and railheads in staging, **6**. The plan includes one depot in the modeled area to provide a spot for switch jobs to work after leaving the port and before entering staging.

The peninsula housing the main pier represents the Terre Plein where LSTs docked and the Allies built a wharf along the seawall at the Reclamation. The Digue du Homet along with a Liberty ship occupy the lower left. The tracks on the Digue and the wharf provide switching locations as well as