# Containerization and the Changing Nature of American Railroads

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## Introduction

In the past thirty years, America's railroads have seen many changes in equipment technology. The development of the 100-ton wheelset in the 1960s led to increased sizes and capacities in freight cars. At the same time, a trend was growing towards the use of unit bulk commodity trains such as coal or grain trains. Perhaps the one greatest change in railroad freight car technology has come about in the growth and development of intermodal railcars.

What is intermodal? Muller (1989) defines intermodalism as the movement of cargo using several different methods of transportation. Whenever a railroad hauls highway trailers or sea containers, it is an intermodal movement. Thus, the railcars involved in such movements became known as intermodal railcars. Intermodalism did not make a significant impact on railroads until the 1950s when advances in railcars and loading terminals made it practical to use piggyback services (DeBoer 1992). In addition, in the 1960s the sea container was growing in popularity with shipping companies as well, and more and more were showing up on America's railroads (Hannes 1996). These factors led to the development of today's modern intermodal railcars.

## The Eighty-Nine-Foot Flatcar

Prior to the early 1960s, the 50-foot flatcar was the usual piece of equipment used for intermodal movements (DeBoer 1992). These cars were equipped with one trailer hitch to allow one highway trailer to be secured to it. These cars were not very efficient, though, since the weight of the flatcar itself (mostly due to the wheelsets) did not make it economical to ship one trailer per car (DeBoer 1992). The flatcars would be more efficient if two trailers were hauled. A 75-foot flatcar design was produced in the mid-1950s to solve this, but it was only capable of hauling 35-foot trailers. In 1957, 40-foot trailers were allowed on American highways thus making the 75-foot cars obsolete (DeBoer 1992). Consequently, railroads began looking into 85-foot and 89-foot flatcar designs. The first cars produced could carry two trailers up to 40 feet in length each.

At the same time, more and more sea containers were showing up on railroads. Usually they were hauled piggyback-style on their wheeled chassis (Hannes 1996). However the flatcars would be lighter if the containers were carried without the chassis. In 1966, American Car & Foundry (ACF), a major railcar manufacturer, designed an 89-foot flatcar with two trailer hitches that could be folded down to accommodate containers (Hannes 1996). In addition, there were eight container pedestals on each side that could be positioned on one foot increments to secure various combinations of containers (Hannes 1996). Other manufacturers including Pullman-Standard and Bethlehem Steel built virtually-identical versions of this car (Chatfield 1992). This new "all-purpose" flatcar proved to be a popular design and was the backbone of the American intermodal railcar fleet until the 1980s. Most were owned by the Trailer-Train Corporation, a nationwide railcar pool operator (DeBoer 1992).

In the late 1970s, 45-foot trailers came into use thus forcing Trailer-Train and the railroad owners to rebuild the 89-foot flatcars with the hitches spaced further apart (Casdorph 1988). Cars rebuilt with this modification are usually stenciled "Twin-45" of "Dual-45" indicating the car's capability to handle two 45-foot trailers. Some 89-foot intermodal flatcars were rebuilt with a third collapsible hitch in the middle allowing it to carry two 45-foot or three 28-foot trailers (Casdorph 1988). Figure I shows one of Trailer-Train's (now called TTX Corp.) 89-foot all-purpose flatcars. Figure 2 is a container pedestal on modern intermodal flatcar.

## Intermodal Flatcar Conversions

In the early 1980s, the growth of intermodal rail movements caused a shortage in available railcars (Casdorph 1988). At the same time, railroads found themselves with a surplus of general-service flatcars (Panza 1990). Naturally, the railroads began converting older 60, 85, and 89-foot flatcars into intermodal flatcars capable of handling 20-foot of 40-foot container combinations (Casdorph 1988). Figure 3 illustrates one of these flatcar conversions. Some railroads even cut boxcars down into intermodal flatcars to alleviate intermodal railcar shortages (Casdorph 1988). These rebuilds were equipped to handle one highway trailer up to 48 feet in length and are interestingly similar to the original 1940/50s piggyback flatcars.


FIGURE 1. A TTX Company (Formerly Trailer-Train Company) 89' All-Purpose Flatcar. Note the trailer hitch in the upright position (G. Hannes Photo).

FIGURE 2. A close-up of a container pedestal on a Denver, Rio Grande, and Western COFC Flatcar (G. Hannes Photo).

## Spine Cars

In the 1970s, the Atchison, Topeka & Santa Fe Railway (ATSF) began looking into lightweight, articulated flatcar sets for use in piggyback service. This design consisted of 10 flatcar units joined together on articulated wheelsets, meaning that each adjacent unit shares one wheelset with the other. This reduces weight, maintenance, and coupler slack (Hannes 1996). In addition, the flatcar units were built with only a center sill (for linear structural support) and a small platform to support the wheels of the trailer. This design greatly reduced weight (DeBoer 1992). These cars became known as "spine" cars because of their skeletonlike design. These early cars could only carry highway trailers and were not equipped to haul containers without their chassis. The vast majority of spine car sets manufactured since the initial ATSF 10-unit cars were built in 5-unit sets (Casdorph 1988). In 1987, Trailer-Train purchased a small group of 5-unit spine cars without trailer hitches and equipped solely for containers mounted on pedestals (Casdorph 1995).

In 1989, the 5-unit articulated spine car design was updated by including container pedestals on each unit to handle containers (Panza 1991). This design, called the all-purpose spine car, has become a popular trailer-carrying flatcar and has only been revised to accommodate larger trailers (up to 53 feet on the newest ears). One is shown in Figure 4.

## The First Double-Stack Container Cars

In the 1970s, the growing use of transcontinental "landbridge" container shipments caused some railroads to look into more efficient ways to handle sea containers (Muller 1989). In 1971, the Canadian National Railway tested an 85-foot flatcar design that could hold four stacked 20-foot containers in between the wheelsets and another 20-footer over each wheelset on the ends (Hannes 1996). However, the weight of even four fully-loaded 20-foot containers would exceed the capacity limit of the car. Consequently, the design was not mass-produced.

In 1976, the Southern Pacific Railroad began working with ACF on a new type of railcar that could carry two containers, one stacked upon the other, in a "well" between the wheelsets of the car (Hannes 1996). Rather than having a center sill as on conventional flatcars, the sides of the well would act as the sill, thus allowing the bottom container to sit low to the ground (only 14 inches from the railhead) to maintain a low center of gravity and to conform to height clearance requirements (Sperandeo 1983). Triangular bulkheads had devices mounted on them to help hold the upper container in place. The first single-unit ear was produced in 1977, followed by a 3-unit articulated design in 1979 (Hannes

(continues on page 64)

FIGURE 3. Two OOCL 20' containers set on a VTTX 60' Flatcar (G. Hannes Photo).

FIGURE 4. An All-Purpose Spine Car with a Sea-Land Refrigerated Container (G. Hannes Photo).

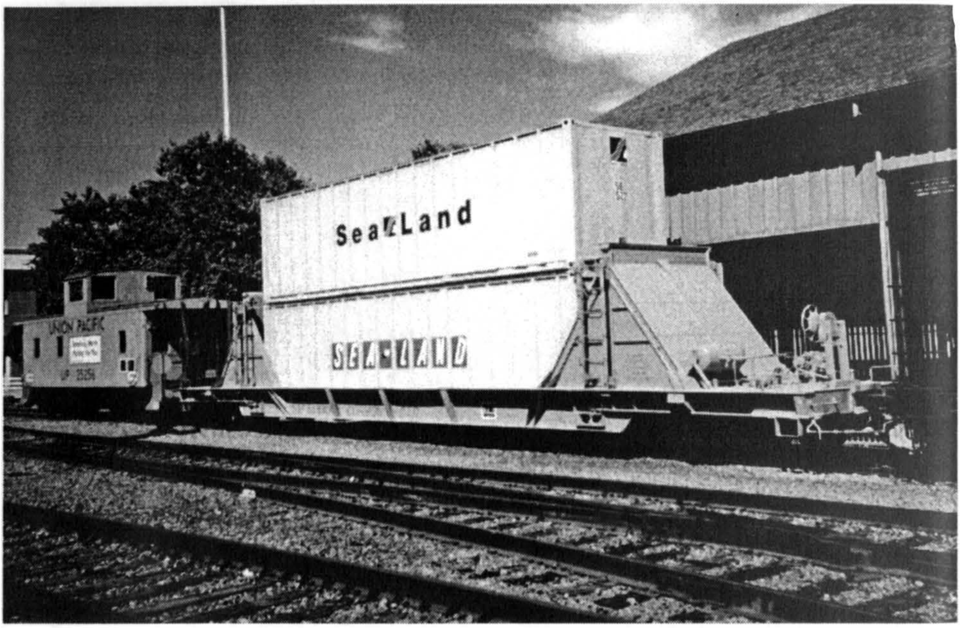


FIGURE 5. The first Southern Pacific Railroad Stack Car at the California Rail Museum (M. Hannes Photo courtesy of Model Railroad Magazine).


FIGURE 6. An example of a Thrall Double-Stack Car (G. Hannes Photo).

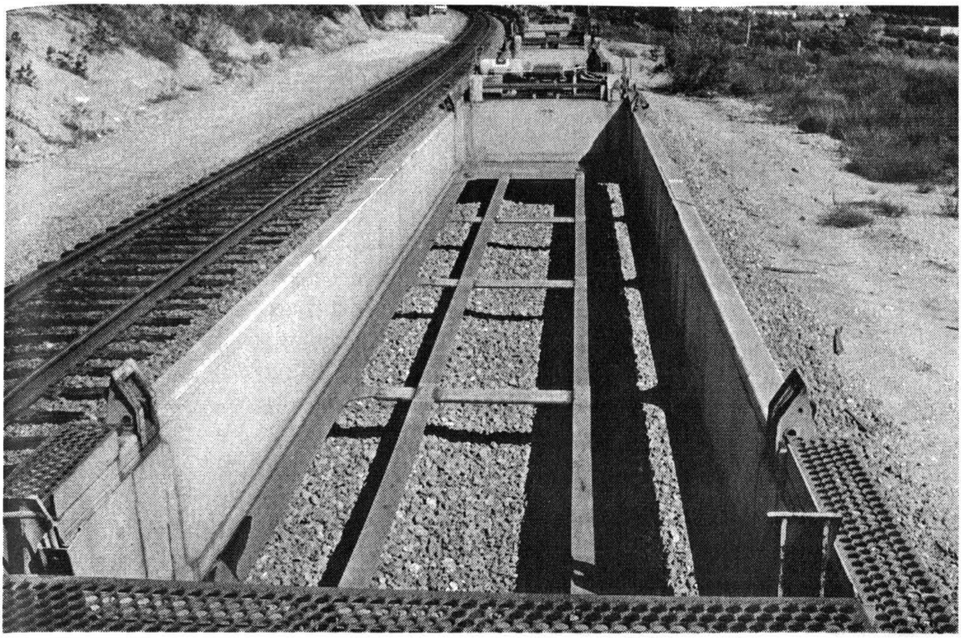

FIGURE 7. An inside view of the lacy nature of a Thrall Double-Stack Car. Notice how close the car is to the ground (G. Hannes Photo).


FIGURE 8. A Burlington Northern Twin Stack Car. Note the bulkheads for holding the containers (G. Hannes Photo).

1996). Both cars were successful, and forty-two 5-unit ears were produced in 1981 (Casdorph 1993). They became known as "double-stack" cars because of the unique way they hauled containers. Figure 5 shows one of the first ACF double-stack railcars.

## The Thrall Double-Stack Car

The ACF double-stack railcar was the only design in use until 1984 when the Thrall Car Company offered another new design. The 5-unit Thrall LO-PAC 2000 design, shown in Figure 6, did not use bulkheads to hold the upper container in place. It relied only on small locking devices called inter-box connectors (IBCs) to lock the upper container in position. Until this time, IBCs were only used to secure containers together on board ships. By eliminating the bulkheads, the LO-PAC 2000 design reduced car weight (Hannes 1996). However, some railroad officials thought that the design would not be safe. As time went on, these cars proved to be just as safe as others. Figure 7 shows the interior construction of these cars.

## The Twin-Stack

In 1985, Gunderson Incorporated, another railcar builder, acquired a double-stack car design from the FMC Corporation's railcar division called the Twin-Stack (Hannes 1996). It, like the earlier ACF design, used bulkheads to support the top container. The Twin-Stack also incorporated some structural component modifications that reduced car weight and allowed an increased container payload. Figure 8 illustrates a Gunderson Twin-Stack car and Figure 9 shows an articulated connection on one.

## The Backpacker

Trinity Industries, a new railcar manufacturer to enter the scene at the time, began producing a 5-unit double-stack railcar called the Backpacker in 1986 (Hannes 1996). It was similar to the Thrall LO-PAC 2000 design. The main difference in structure was that the Trinity car had smooth side panels whereas the Thrall car had vertical posts on the sides. Refer to Figure 10.

## The Maxi-Stack

Gunderson soon found that the Twin-Stack still could not compete with the lightweight Thrall design. In addition, safety fears were being put to rest as the Thrall cars operated for years without problems. In 1988, Gunderson introduced a design called the MAXI-STACK which


FIGURE 9. The articulated joint between two units of a Twin Stack Five Unit Set (G. Hannes Photo).


FIGURE 10. A Trinity Well Car with a Sea-Land 45' Marine Container and a Triton 40' Marine Container (G. Hannes Photo).


FIGURE 11. An example of a Gunderson Maxi-III Double Stack Five Unit Car Set (G. Hannes Photo).

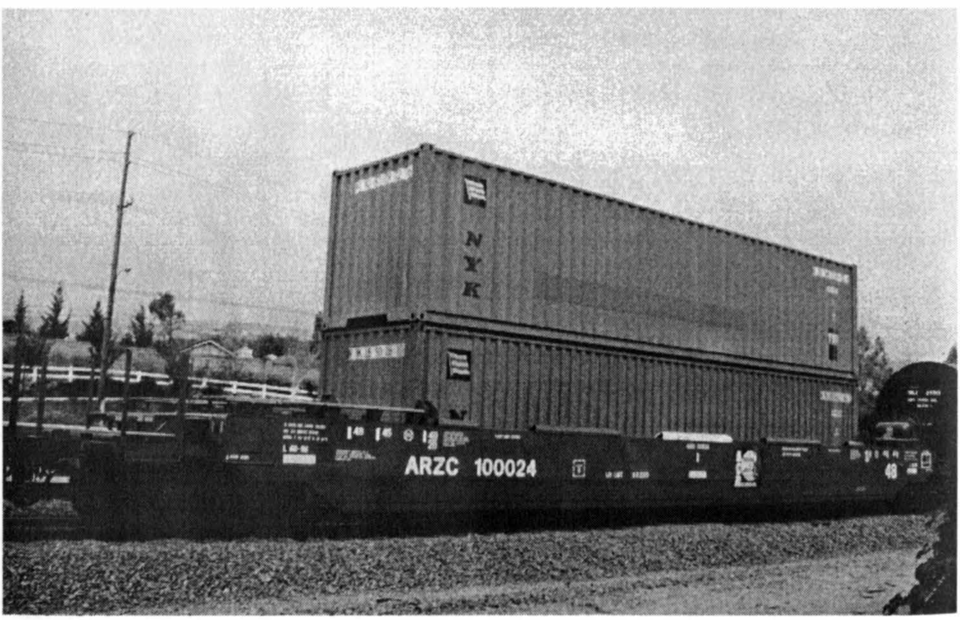


FIGURE 12. An Arizona-California Husky Stack Car with NYK Marine Containers. These containers are carrying hay through Yorba Linda, California, bound for shipment to Japan (G. Hannes Photo).

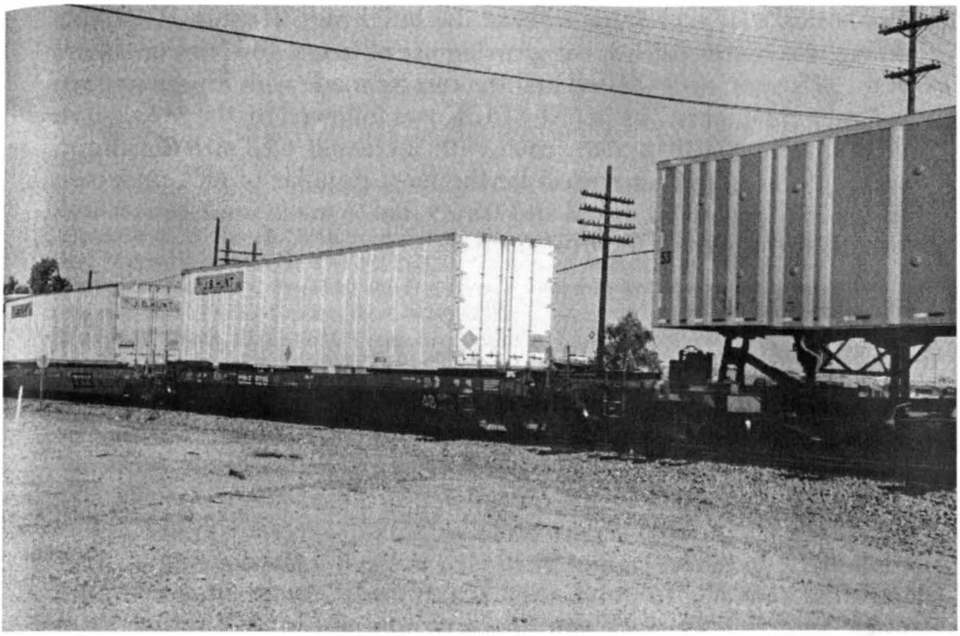

FIGURE 13. A J. B. Hunt Trailer Sets inside an All-Purpose Well Car. The 53' Trailer to the extreme right rides on a All-Purpose Spine Car Set (G. Hannes Photo).

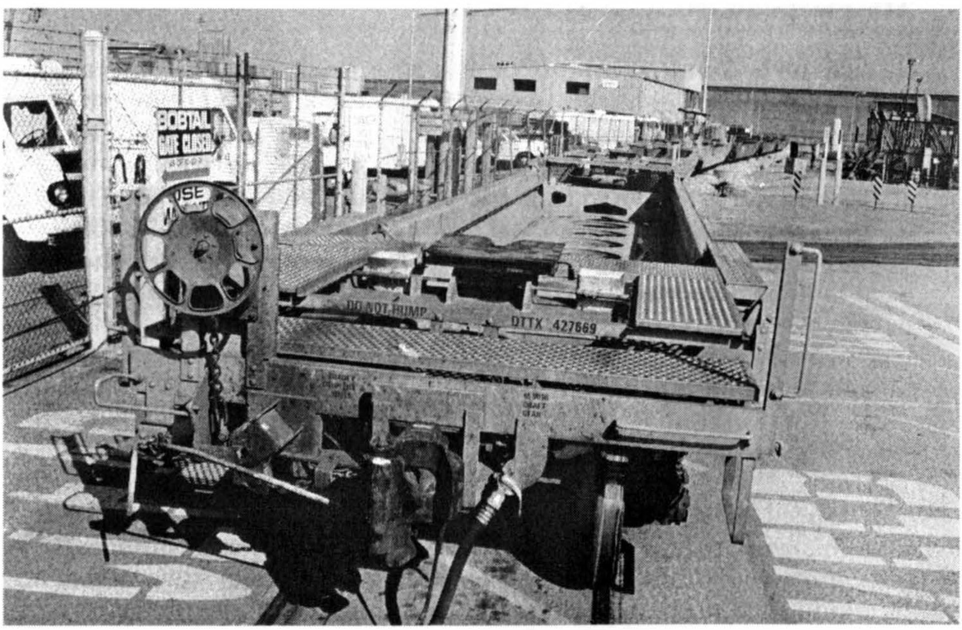


FIGURE 14. An empty All-Purpose Stack Car Unit at the Port of Long Beach, California. Note the truck trailer hitch near the front of the railroad car (G. Hannes Photo).

was basically a Twin-Stack without the bulkheads (Hannes 1996). This design was successful, but the growing use of larger, 48-foot, containers in the U.S. soon necessitated that the cars be made with longer wells to fit larger containers. The MAXI-STACK was followed by the MAXI-II in 1988 and MAXI-III in 1989, each with increased well size (Casdorph 1993). The MAXI-III proved to be the most popular of all Gunderson designs (see Figure 11). Thrall and Trinity had to make similar modifications in the design of their cars as well.

## Single-Unit Cars

Twenty-foot containers are often just as heavy as 40-foot containers; thus it stands that a freight car loaded with two 20-foot containers in the bottom position and one 40-footer on top (20-footers cannot be put in the top position) would equal the weight of three 40-foot containers. This proved to be a problem on articulated railcars because the shared wheelsets decrease each unit's weight capacity. Oftentimes 20-foot containers, therefore, cannot be hauled in the intermediate units of articulated railcars. To solve this, Thrall and Gunderson have built single-unit double-stack cars to carry containers with heavy loads (Hannes 1996). One is exhibited in Figure 12.

## All-Purpose Double-Stack Cars

In 1993, Gunderson introduced a new single-unit double-stack railcar that had trailer hitches over each wheelset and a floor piece thus allowing highway trailers to be set into the well (Hannes 1996). This allows the car to be used either in container or trailer service. This new all-purpose car is shown in Figure 13 and Figure 14. Thrall, Trinity, and a Canadian manufacturer, National Steel Car Company, have all subsequently designed similar all-purpose double-stack cars. So far most have been built as non-articulated cars; but in 1995. Gunderson began producing a 3-unit articulated set of all-purpose double-stack cars. At the time of this writing, no other companies have built articulated all-purpose car sets though it is expected they will.

## Conclusion

Indeed, the development of intermodal railcar technology has forever changed the face of American railroading. Intermodal shipments continue to grow as more shippers switch from boxcars to truck trailers. In addition, as more and more containerships are built that are too wide to fit in the Panama Canal, the railroad systems are acquiring an increasing amount of coast-to-coast "landbridge" container shipments. These changes are helping the American freight railroads move into the

21st century.

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