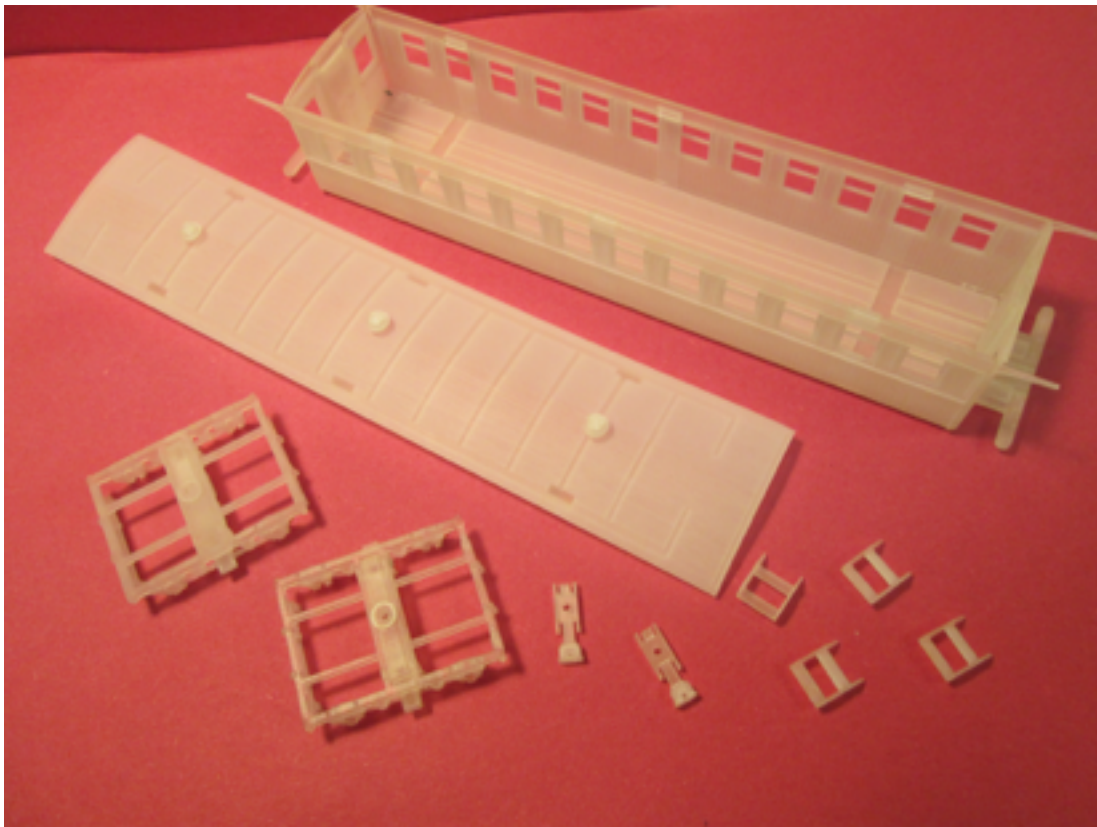


## Building a 3-D Printed Coach by Al Mueller

Gerry Dykstra has created an antebellum/Civil War era coach on the Shapeways web site. Gerry used Inventor software to design the car. His finished product, in my opinion, is a much more accurate rendition of a passenger car of this era than anything previously available in HO Scale. It is somewhat freelanced, taking its length, number of windows, truck centers and truck wheelbase from E.P. Alexander's book "Civil War Rail Roads and Models", Figures 180 and 183. John White's "American Railroad Passenger Car Design" also influenced the design, as did Gerry's visits to the Pennsylvania Railroad Museum. The trucks are based on actual measurements Gerry took there. The roof, ventilators, window size, radiused corners and recessed doors with radiused side posts came from the Cumberland Valley car at the museum. The car length is 46'6".

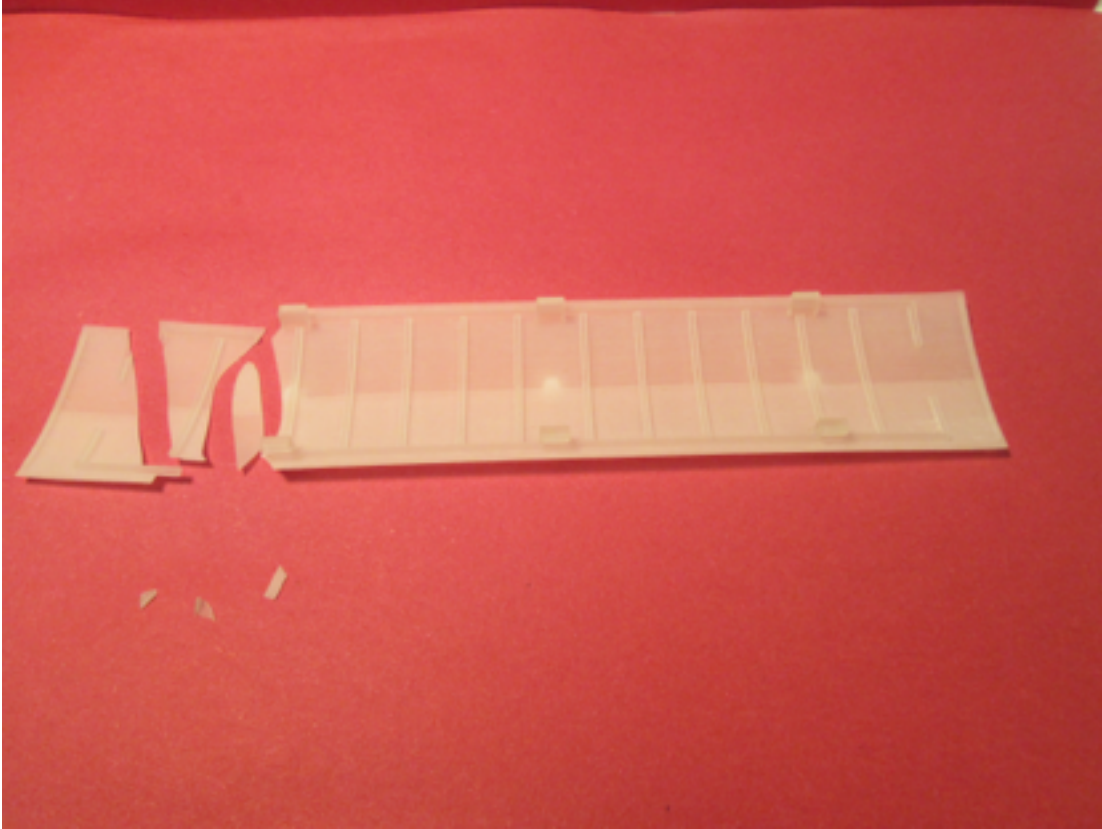
When printed in "Frosted Ultra Detail" by Shapeways, the level of detail on the car is excellent! All details are crisp and clean. The three roof vents are see-through with four (4) 0.012" posts supporting each vent cap. It is amazing what can be accomplished with 3-D printing!

As delivered from Shapeways, the model consists of a one-piece body and frame, roof, four stairs, two link and pin couplers and two trucks (less wheelsets), as shown in the following photo (photographed after washing as discussed below).



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The major drawback to 3-D printing using “Ultra Fine Detail” is that parts made to exact scale, as this car is, can be VERY brittle. Gerry tried printing the car using other Shapeways materials but the level of detail suffered. The photo below shows what happens when the roof is flexed a little too much. **TREAT THE PARTS GENTLY!**

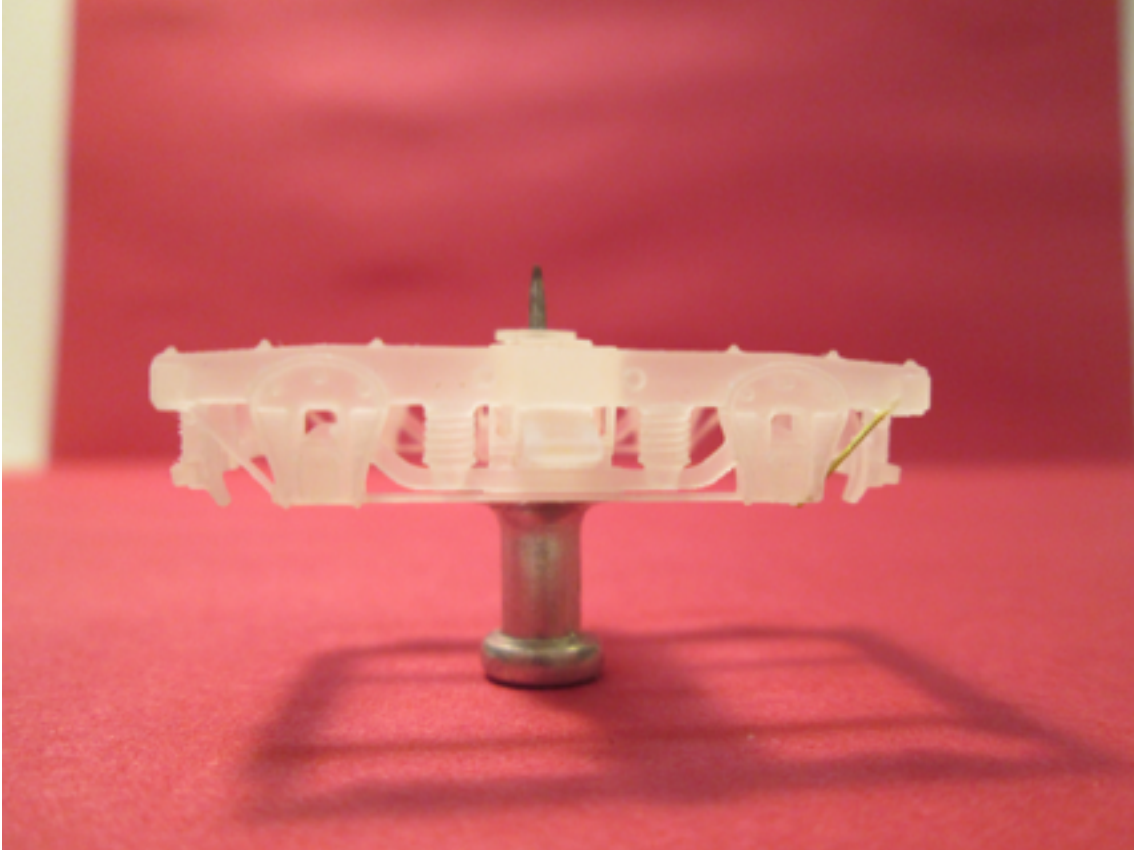


The following narrative explains how I assembled the kit:

1. Ream the truck axle journals with an EXXACT SOCKET sold by Micro-Mark. BE CAREFUL! Spread the sideframes GENTLY! Four turns in each direction for each bearing was sufficient for me to GENTLY install Semi-Scale 33” InterMountain wheelsets #IRC 40052. These sets have 1.005” length axles. The trucks roll fabulously with them!
2. Wash the parts (I used a clear Pyrex pan). Do NOT attempt to hold the stairs with tweezers while washing; they will break! The parts have an oily residue from the printing process. Shapeways recommends cleaning with a product called “Bestine” (see their web site). Others recommend repeated baths in alcohol and washing with dish soap. After each washing in dish soap, let the soap stand for 10-minutes, then inspect it for any sediment you have washed off. Once you don’t see any sediment, the parts should be clean and appear almost

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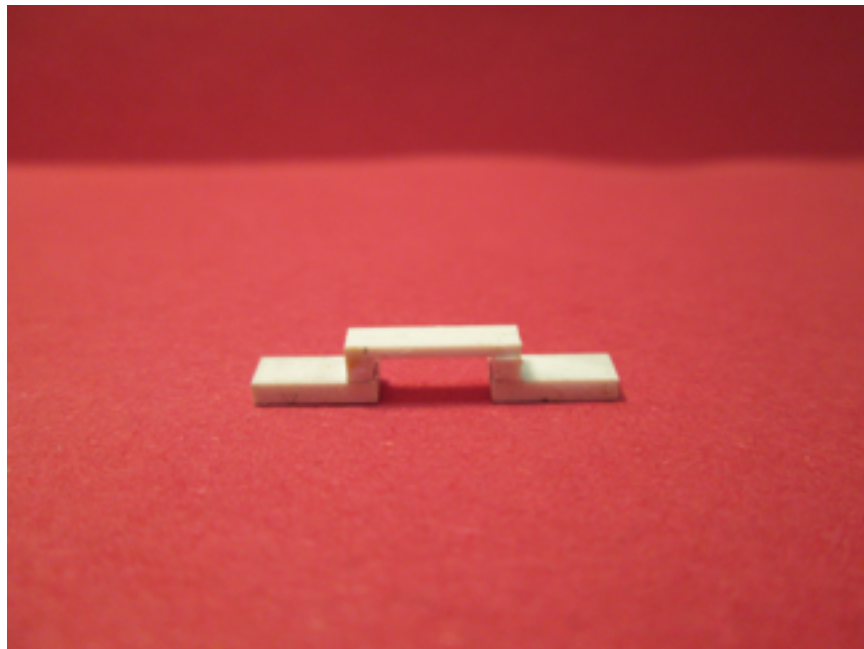
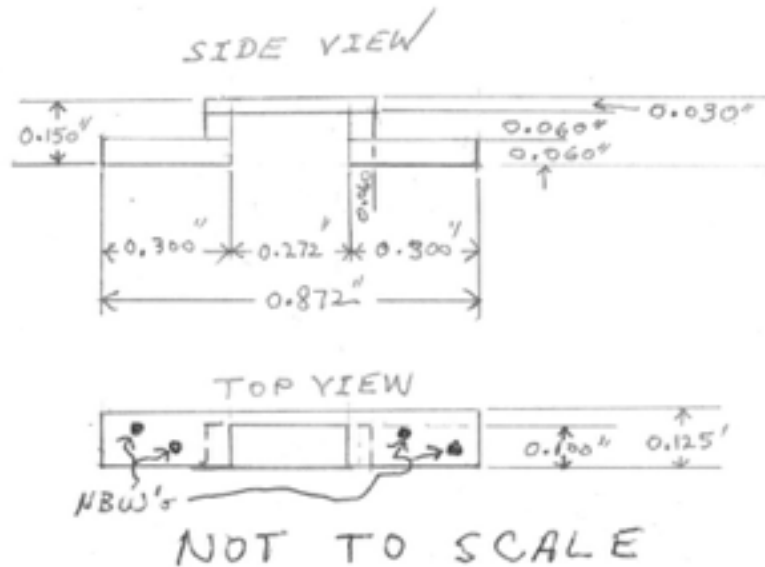
transparent. Getting the parts absolutely clean and oil free is critical. I used repeated scrubbing with a Lysol solution instead of Bestine or alcohol, and had problems with paint adhesion. The 0.012" rods at the corners of the trucks may break during washing. They can be easily replaced by drilling holes and inserting 0.012" brass wire, as seen in the photo below.



3. Locate and drill holes for the grab irons (on car ends), brake staffs and railings. I used 0.015" brass wire for the grab irons and railings and 0.019" brass wire for the brake staffs.
4. CAREFULLY fit the roof. It has 6-tabs which engage 6 similar tabs on the body. Start by placing the roof on the body so the tabs are in line and touching. GENTLY lift the roof ends to clear the body ends as you GENTLY slide the roof on. If you feel any resistance, BACK OFF! I found it necessary to lightly sand each notch face. I made four strokes on each notch using a 1.5" square piece of 220-grit wet-or-dry sandpaper. To remove the roof, GENTLY lift the ends to slide it off. Attaching and removing the roof is a delicate process!

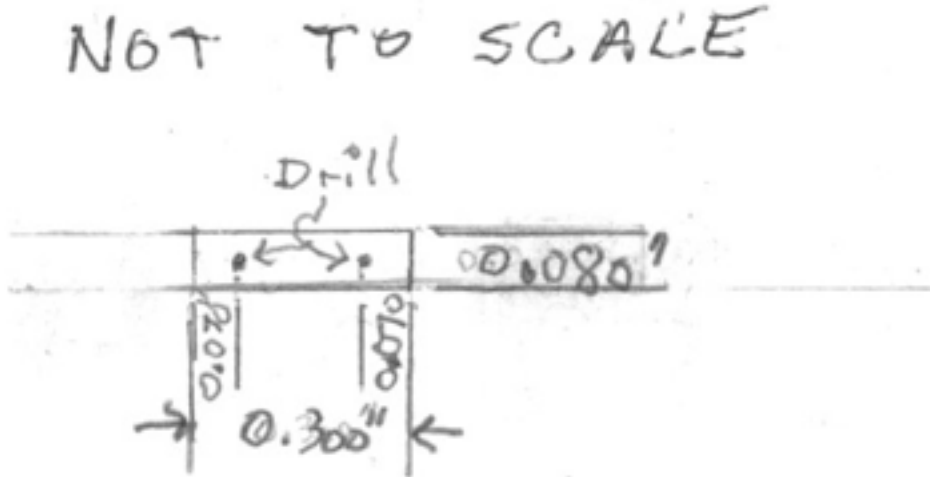
## Building a 3-D Printed Coach by Al Mueller

5. Drill each end beam 0.026" (#71 bit) for four (4) Grandt Line #5093 2.5" nut-bolt-washer (NBW) castings. Also drill and tap the dimpled holes in the bolster for 0-80 screws to secure the trucks.
6. Make two (2) brake hangers using 0.060" X 0.060", 0.060" X 0.100" and 0.060" X 0.125" styrene, as shown in the diagram and photo below. Glue them in place as shown in the photo on page 5.



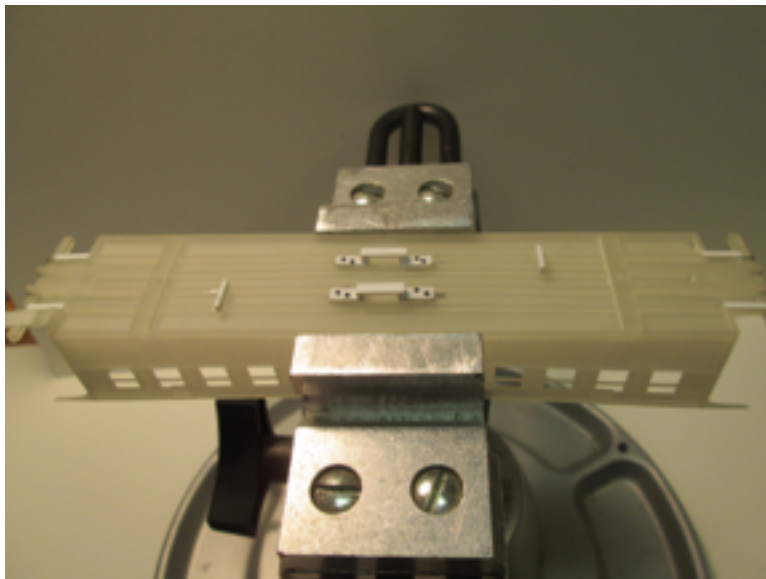
## Building a 3-D Printed Coach by Al Mueller

7. Make two (2) brake rod supports from 0.040" X 0.080" styrene as shown in the diagram below.



These hold the ends of the brake rods beneath the trucks. Drill 0.021 (#75 bit) holes as shown. Position these 0.540" in from the inside edge of each bolster and glue in place as shown in the photo on below.

8. Drill eight (8) holes in the brake rod supports as shown in the diagram above and the photo below. Drill 0.0225" (# 78 bit). Add eight (8) Grandt Line #5098 2.25" NBW castings as shown.



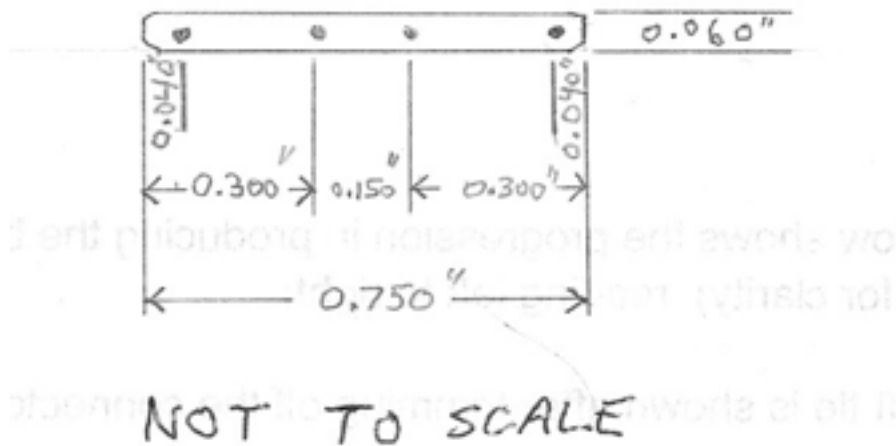


## Building a 3-D Printed Coach by Al Mueller

9. Make two (2) brake levers from 0.015" X 0.060" strip brass as shown in the photo below.

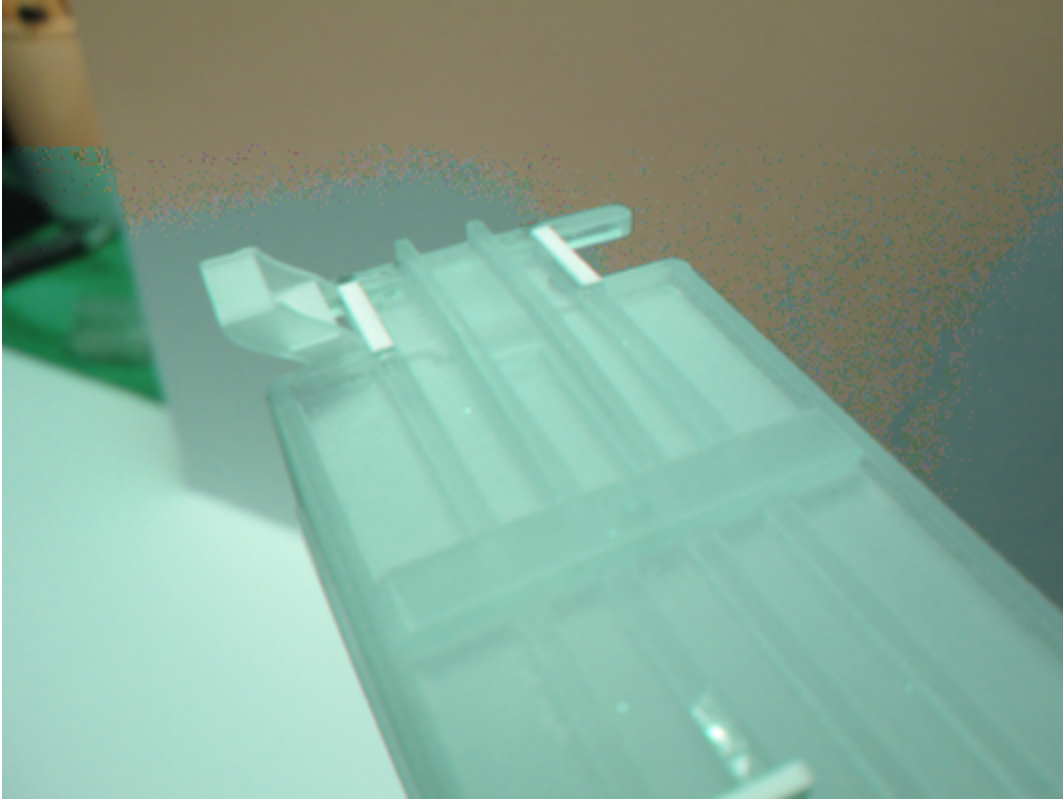


Drill 0.021" (#75 bit) holes in the levers as shown in the diagram below.



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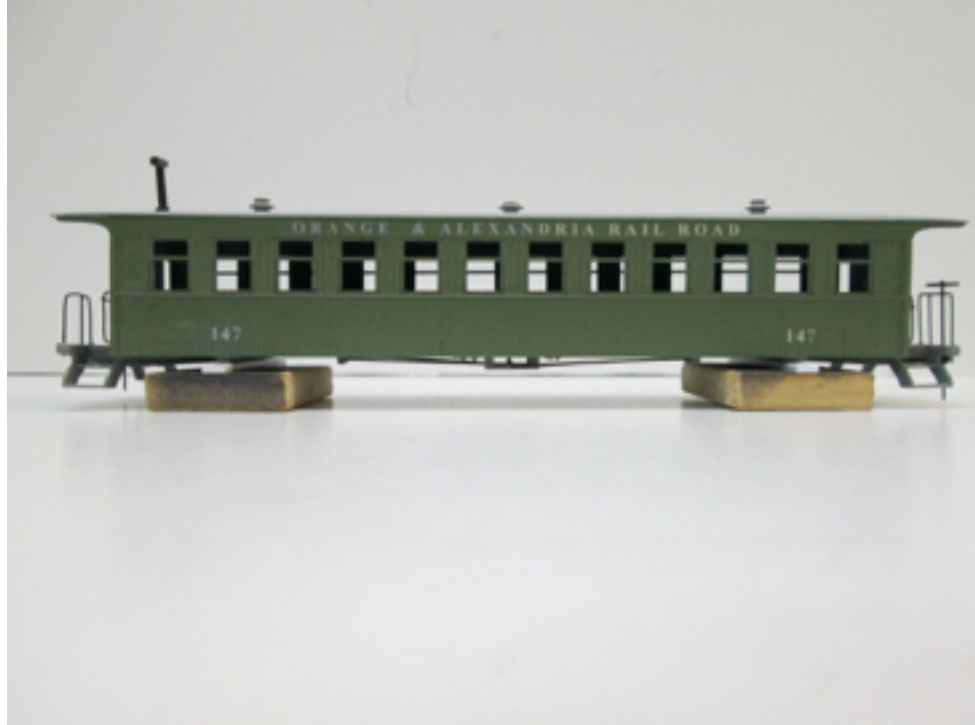
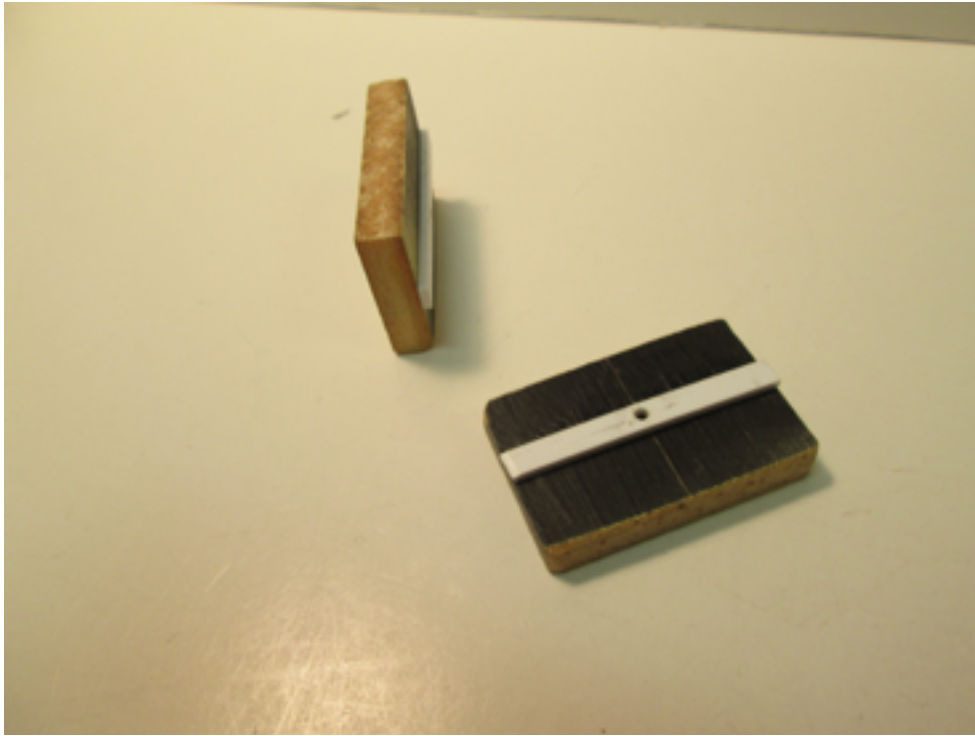
10. Cut four (4) pieces of 0.020" X 0.060" styrene to a length of 0.350" and glue in place flush with the edges of the end platform stair notches, as shown in the photo below. These strips will allow you to install the stairs easily.



11. Butt the stairs against the strips attached in step 10., above and glue in place using ACC.
12. Make two (2) wood blocks 0.25" thick X 1" X 1.5". Cut two (2) pieces of 0.060" X 0.156" styrene 1.5" long and glue to the center of the blocks as shown in the photos below. Drill two 0-80 clearance holes in the center of the blocks and attach them to the body bolsters. These block will help prevent the stairs and the details from being damaged during the assembly process (the voice of experience).

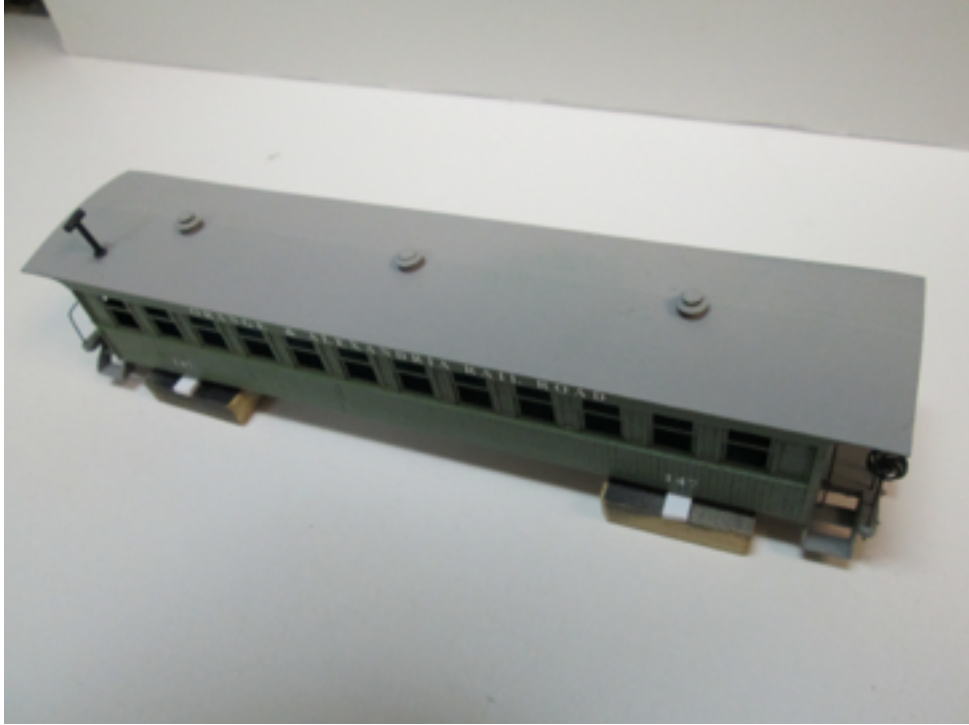
# Building a 3-D Printed Coach

by Al Mueller



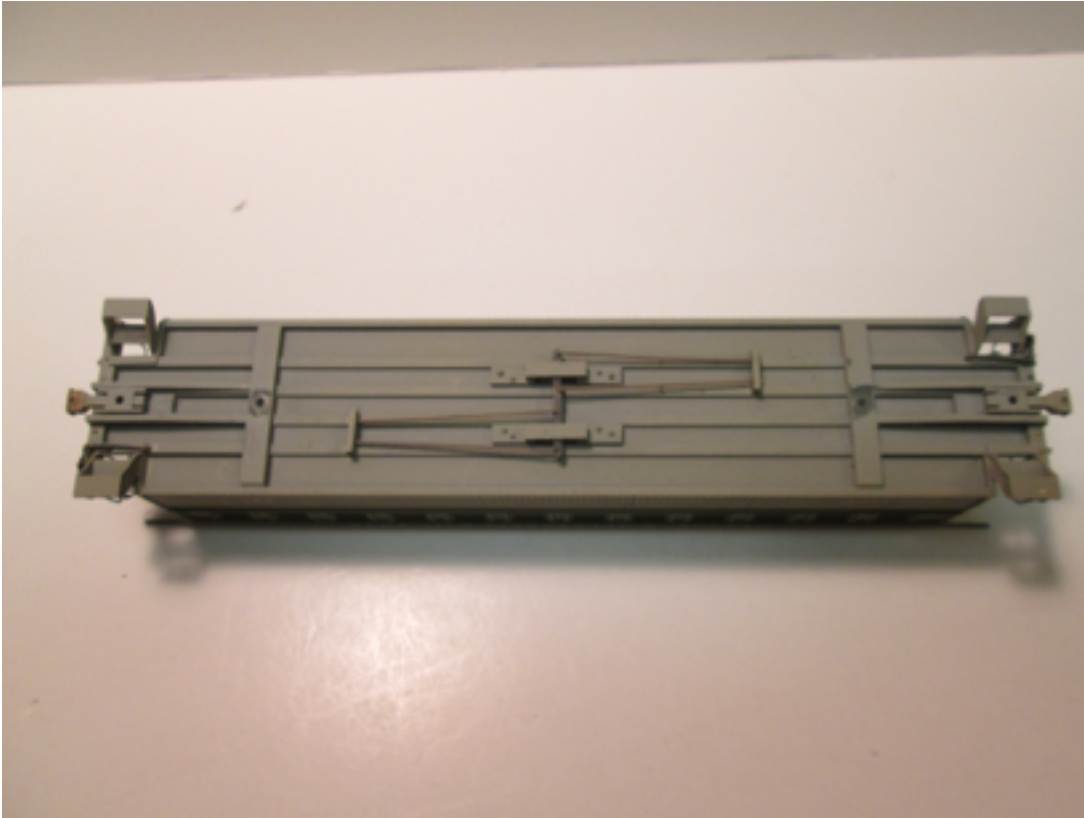


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13. The couplers can be screwed in place to provide a small amount of swing on tight radius curves. I chose to glue them in place. I placed a piece of 0.010" thick styrene on each side of the coupler to center it. Remove the styrene before gluing them in place with ACC.
14. Add a stack for a stove if you wish.
15. Paint and decal the coach.
16. Add brake rods made of 0.019" brass wire with one end bent at 90-degrees to fit in the brake lever, as shown in the photo below.

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17. Add grab irons, railings and brake staffs and wheels. I added brass nails for door knobs (Micro-Mark part #14315 brass nails, 3/32" X 0.020" diameter).
18. To weight the car I used my personal formula for passenger car weights: 1.0 ounce +(0.15 ounce per inch of length). This 41' car should therefore weigh 1.85 ounces or 52.4 grams. It's actual weight after adding an interior and passengers was 48.3 grams. I added a few standing Musket Miniature people to bring the weight up to 52.4 grams.
19. You can buy this car by going to the Shapeways web site and search on "Gerry's Early Rail models". The coach costs \$69.56.
20. Photos of the finished model can be viewed in the album "Al Mueller's Models" in the photo section of our Group's web site.