Tsunami 2 Installation Into a Westside D&RGW K-27 Class HOn3 Steam Locomotive

By Chuck Graham Photos by the author

Photo 1: My first K-27, or Mudhen, after conversion from DC to DCC sound, poses on the Chama turntable.

This locomotive, D&RGW #452, was my first to have sound – but it was DC analog sound, powered by a Throttle-Up DC sound system. This was Soundtraxx's entry into the locomotive sound market, and used the same technology as the more familiar PFM sound systems of yesteryear. The sound was provided by a variable AC sound signal on top of the DC voltage applied to the track, not by a digital signal, network and a microprocessor in the locomotive. The sound was produced in the locomotive by a condenser and coil ("LC circuit"), which filtered out the DC to leave only the AC which was projected by the speaker in the tender. It was simple, but had numerous drawbacks, in comparison to the DCC systems of today. Now that my layout runs on DCC, it was time for the upgrade to DCC sound using Soundtraxx' Tsunami 2 decoder.

Upgraded sound was not the only objective of this DCC installation. I also wished to improve the electrical pickup from the track, so the sound and lights would be uninterrupted. To accomplish this, I added weight to the tender, improved the tender pickup, and added a Keep Alive to maintain voltage on the decoder, even if electrical contact with the track is momentarily lost because of dirty track. I also added a working headlight and backup light, using some of the lamps that I had on hand.

Preparing the Installation. First, the analog sound components were removed from the tender (see Photo 2), and the space inside the tender was evaluated for the new DCC sound components. These include the decoder, an enclosed oval speaker, and a Keep Alive. Also, the locomotive needed both a working headlight and a backup light, plus a resistor for each 1.5V lamp. And finally, because I wanted to detach the locomotive from the tender for occasional

storage in its original box, I avoided permanent wire connections between the two and instead, used a 6 pin connector wire harness between the loco and tender.

Photo 2: The analog sound components have been removed from the tender – the square face-ported PFM speaker, the LC coil and capacitor, an ON/OFF DIP switch (blue) and a wire to connect to a cam on the 2nd loco driver to provide the synchronized chuff sound.

Building the speaker enclosure. As usual, the main challenge with adding sound is to fit as large a speaker as practical into the space inside the tender. For the speaker to project sound outward, the back of the speaker (16mm x 35mm x 5mm) must be sealed in an airtight enclosure. For this, I used 0.040" styrene sheet to make a box that was 18mm x 37mm x 8mm, with styrene scraps in each corner to support but slightly recess the speaker. I drilled two #74 (0.0225") holes through one end and fed the two purple wires from the Tsunami decoder through the holes and soldered them to the speaker terminals. [Polarity of these wires is unimportant, unless more than one speaker is being used.] Using Tacky Glue, I glued the corners of the speaker to the enclosure, being sure to seal the gaps but avoiding contact with the speaker cone.

Modification of the tender. After the analog components were removed, the components were test-fitted into the tender (see Photo 3). While the fit was barely adequate, I elected to remove much of the sloped tender sheet. Using a Dremel cutoff wheel and finishing with a jeweler's saw, the tender space was opened up as seen in Photo 4. Now space was no problem.

Photos 3 and 4: The three main components, the Keep Alive (green), Tsunami 2 decoder (purple), and speaker (black in a white styrene enclosure) appeared to be a tight fit in the tender, so the sloped sheet (brass) was removed with the help of a jeweler's saw.

Next, the backup light was installed on the tender. First, I drilled horizontally a #70 hole through the back of the light casting. This hole was enlarged with a #55 drill (0.052") to accommodate the thicker wire insulation at the rear of the lamp, which protrudes from the rear of the casting. A hole was drilled (#70) vertically into the sloped sheet of the tender behind the light for the

wires, and a 1.5V lamp was test-fitted. Then the inside of the casting was painted using Floquil Old Silver paint. After drying, the lamp was re-installed, tested with a 1.5V battery, and glued in place with CAA adhesive. Finally, I trimmed a scrap of clear plastic sheet to fit in the 0.166" light opening, and glued it in place with CAA. I would have preferred to use a lens from M.V. Products, but I had only one lens and elected to use it on the front headlight instead.

The underside of the tender was modified. Eight holes (7/64") were drilled through the floor of the tender beneath the downward-facing speaker to project the sound outward, using a drill press. Also, two holes inside the U-channel center beam, immediately forward of the front truck bolster, were drilled for the wiring harness to the loco, as two groups of three wires each. See photo below.

Photo 5: The underside of the tender, with 8 holes for the speaker drilled on the engineer's side and two holes drilled through the center beam immediately forward of the front truck screw hole, at the left. The 3 large openings had been cut out previously for the earlier installed analog system and speaker.

The electrical pickup on the tender wheels was upgraded. As manufactured, the tender wheels on the right (engineer's) side are insulated from the axle, and the left side tender wheels provide all the pickup from the left rail. Conversely, all the pickup for the right rail comes from the loco drivers, and none from the tender. This arrangement, while common, often leads to intermittent poor contact and subsequent loco stalling. So, I added additional contacts in the form of phosphor-bronze strips which rub against the axles. These are soldered to a small plate fabricated from 0.005" thick brass sheet (shim stock), with a 7/64" (0.109") hole for the truck screw and bent around the 2 axles on each truck (see photo). Also soldered to the plate is a 30 gauge wire which will carry the current to the tender superstructure and the decoder. The shape and size of this brass plate must be small enough to allow free rotation of the truck. After carefully confirming the polarity of the trucks, this plate holding the axle wiper was permanently attached to the truck bolster using 5 minute epoxy.

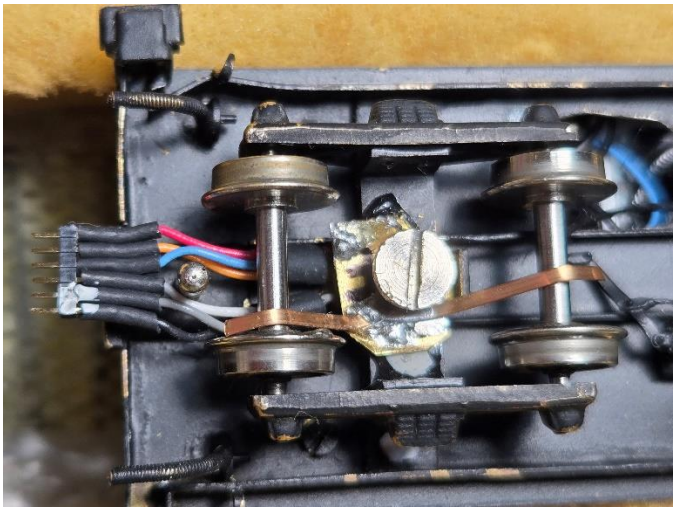

Photo 6: A close-up of the brass plate which held the phosphor bronze axle wiper and the hard-wired connection (black wire) to the decoder. This plate was secured to the truck bolster using 5 minute epoxy.

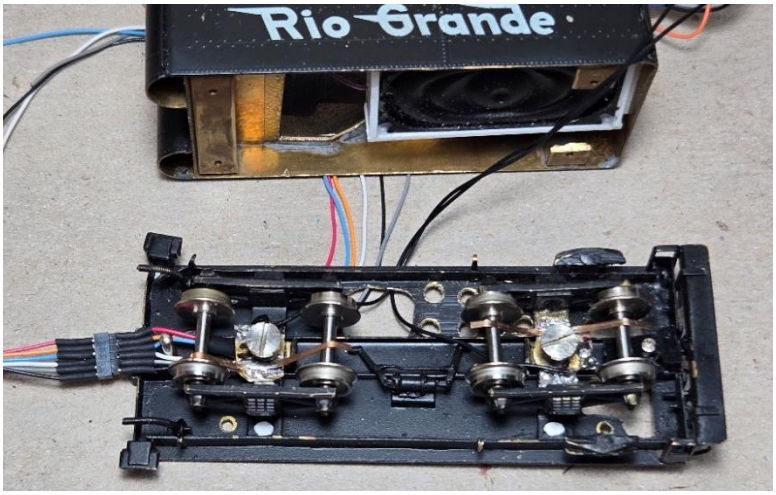

Photo 7: The underside of the tender and modified trucks, each with a phosphor-bronze axle wiper soldered to a small brass plate held in place on the truck bolster with epoxy. A black wire from each truck goes to the decoder. This hard-wired arrangement eliminated the truck frame-to body bolster electrical connection which had been problematic in its DC days. Similarly, the wiring harness to the locomotive eliminated the drawbar-to-tender problematic connection.

Decoder and harness wiring in the tender. The 6 conductor color-coded wiring harness, connecting the tender and loco, was centered around the drawbar pin on the tender, and the wires were fed through the two new holes in front of the tender bolster. At this point, the speaker was attached to a back corner of the tender superstructure, facing downward, using 3M double-sided foam tape. Next, the decoder and Keep Alive are taped inside the tender superstructure, and the wires are cut to a convenient length (but with a minimum of excess). A short length of 1/16" shrink tubing is slipped over the wire for insulation, and the wires are soldered as follows:

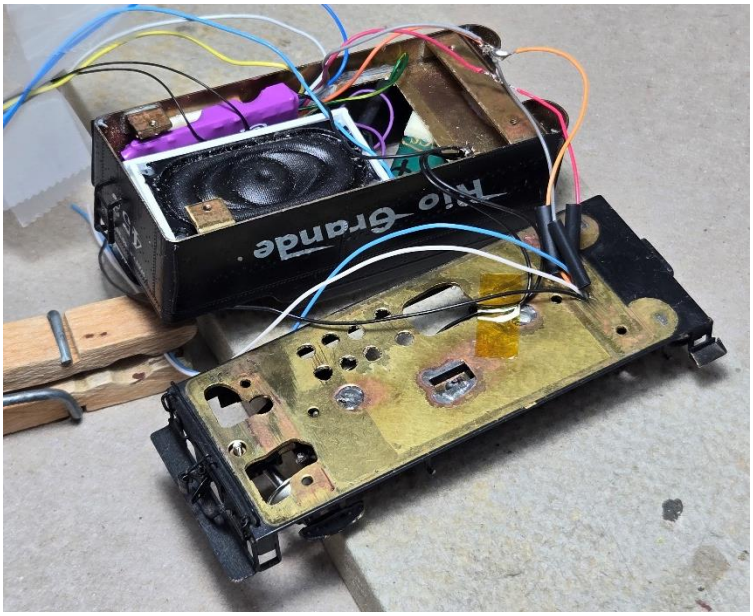

Photo 8: The components are attached to the tender superstructure with double-sided foam tape, and the wires for the rail pickup (black and red) and the motor (gray and orange) are wired to the decoder and wiring harness.

The black wire from the decoder was soldered to the black wires to the tender trucks (left rail pickup). The red decoder wire was soldered to the red wire from the harness (right rail pickup from the loco). The two wires for the motor, gray and orange, were shortened and soldered to same color wires from the harness. The connections were then insulated using a heat gun on the shrink tubing; the decoder and other components were insulated from the heat with wood

scraps. The remainder of the connections were postponed until after the decoder was tested (see below).

Modification and wiring of the Locomotive. The boiler was removed from the frame by first removing the brass screws holding the pilot and trailing trucks, then removing the two steel screws under the cab and the large screw under the stack. The boiler was then carefully slid forward until the pipes under the cab were free of the brake cylinders and could be lifted off. The wire connecting the cam wiper (for chuff synchronization) was unsoldered and the wiper removed, and the wires to the motor were unsoldered. The boiler weight was removed. The cam on the 2nd driver axle will not be used, but instead will use the decoder's auto chuff synchronization.

The headlight casting on the locomotive was modified in the same manner as the tender's backup light, and a hole was drilled in the top of the smokebox behind the light. The wires of a 1.5V lamp were fed through the back of the casting and into the boiler, its fit was confirmed, and the lamp was checked with a 1.5V battery. A headlight lens (M. V. Products) was modified by filing off the center of its backside reflector, and the bulb was glued with CAA adhesive to the back of the lens. Finally, the lens was glued into the headlight casting, and the boiler weight was reinstalled.

The female end of the 6 conductor wiring harness was centered, three wires on each side of the drawbar screw, and bundled together with a short section of 1/16" ID shrink tubing. The harness was properly aligned by color to match the male end, already installed on the tender. The polarity of the motor was not marked, so I guessed and soldered the orange and gray wires to the motor contacts. The red wire was soldered to the loco frame, for the right rail pickup. The blue (common) and white wires went to the headlight, with shrink tubing insulation over the wire connection. The unused black wire were trimmed to about an inch and taped out of the way. Provided that I guessed correctly on the motor polarity, the loco wiring is finished. Finally, the wiring harness was held in place using Kapton tape (see final testing below).

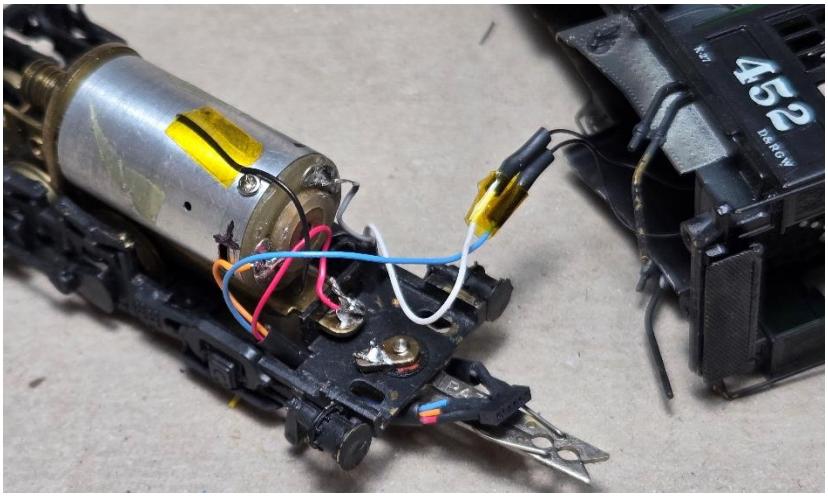

Photo 9: The wiring harness sits above the drawbar, and is centered, 3 wires on a side, around the drawbar. The gray (-) and orange (+) wires are soldered to the motor, and the red wire (right rail pickup) to the loco frame. The blue and white wires go to the headlight.

Initial testing and programming the decoder. At this point, it's time to see if the wiring completed so far was done correctly. I connected the wiring harness plug, set the loco and tender on the programming track, set the boiler back on the loco frame, the tender shell back on the tender frame, crossed my fingers, and turned on the programming track power. I was able to "read" the decoder (it gave the correct decoder manufacturer and model), which meant things

were wired correctly and there were no shorts. I then entered the long address (452) for the loco, and exited the programming mode. I then moved the assembly to my test track, and turned on the DCC power. The loco sound came on, and the loco moved in the correct direction, which meant I had guessed correctly on the motor polarity when soldering the gray and orange wires. Everything looked good. It's time to finish the wiring.

Completing the wiring in the tender. The remaining components to wire up were the Keep Alive, the headlight, and backup light. The Keep Alive black with white stripe wire (ground) was soldered to the decoder's green and yellow striped wire, and the blue wire was connected to the decoder's blue wire (common, +12V). One wire from the backup light was soldered to a 560 ohm ¼ W resistor (insulated on both ends with shrink tubing) and the decoder's yellow wire was soldered to the other end of the resistor. The other wire from the backup light was connected to the decoder's blue common. Similarly, the white wire (harness) from the headlight was soldered to a 560 ohm resistor, and the white wire (decoder) soldered to the other end of the resistor. The blue wire (harness) was connected to the blue wire (decoder), and this 4-wire common connection was soldered and insulated. The remaining unused wires were trimmed to about an inch and taped out of the way. See Photo 10.

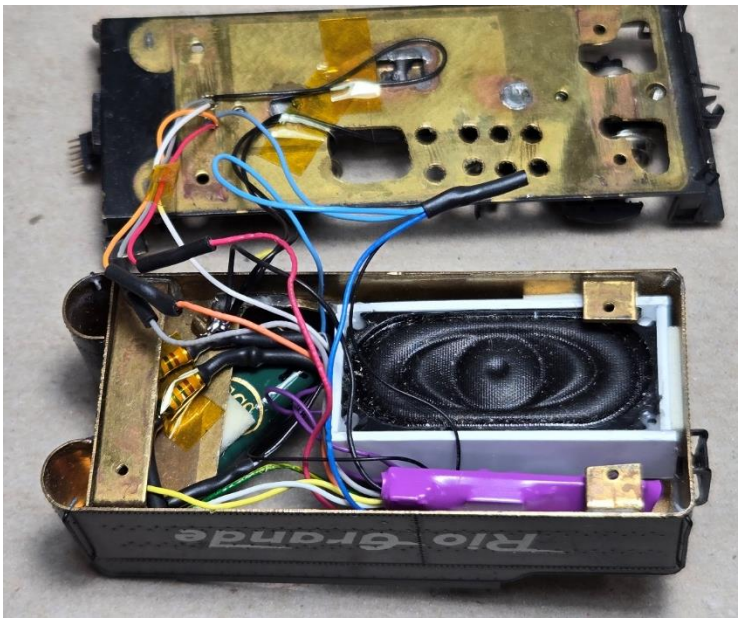

Photo 10: The completed wiring of the tender, showing the components, including the two resistors for the lamps, the connections insulated with shrink tubing, and the minimized amount of excess wire.

Lastly, a 0.75 oz. piece of lead sheet was added on top of the components and was covered by the coal load glued to a scrap of foam.

Final testing and programming. After the loco and tender were reassembled, the loco was tested on the layout to see how it ran and how the functions worked. As is sometimes the case, it did not run well – there was occasional derailing and stalling. Placing the loco upside down in a foam cradle quickly revealed the problem: the wiring harness on the loco side had shifted out of place and was interfering with side-to-side travel of the trailing truck, causing the drivers to be lifted off the rails. Some judiciously located Kapton tape and a spot of glue on the sleeve of shrink tubing held the wires out of harm's way, and the problem was solved.

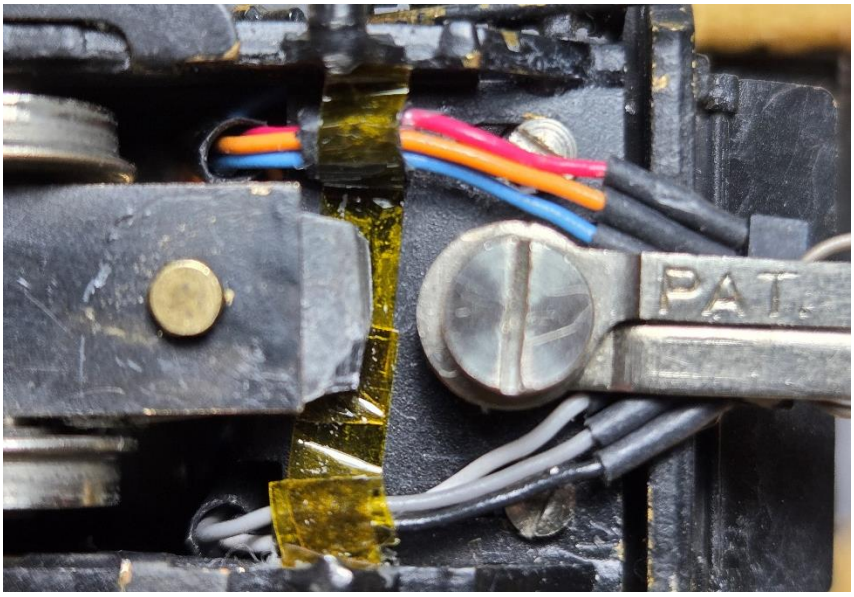

Photo 10: A few small pieces of Kapton tape (yellow) hold the sleeves of shrink tubing and the harness wires away from the trailing truck wheels at the far left

Once the loco showed satisfactory performance on the layout, the following basic CV settings were set for this locomotive.

CV No.	CV Name	Value	Setting
120	Whistle	014	D&RGW # 340
122	Bell	029	Heavy brass
123	Exhaust Chuff	001	Light exhaust 2
124	Air pump	003	Cross-compound
125	Dynamo	002	

Other CVs can be changed to achieve other operating, sound and lighting effects as desired.

It's done! Time to welcome another to the stable of DCC sound-equipped narrow gauge locomotives!

Parts used.

Westside Models K-27, HOn3, unpainted. Later custom painted and decaled by Bud Garner
Tsunami 2 DCC decoder, TSU-1100-Steam 2 #884006
Train Control Systems TCS #1477 6-Pin micro connector with colored wires
Keep Alive KA1 capacitors (Train Control Systems, TCS)
Speaker, small oval, 16 x 35mm, 8 ohm, 1 watt, (#tdsbsmoval, Tony's Train Exchange)
Scrap of sheet styrene, 0.040" thick, for speaker enclosure
Lamps: 1.5V, 1.7mm clear, Miniatronics 1870110
Resistors: 560 Ω, ¼ watt, TCS)
Headlight lens, 0.166" diameter (#LS166, M.V. Products. Now available on eBay)
Phosphor-bronze strip, 1mm wide, 0.005: thick, #PB1 M, Albion Alloys Precision Metals
Extra decoder wire, in colors red, white, gray, brown, blue, and black, if needed.
Shrink tubing for insulation, 1/8" diameter
Kapton tape, ¼" wide (TCS)
Glue: Allene's Tacky Glue; styrene cement (MEK)

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