Tsunami 2 Installation into a Sunset C-16
By Chuck Graham Photos by the author

Photo 1: The completed C-16 on the Chama turntable, after installation of a Tsunami 2 DCC decoder.

Sometimes one has to begin a conversation with a confession. I confess that I have a number of DC brass HOn3 locomotives, D&RGW C-Class and K-Class, which are languishing in boxes instead of running on my now-DCC layout. My Blackstone K-27s, with factory installed DCC and sound, have been overworked while the brass, both painted and unpainted, lay warm and snug in their boxes.

HO narrow gauge modelers have always been challenged by the geometry of squeezing a DCC decoder and speaker into a steam locomotive tender, which always seems too small. But now, some of these brass beauties are returning to the rails, complete with DCC sound, thanks in part to the new Tsunami 2 TSU-1100 steam decoders from Soundtraxx (P.N. 884001). This decoder has quite a few new features, but its smaller size is a big plus when trying to cram it into a small tender. Other relatively new DCC accessories, such as smaller “sugar cube” speakers, have also helped.

In this article, I will describe how I installed a Tsunami 2 DCC decoder into a Sunset brass C-16. A list of parts is at the end of this article. I confess that taking apart a brass loco terrifies me – that after spending a lot of money, that I wouldn’t be able to get it back together (especially the running gear) and have it run again. But I had considerable help in this project, from the late Jim Vail. Years ago, Jim’s series of articles in the *NG&SL Gazette* on “Getting Them Running” and “Painting a Brass Locomotive”, ending with Part 7 (*NG&SL Gazette*, March/April 1990) gave good directions on painting a C-16, which I followed closely, and I was quite pleased with the results. Then in more recent years, Jim wrote two articles on DCC installation in a C-16 (*NG&SL Gazette*, Mar/Apr 2015 and *HOn3 Annual 2001*, p.38), which I followed with a few deviations. So, one DC brass loco joined my stable of DCC-equipped Blackstone K-27s, and I couldn’t be happier.

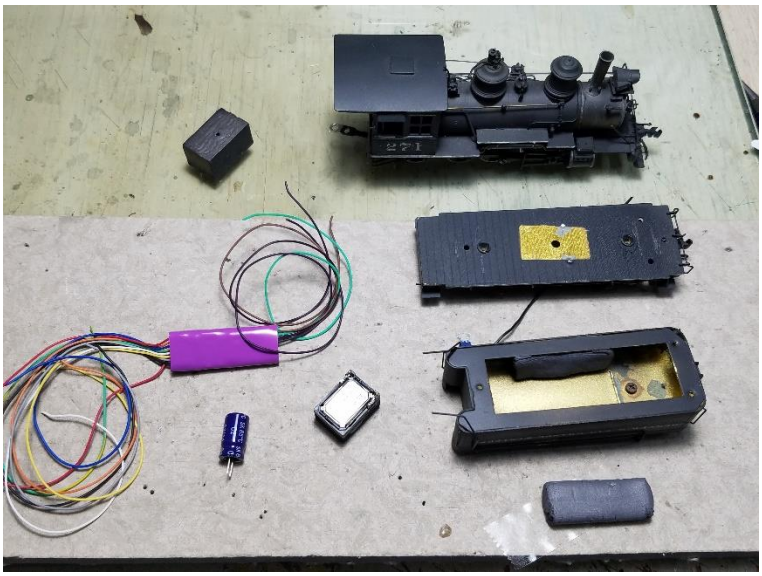


Photo 2. Here is the disassembled C-16 #271, along with DCC parts. Clockwise from upper right: the loco, tender frame, tender superstructure (upside down), malleable lead weight, sugar cube speaker, Soundtraxx Capacitor, Tsunami 2 decoder with wires, and the factory tender weight. The factory weight was discarded and later the Soundtraxx capacitor was replaced with a Keep Alive KA2 bank of capacitors.

Planning the installation. Jim Vail's articles cited above were a great starting point, but I ended up making a number of changes. Once the tender was disassembled, I could see what would fit and what wouldn't. The round mega bass speaker and the Soundtraxx Current Keeper were replaced with a smaller speaker, with the sound escaping downward, and a capacitor (later replaced with a more effective Keep Alive). I elected to keep as much of the weight as possible to help with tender electrical pickup; Jim had no room for weight. I also tried to minimize the amount of the lip around the base of the tender shell that needed to be removed. I liked Jim's tender axle electrical wiper pickups. I also had to add a headlight on the loco. And a big decision: I decided to hardwire the loco to the tender without a plug and socket – so they were permanently connected. This was how Jim did the installation, and I was unsure how to install a plug in the limited space available. And finally, I decided to take good notes on what I did – it helps with future installations.

Preparing the tender. I removed the tender shell and the weight which was centered on the tender frame. The trucks were removed, and using 0.005" brass shim stock and phosphor bronze strip, I constructed axle wipers for each tender truck as did Jim. I drilled a hole in the shim for the tender truck screw and a small hole for the connecting wire, then soldered the wire and the contact points for the phosphor bronze wipers. Do not overheat the phosphor bronze or it will be degraded. See Photo 3.

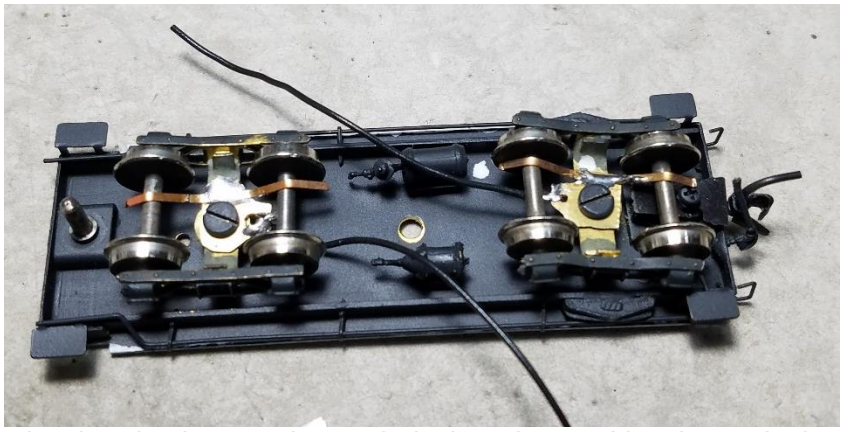
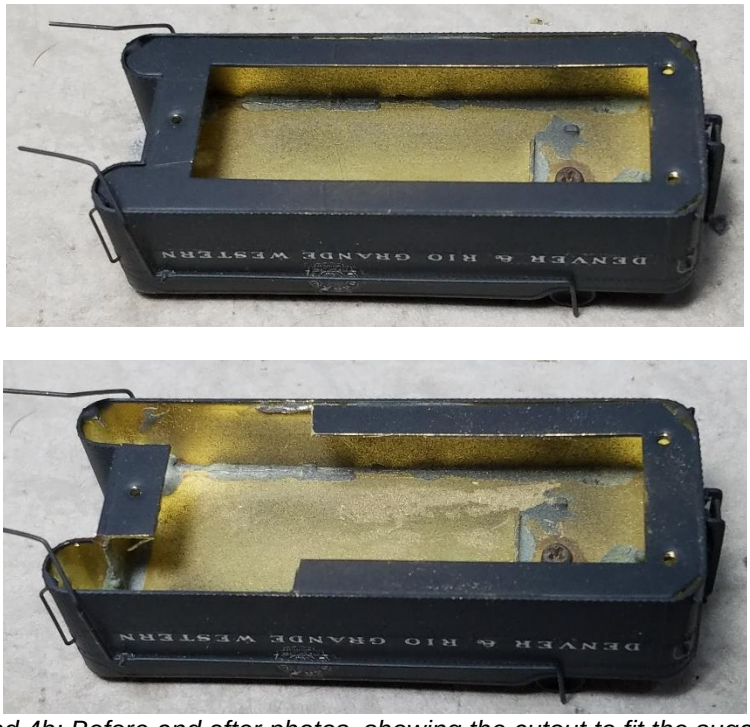


Photo 3: The phosphor bronze wiper and wire have been soldered to each piece of brass and the trucks have been reinstalled. Be sure to keep the insulated wheels on the proper side or a dead short will have been created!

Next, I drilled holes for the speaker through the tender floor, using my drill press and 7/64” drill. Then I drilled pilot holes, by hand using a pin vise and #65 drill, for decoder wires to the loco through the front plate of the tender on either side of the drawbar kingpin. I enlarged the pilot holes with a 1/16” drill and removed the burrs with a file. I repeated this for holes through the tender floor, behind the tender’s water legs. These holes are just big enough to carry the decoder wires, and together the holes will provide enough friction to keep the wires from sagging onto the track.

The base of the tender top shell was too narrow to accommodate the sugar cube speaker, which was to be mounted sideways. Very carefully using a Dremel cut-off wheel, I made cuts through the folded-under tender sides, then carefully using pliers, I bent and broke off the material to be removed. See before and after Photos 4a and 4b below.



Photos 4a and 4b: Before and after photos, showing the cutout to fit the sugar cube speaker.

Preparation of the locomotive: I disassembled the boiler from frame by removing the screw through the cylinders, and 2 small screws under cab, and prying off the cab back wall. Then I slid the frame to the rear to detach it from the boiler, and I removed the drawbar.

The rewiring was begun by unsoldering three wires: the wire attached to the frame (front of motor mount), the top motor contact (-) connecting to the tender/left rail and the bottom motor contact (+) connecting to the loco frame/right rail. Note: Sunset connected the motor leads reversed from convention – meaning the bottom motor contact was connected to the tender, not to the loco frame. Rewire the motor leads as described below, or the locomotive direction will be reversed from that indicated on a throttle. (This can be corrected also by changing a CV value). Using an ohmmeter, I confirmed that the motor contacts are isolated from the loco frame. Then I soldered three new ~ 30 gauge wires, each long enough to reach the rear of the tender: red, soldered to the frame contact on the front of the motor mount; orange, to the bottom (+) motor contact; and gray, to the top (-) motor contact, the colors conforming to DCC wiring standards.

Installation of the headlight: Using a pin vise, I drilled a #61 hole through the back of the brass headlight casting for the headlight & wires, then carefully enlarged this hole with a #55 drill (0.052”), followed by a 1/16” drill (0.0625”). Directly behind the headlight, I drilled a hole (#55) downward into the top of the boiler for the wires. Using a small 1.5V, 0.052” diameter lamp, I fed the wires through the holes and into the boiler, making sure the lamp can recess far enough into the headlight housing to fit the lens. Before proceeding further, using a 1.5 volt battery, I confirmed that the lamp still lights after feeding the wires through the holes. I also confirmed with an ohmmeter that the lamp leads are not short circuiting to the locomotive frame, which could damage the decoder later. Then, using a small file or X-Acto knife, I removed enough of the aluminum backing on the headlight lens for the light to shine through, cemented the lamp to the back of the lens, then the lens in place with ACC glue. The lamp leads were trimmed to reach just beyond the backhead, and pieces of blue and white decoder wire, long enough to extend to the decoder in the tender, were soldered to the lamp leads and insulated with shrink tubing. The boiler weight was reinstalled, and the loco was reassembled with the screws. The 5 wires were fed down through the gap between the motor and the backhead; see Photo 5.

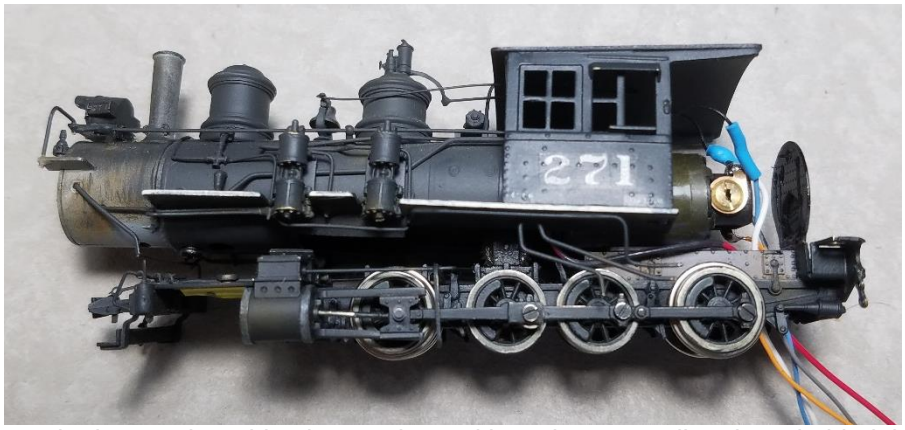


Photo 5. The locomotive wiring is complete, with 5 wires extending down behind the backhead.

Rebuilding the loco/tender drawbar: I elected to replace the metal/spring drawbar with one of styrene to help insulate the loco from the tender. Using 0.020” black styrene sheet, I cut a new

drawbar the length of the metal drawbar, drilled a 7/64” hole in the loco end, and a 3/32” hole in the tender end. Using 0.010” styrene sheet, I cut a plate to hold the wires above the drawbar. I reused the loco screw, but minus the spring. Then I fed the 5 wires from the loco to the tender between the styrene plate and the rear bottom of the loco frame. See photos 6a and 6b.

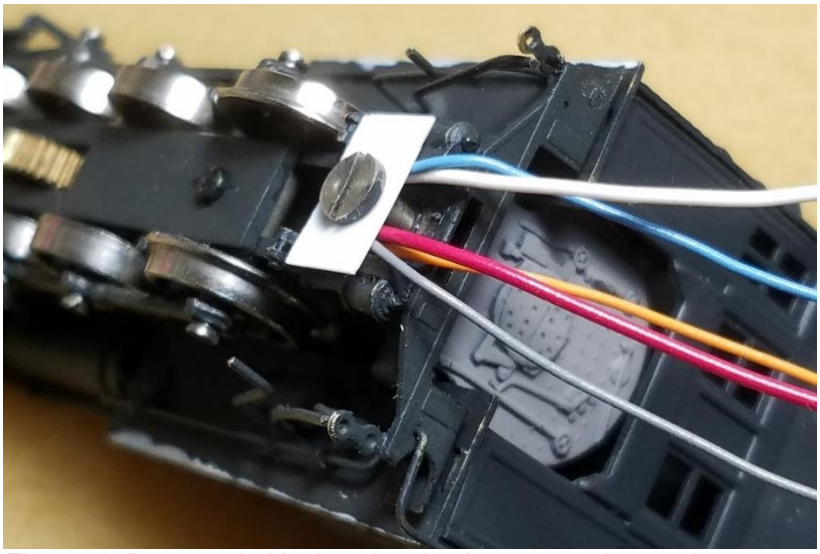


Photo 6a: The 0.010” styrene holds the wires in place, toward to tender.

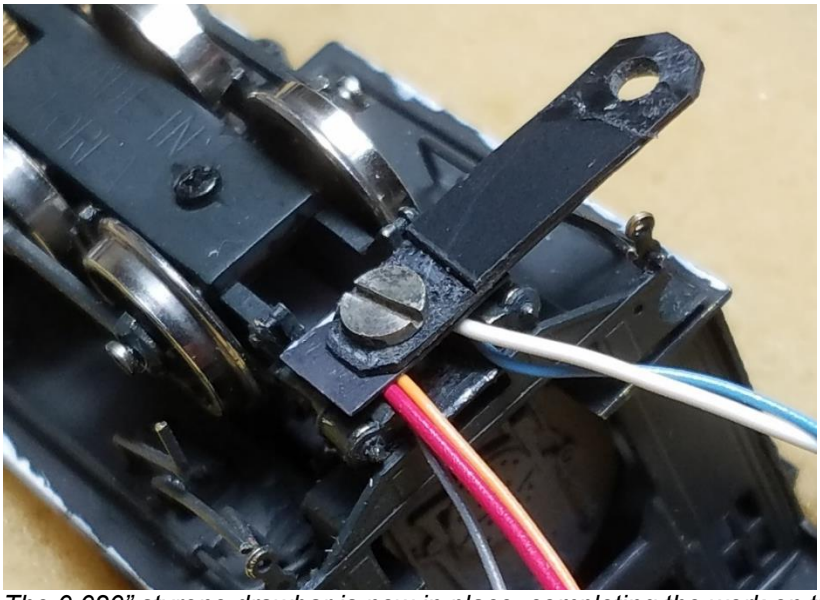


Photo 6b: The 0.020” styrene drawbar is now in place, completing the work on the locomotive.

Wiring the tender and the decoder: Next, I fed the wires from the back of the loco through short 1/8” pieces of shrink tubing (to help group the wires), then through the holes drilled into the front of the tender frame, then up through tender floor. I trimmed off some of the excess wire from the decoder, and wired the speaker to the purple wires. I painted the speaker terminals using Liquid Tape insulation. Likewise, I wired the supplied 220µF capacitor to the decoder, and used shrink tubing for insulation. The negative capacitor terminal, marked with the white stripe and (-) sign, was connected to the green/yellow stripe decoder wire and the positive terminal to the blue (common) decoder wire, making sure the shrink tubing thoroughly covered

the capacitor's terminals. (Note: I later replaced this capacitor with a Keep Alive, wired similarly). Next, I trimmed and soldered the motor wires to the decoder wires: (+) is orange, (-) is grey. Likewise, I trimmed and soldered the track pickups: tender is black, loco is red. See Photo 7.

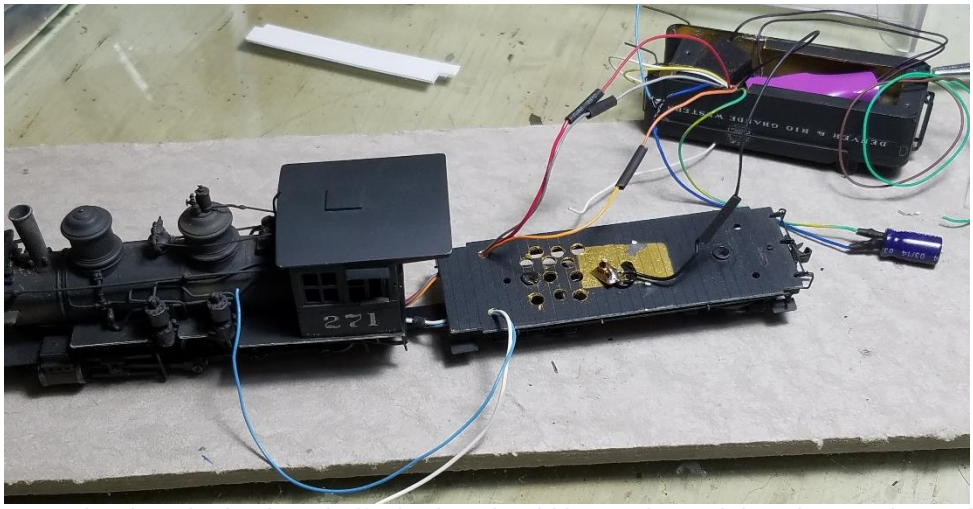


Photo 7: The decoder is about half-wired. I should have trimmed the wires to shorter lengths.

I trimmed and soldered the white headlight wire to a 1 kΩ, 1/6 watt resistor [Note: Soundtraxx recommends a 560 Ω, ¼ Watt resistor, but the hobby shop had only the 1 kΩ.] Upon testing in the next step, the headlight was very dim. So a second 1 kΩ resistor was soldered in parallel across the first, dropping the resistance in half. Now the headlight was the same brightness as on a Blackstone K-27 Mudhen. If lower brightness is desired, set the value of CV 64 to less than 255. Finally, using moldable lead weight, I added about 1 ounce of weight inside the bottom lip of the tender shell, in 3 pieces: a short one at the front, and equal sized pieces on each side toward the rear. I glued them in place, using Loctite Power Grab all-purpose interior construction adhesive; other adhesives also could work. Similarly, I glued the speaker enclosure to the tender shell, with the speaker facing down. See Photo 8.

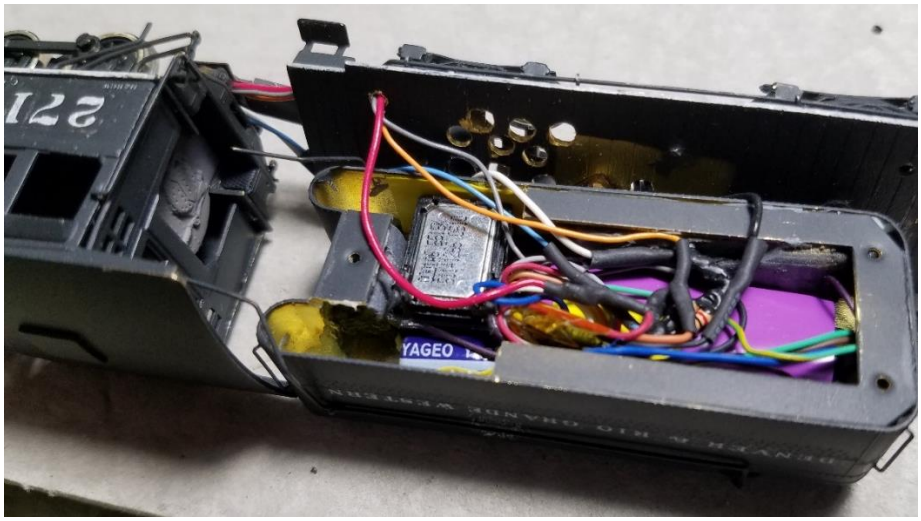


Photo 8: All the components have been crammed into the tender shell (viewed upside down), with the shiny face of the speaker clearly visible. The YAGEO capacitor was later replaced in the same location with a more effective KA2 Keep Alive.

I did not reattach tender shell until the testing step was complete and everything checked out OK.

Testing the locomotive and programming the loco address: I started testing by putting the loco on the layout (which has better protection in case of a short circuit) and setting the throttle's Select Loco to 3 (default address for decoder). With the DCC track power on, if all is well, the air pump should start. I then checked the bell & whistle, and run in forward & reverse. When everything worked, I moved the loco to programming track for setting the loco's long address to 271. Additional programming was done later.

I found that the loco still occasionally stalled on turnouts and other locations, and confirmed that this was not caused by a short circuit. The 220 µF capacitor was insufficient to maintain voltage on the decoder during an interruption of electrical pickup, so the loco lost power and stalled. The capacitor was replaced with a KA2 Keep Alive (bank of 4 capacitors from TCS; also available from Streamline Backshop). I had to remove some of the moldable weight to make room for the KA2. After cramming all the wires back into the tender, the stalling disappeared; in fact, when the power is turned off, the loco continues to produce sound for another 6+ seconds, thanks to the Keep Alive.

My final work on the loco was to do some touch-up painting with weathered black on the loco and tender as needed, as well as on the wires between the loco and tender. I also added a tender apron (steel plate between the loco and tender to stand on), which the locomotive never had, made of 0.020" black styrene sheet.

Additional DCC programming: I reset a number of Configuration Variables (CV) using my NCE throttle on the programming track. This could also be done using Decoder Pro from JMRI if available.

CV #	Configuration Variable Purpose	Old Value	New Value	
112	Sound configuration 1	008	001	2 singles
113	Quiet mode time-out period (sec)	0	0	
120	Whistle type	028	13	D&RGW single chime
122	Bell	029	10	
123	Chuff	006	003	
124	Air pump	003	001	
125	Dynamo	002	001	
128	Master volume	192	150	
130	Bell volume	085	085	
64	Master brightness	255	200	
	Dynamic Digital Exhaust (DDE)			
187	DDE filter initial freq	0	200	
188	DDE tracking coefficient	0	200	
61	F11 Braking rate	153	178	
3	Baseline acceleration rate	0	25	
4	Baseline braking rate	0	75	

Part List:

Tsunami2 DCC decoder, TSU-1100-Steam 2 #884006, (220µF capacitor included)
Keep Alive KA2 capacitor (Train Control Systems, TCS)

Speaker, sugar cube #4053 (11 x 15mm, 8 ohm, SBS, Streamline Backshop)
Headlight: 1.5V, 0.052” incandescent lamp
Headlight lens: M.V. Products #LS 166, 0.166” diameter, clear
Resistors: 1 kΩ, 1/6 watt (TCS). Preferred is 560 Ω, ¼ watt
Extra decoder wire, 30 or 32 awg, in colors red, white, gray, brown, blue, and black, if needed.
Phosphor bronze strip, 1 mm x 0.005” thick (Albion Alloys Precision Metals)
Brass shim stock,
Styrene sheet, black, 0.020”
Liquid Tape (electrical insulation, Plasti-Dip Internat’l)
Shrink tubing for insulation, 1/8” diameter
Kapton tape, ¼” wide (TCS) for holding electrical components in place as needed
Glue: ACC, styrene cement, adhesive for attaching weights inside tender.

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