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DCC IMPULSES

column

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WIRELESS DCC: PART 1, THE RADIO SIDE

No, THIS IS NOT ABOUT RADIO CABS FOR YOUR DCC system. I'm going to talk about removing the voltage from your track (dead track) and continuing to use DCC technology to run trains.

In the past, I've written about wiring my garden layout for DCC (mrhmag.com/magazine/mrh-2015-07-jul/di_dcc-garden-wiring-tips). I had been hoping to be able to run DCC in the garden with the brass track, since I live in the desert. That didn't happen without a lot of track cleaning.

My experiments were with what long-time garden railroader Stan Ames called hybrid drive: running the loco on track-supplied DCC but including a small battery to help it over the bad spots. This is an enhanced version of the energy storage capacitor schemes being marketed under various names by DCC decoder manufacturers. Instead of a few seconds of running without track power, hybrid drive would keep locos running for minutes. But, if the loco derails, it would keep running without

► DCC TIPS, TRICKS, AND TECHNIQUES

a control signal. Not a good thing with water-filled ponds as part of the layout.

Folks always said, “go radio and battery-powered and you’ll be happy.” Yah, but ... my garden layout is a switching layout based on southwestern Colorado narrow gauge in the Depression era: short 3- to 5-car trains with runs where every car would get switched out along the way. No room for a battery car that has to stay with the train. This is gonna take more than a quick fix.

Our club’s garden layout (pcmrc.org/garden.html) had one AirWire-equipped loco and a battery car, so I had a place to experiment. I kept looking at how to marry wireless DCC and battery power. Battery technology getting better increased my chances of fitting the batteries in the locos. This column isn’t the final chapter, but here’s how the story is unfolding.

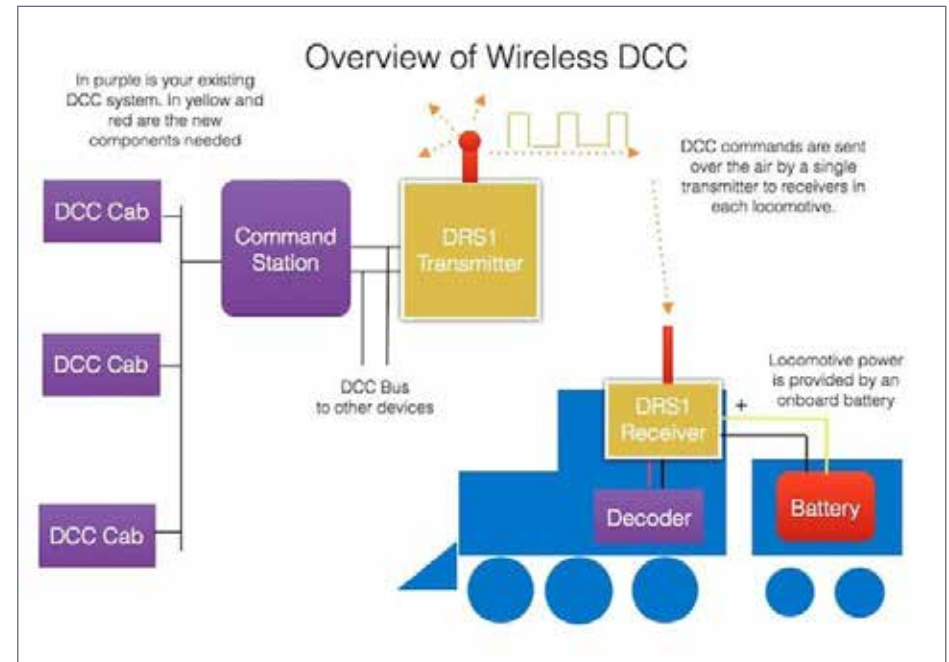
The solution has two parts: getting power to the locomotive and controlling its motion, sound and lights. Let’s tackle the communication side first.

The trick with so much of this technology is adjusting battery size to fit the physical space available and still supply the needs of your locomotive to run a meaningful amount of time.

I have found methods which will yield reasonable run times for everything from HO to garden locomotives.

DCC over-the-air

To maximize my DCC investment: cash, knowledge, time and equipment, I wanted solutions that actually used the DCC packets delivered by radio. The Dead Rail Society was formed a few years back in southern California to bring like-minded modelers together. They have a nice web site (deadrailsociety.com).



1. System diagram of the Tam Valley Depot DRS1 system. All the systems discussed here are similar. The AirWire and S-CAB systems combine the DCC Cab, command station and transmitter functions into a complete handheld module. The DRS1 is designed to leap-frog off an existing DCC system. *Tam Valley Depot drawing*

com). On their “suppliers” tab, they list only three systems that use DCC and support sound. So here is what I’ve found out about these systems:

Let’s step back and explain what this really means. Figure [1] shows the system diagram of the Tam Valley Depot DRS1 system. The boxes in purple represent an existing DCC system. The DRS1 system consists of the transmitter and receiver shown as the yellow boxes. The DCC control signal moves through the

air from the transmitter to the receiver as shown by the dotted yellow arrow. Power coming from the battery (red) completes a totally wireless system.

There are several methods of implementing the receiver side of this DCC system:

- 1) Make the receiver a complete DCC decoder and provide motor and function outputs. Usually this solution works best in non-sound installations. It may also be the smallest version, as there are not two or three electronics modules to fit into the loco.
- 2) Make the receiver a DCC “booster” and have it drive an external DCC decoder. This way, whether the DCC decoder is a simple motor and lights version or the most exquisite sound,

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motor and lights decoder, the performance is determined by the decoder, not by the wireless system.

- 3) Build a DCC receiver that talks to the internals of a DCC decoder with low voltage signals. This necessitates the modification of the DCC decoder, but saves some size and heat in the process.

So, let's evaluate the offerings of the three players mentioned on the Dead Rail Society website.

CVP: AirWire

CVP, the folks who bring you the Easy DCC system, are one of the pioneers in garden wireless command with their AirWire system (cvpusa.com/airwire_system.php). The garden superintendent of our PebbleCreek club (PCMRC.org) started using the AirWire cab and receiver packages for our garden layout. I have continued with that standard and added more cabs and locos for the club.

The operator side of the AirWire system has evolved to the T5000 [2] cab. The T5000 combines a DCC command station and a cab with a nice display and a radio transmitter into one package. Two versions are available, with or without backlight for the display. The backlight depletes the batteries when used, but makes the throttle usable at night. It also adds to the cab price. The venerable economy version T1300 cab is still available.

Batteries (2 x AAA) for the T5000 are user changeable. I normally use NiMh batteries in all my throttles. However, the T5000 seems to have been designed with alkaline batteries in mind. Fully charged NiMh batteries show almost completely dead on the T5000s meter. So, against my green side, I recommend alkaline for the T5000. The T1300 has built-in rechargeable batteries.

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The AirWire system can operate on seventeen different frequencies within the 900 MHz band. For most reliable operation, I recommend putting each receiver on a separate frequency and using its own cab (on that same frequency) to control it. If you try to run two links on the same frequency there is a high probability of interfering with yourself. With all the choices, why gamble?



2. CVP AirWire T5000 cab. Bruce Petrarca photo

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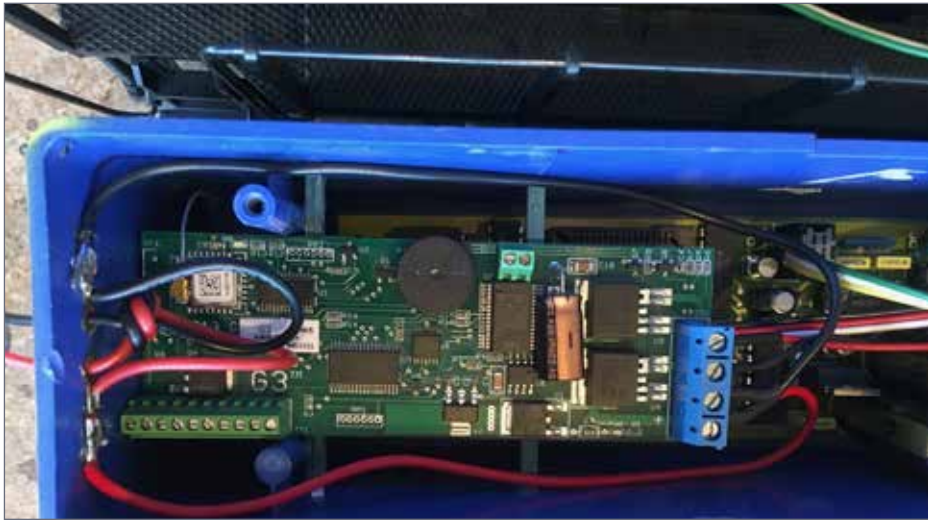
The locomotive side of the AirWire system uses either a receiver /motor driver [3] and [4] or a receiver / DCC booster board [5].

The current version of the receiver/motor driver board for the garden is called the G3 [3] and can operate on any of the 17 frequencies that the T5000 speaks. The G3 basically turns your battery voltage into pulse-width modulated DC to operate the motor (and any track powered sound unit). The G3 will supply up to 10 amps of output power.

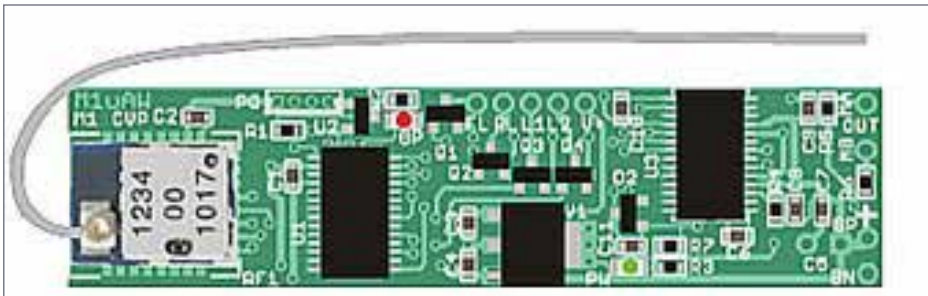
I use G3 boards, for example, in our club's garden scale LGB locos that came with motion, sound and lights all driven off track DC power. A simple double-pole, double-throw (DPDT) toggle switch can be installed in the loco and switch from track power to AirWire control. Battery power can be installed in the loco or or a trailing car.

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3. AirWire G3X external antenna board installed in LGB diesel. Battery power comes in from the left (red and black wires) and enters the G3X board on the lower screw terminals on the right side. The red and black wires from the upper terminals on the right connect to the LGB factory electronics where the track feed previously attached. The gray wire coming off the copper terminal in the upper left is the antenna, just routed up toward the roof of the shell and along the inside. *Installation and photo by Bruce Petrarca*



4. CVP's microDECODER interface board for AirWire control of smaller scale locos. *CVP photo*

The G3 electronics are available in two additional form factors for easy installation into Bachmann G-gauge steamers and many USA diesels.

Of interest to the fans of the smaller scales, is the microDECODER. This board, functionally equivalent to the G3, is small (0.6 x 2.4 x 0.25 inches) and will control 4 functions and a



5. CVP CONVRTR-25 AirWire to DCC converter. The internal antenna is shown in the photo as the blue rectangle in the upper right. *Bruce Petrarca photo*

motor up to 1.5 amp running current. Coupled with the S-CAB BPS, discussed later in this column, it represents one of the solutions for HO and On30 dead track operations..

These AirWire boards are available with internal antenna boards (blue rectangles) or external wire (grey) antennas.

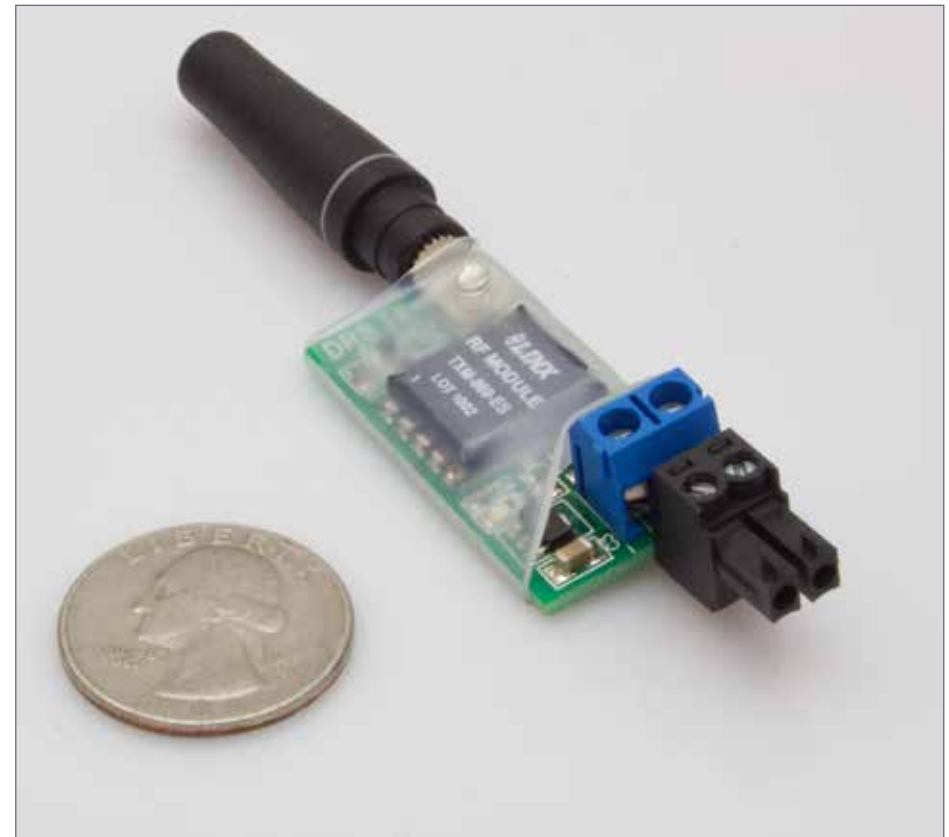
Okay, what's the DCC booster board story for AirWire? They offer three sizes of board in two versions. Their CONVRTR version boards house a receiver and DCC booster ready to drive your DCC decoder. These boards offer three current level outputs: 1.5, 2.5 and 6 amps running current with appropriately higher stall currents. The 2.5 amp version (CONVRTR-25) is shown in [5].

Thus, you can choose the power level you need and have the cost and board size adjusted accordingly.

In summary, the AirWire system offers a stand-alone DCC-over-the-air system: handheld transmitters and loco-mount boards to drive your motor, lights and sound directly or through an installed DCC decoder. I am not wowed by the ergonomics of their rectangular-box cabs. But they have earned a reputation for reliability.

Tam Valley Depot: DRS1

Another system mentioned on the Dead Rail Society web site is the DRS1 from Tam Valley Depot (tamvalleydepot.com/products/drs1deadrailcomponents.html). Duncan McRee, the owner of TVD and a co-founder of the Dead Rail Society, has designed a system to piggyback on an existing DCC layout. This allows running some locos on track DCC and some on battery plus over-the-air-DCC on the same layout at the same time. The DRS1 is an easy way to transition from powered rails to dead track, one loco at a time.

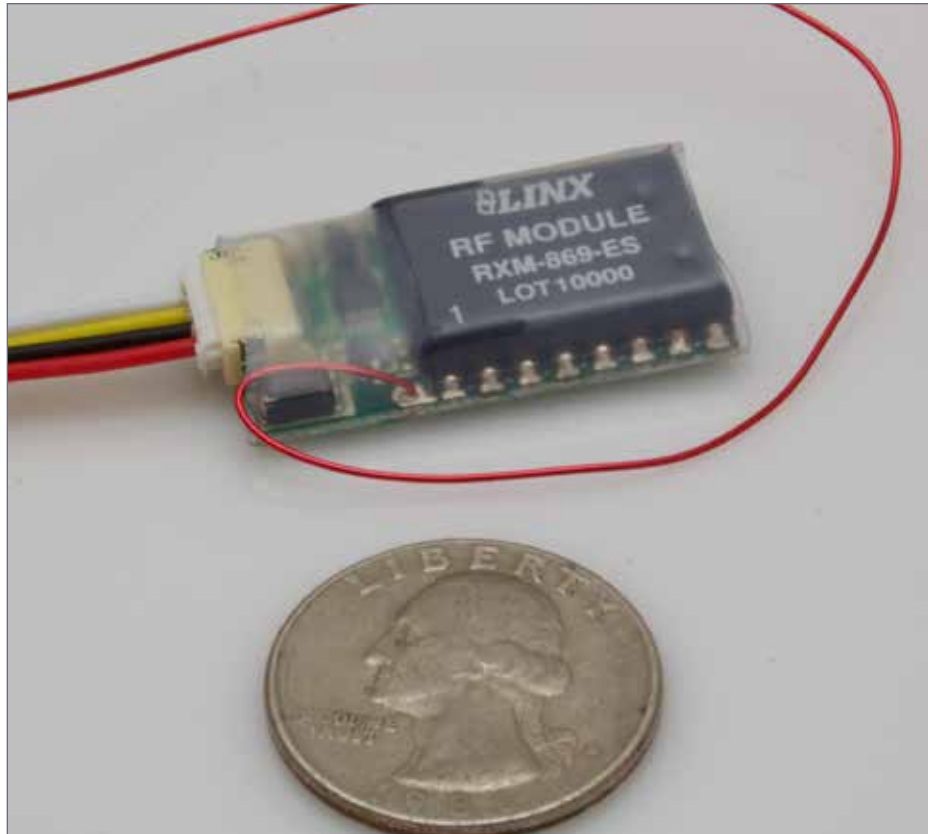


6. The simplicity of the DRS1 transmitter. Connect it to a basic DCC system with two wires connected to the (blue) terminal strip. Shown here close-wired to the terminal strip (black) for the NCE PowerCab. *Bruce Petrarca photo*

The DRS1 uses the Linx radio board set on 916.48 MHz. The ease of use of these Linx boards has many unlicensed items using them and may cause interference, being on the same frequency: NCE radio cabs, for example. There is another frequency, aimed at the folks in Europe: 869 MHz. While it doesn't interfere with the NCE radio cabs, it is not legal to use in the USA.

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The DRS1 transmitter [6] connects to the DCC bus from an existing DCC system. It simply takes the data stream on the DCC system and transmits it. Installation can be as simple as a couple of alligator clips connected to the rails of a layout. A more permanent solution would be to wire it to the rail outputs of your DCC booster. The transmitter draws a few milliamps of DCC power to operate, about the same as a DCC decoder sitting quietly waiting to go.

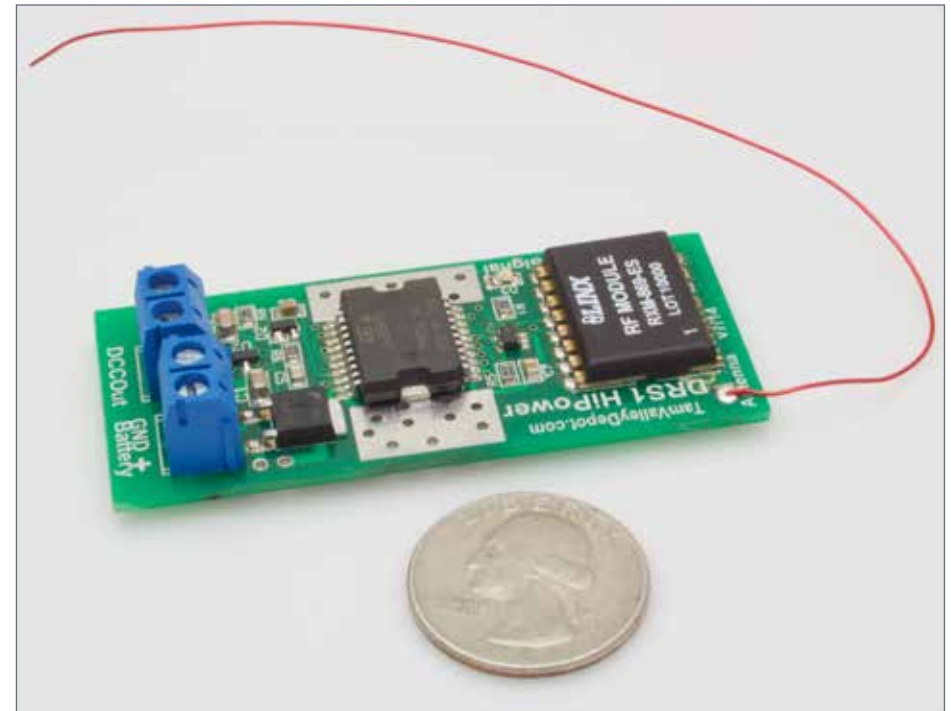


7. The DRS1 receiver, small size, usable up to 18 volts, will deliver 1.5 amps for continuous running. It fits many uses in a package barely larger than the Linx radio module. *Bruce Petrarca photo*

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The DRS1 system has two sizes of receiver. The smaller version [7] is usable with battery voltages up to 18 volts (4 LiPo cells) and will supply 1.5 amps running current (2 amps peak). The larger version [8] will support up to 6 LiPo cells (28 volts) and deliver 3 amps running current (5 amps peak).

On the Tam Valley Depot site there is an example where Duncan installed a high power version of the receiver and 4 LiPo cells in an HO scale dummy B unit. This provided a mobile DCC system to operate BLI sound and motor units, an A and a B, in a UP ABB City of San Francisco lashup.



8. The DRS1 receiver, large size, has screw terminals and a bigger footprint than the smaller unit. This unit will supply up to 3 amps continuously (5 amps peak) with battery voltages as high as 28 volts (6 LiPo cells). *Bruce Petrarca photo*

The locomotive side of the installation consists of connecting the receiver module of choice to your battery and existing DCC decoder and routing the antenna (copper wire) away from motors, batteries and other electronics.

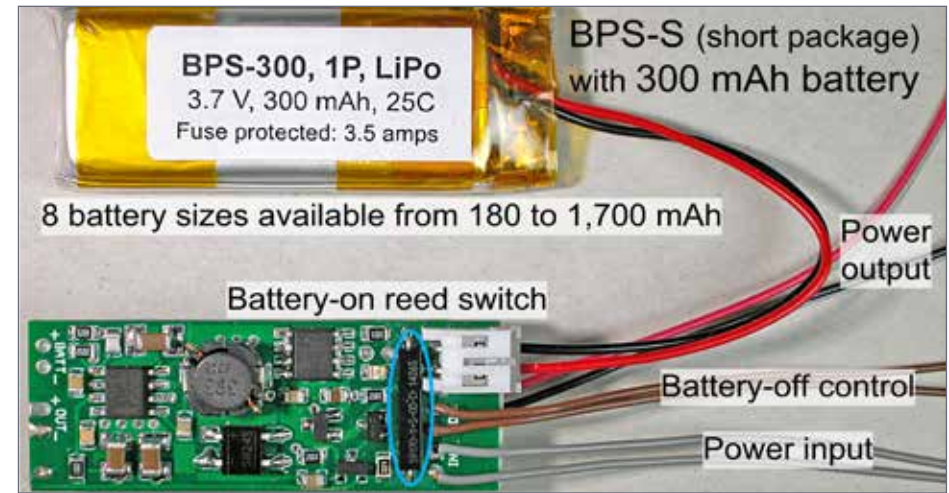
Let's see, who would best be served by the DRS1 system? Folks who were converting an indoor layout (HO or On30 are frequent choices) and already have an investment in a DCC system and cabs are well covered. Just remember the USA-legal system frequency (916.48 MHz) will not work and play well with NCE wireless cabs.

Stanton: S-CAB

In preparing this column, I hooked up with Neil Stanton on the phone. We discussed his S-CAB system (S-CAB.com). I heard some things that I liked and, hopefully, will have more information for you in a future column.

One of his innovative devices is the BPS [9] board (S-CAB.com/battery-power.html) aimed at HO scale and similar sized locos. It connects between a Lithium Polymer (LiPo) battery and track power. When there is more than about 6 volts (DC or DCC) on the track, the battery will be charging. The BPS will convert the 3.7 volt LiPo battery voltage to 11 volts which can be connected to any DCC decoder to become the ultimate energy storage system. When fully charged, even the smallest of these batteries would run a modern loco for many minutes. A selection of battery sizes allows everything from stay-alive support to full dead track operation.

The S-CAB starter kit provides a way to send DCC commands to a receiver inside of a loco. This system consists of a Stanton radio CAB [10] and a radio receiver [11] combined with a DCC decoder [12]. In order to increase the efficiency of the system, Neil connects the DCC signal out of the receiver directly into the decoder.



9. BPS-S (battery power supply) system with a 300 mAh LiPo battery. S-CAB.com photo

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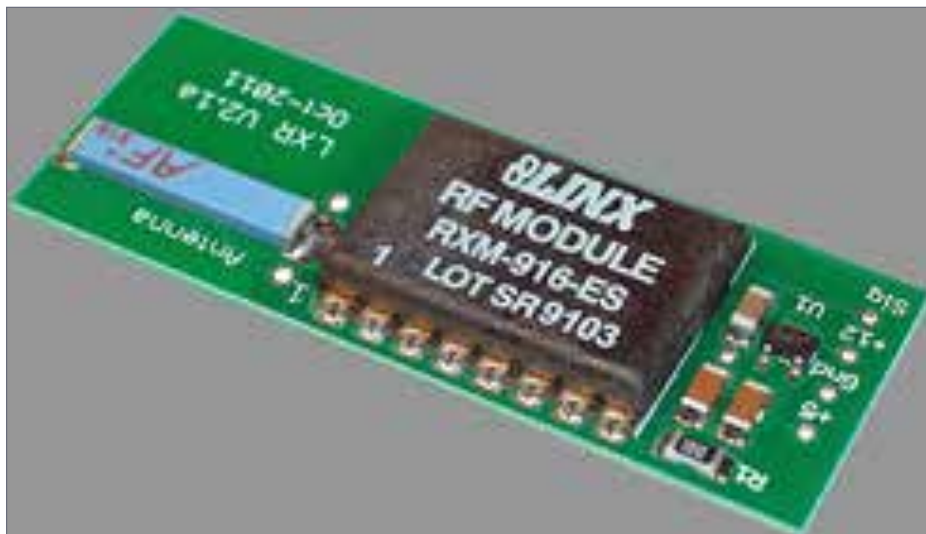


This is why he supplies modified decoders, not just receivers. Don't worry about Neil's mod. Installation of the radio/decoder combo is exactly the same as a regular DCC decoder.

The Stanton Radio CAB is, like the AirWire, an entire DCC command station, cab and radio transmitter in a single unit. The

10. (Left) Stanton Radio CAB. *S-CAB.com photo*

11. (Bottom) S-CAB receiver uses the Linx RF module. *S-CAB.com photo*



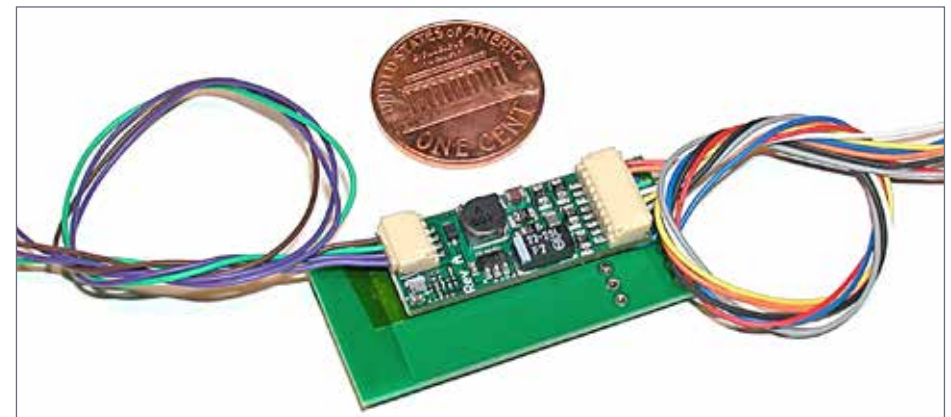
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S-CAB unit has built-in rechargeable batteries. See the charging jack next to the thumb in [10].

If you are working in the larger scales, you will be able to add a high capacity battery pack (connected to the rail via red and black wires of the decoder) for power. In the smaller scales, a BPS [9] system combines on-board battery charging from the track with a battery, all in one integrated package. Instead of using a battery pack, the BPS output (11 volts) connects to decoder red and black wires.

The S-CAB system operates on the 916.48 MHz frequency common to Linx boards. This makes for compatibility between the S-CAB system and others. For example the controller function could be from either an S-CAB Throttle or a TVD DRS1 transmitter. A CVP T5000 cab will work as well, using its channel 16 setting. Again, there is the interference issue with this frequency. However, the S-CAB system doesn't rely on another DCC system to work. So, the NCE issue is less important here.

Neil also offers a Radio Programming Adaptor (RAPA) that functions very much like the TVD DRS1 transmitter. With this unit,



12. S-CAB receiver as mounted to a SoundTraxx ECO-100 Econami decoder. *S-CAB.com photo*

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you can use DecoderPro to customize your S-CAB equipped locomotive the same way that folks can with a wired system. The RAPA even allows read-back of the CV values programmed. I'm looking forward to experiencing this myself.

How do I proceed?

Selecting a communication system requires some thought and planning.

The AirWire cab offers a selection of frequencies. The other two are stuck on one frequency with the possibility of interference. The individual cabs require one cab per loco, which can increase cost.

As I always recommend, it is best to try a cab yourself and insure that you can work well with it.

Once you have a transmitter style selected, then you can move on to selecting a receiver board and batteries. That will be the topic of my April 2017 column.

