RADIO-CONTROLLED, BATTERY-POWERED TRAINS IN THE "SMALLER SCALES"

by Justin Rasas
Photos by the author

Photo 1: From left to right: transmitters with receivers in front of them. Tam Valley Depot DRS-1, CVP T5000, Aristo-Craft Revolution, and Stanton Radio Cab.

In this article I will:

1: Describe how a radio-controlled (RC), on-board battery system for controlling locomotives works
2: Briefly compare several RC train control systems
3: Present several examples of installed systems

Radio-controlled trains with on-board batteries are nothing new – particularly in large scale. However, it is now possible to control smaller scale trains (HO, S, and O) using on-board power with small batteries and tiny receivers. The trains run better than with track power, and you never have to clean the track. Some of the receivers may connect directly to DCC decoders, while others may use proprietary electronics for locomotive control and sound.

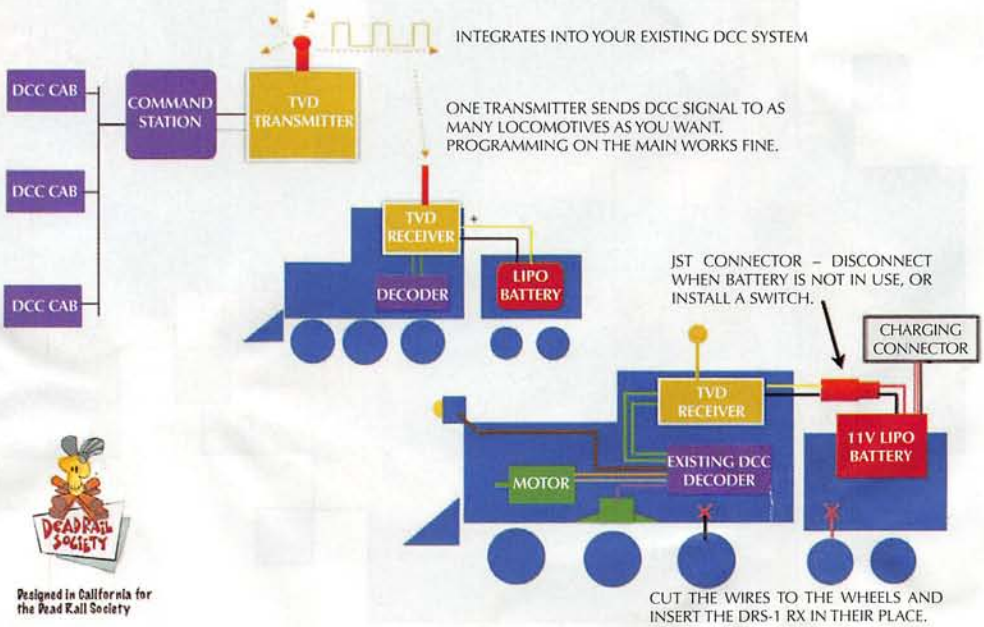
I operate in HO, HOn3, and On30 using RC battery-powered locomotives. My narrow gauge modules have no track power, no wires, and the railheads are painted rail brown. My battery-powered locomotives are safe to run on DC- or DCC-powered layouts as long as the locomotive pickup leads are isolated.

How long will a battery-powered train run before its battery needs to be recharged? This is a function of the battery capacity and the draw of the locomotive, sound, and lights. The bigger the battery – the more runtime. I've been using 11-volt Lithium Polymer (LIPO) batteries with capacities between 200 milliamp hours (mAh) and 800 mAh. These batteries are available from hobby shops that carry radio-control planes and helicopters.

You'll need a battery charger that can charge LIPO batteries. When inquiring or buying a LIPO charger, do learn the specifics about charging LIPO batteries because they require more respect than your typical rechargeable battery. Details on how to charge LI-POs can be found on-line or from the manufacture/retailer of LIPO chargers. Runtime is determined by dividing the battery capacity measured in mAh by the operating current in milliamps (mA). If a can motor draws about 100 mA (0.1 amp) and the 11-volt battery has about 400 mAh, then the run time is about 4 hours (400 mAh/ 100mA). Of course, an inefficient motor, and sound and lights will reduce runtime based on their respective current draws. However, when a locomotive is stopped at a station without lights or sound – the current draw is minimal. You can have a second battery handy, and if the first battery dies, you can swap it out and be up and running again. I've had my kids run battery-powered trains for almost 2 hours at a convention without killing the battery. I don't think I could operate or switch cars for that long, but I may not be the norm.

So, how does it work? Fig. 1 shows the key ingredients of an RC receiver that collects the DCC signal through the air instead of the track. With an onboard battery supplying the power, rails are no longer needed. Rails are truly optional – think about a pole road using real wood. There is one very important thing to remember when using an RC receiver; the antenna cannot be completely enclosed by a brass or metal shell – such as in a tender. RC receiver and battery systems require a transmitter to send the signals through the air. Some transmitters can be added to existing DCC systems thereby reusing equipment or new handheld throttles can be purchased specifically for this purpose.

Fig. 1. Diagram of a RC battery-powered control system. Note how each component works, and how they connect with decoder, motor, speaker, and lights. *Courtesy of Dr. Duncan McRee, owner Tam Valley Depot.*



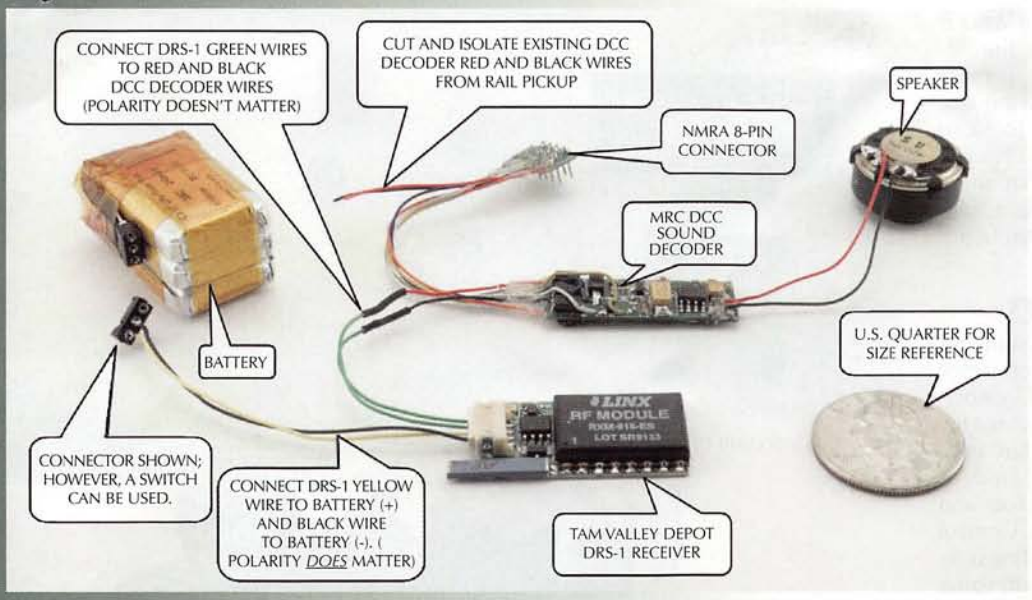


Photo 2: A typical Tam Valley Depot DRS-1 hook-up.

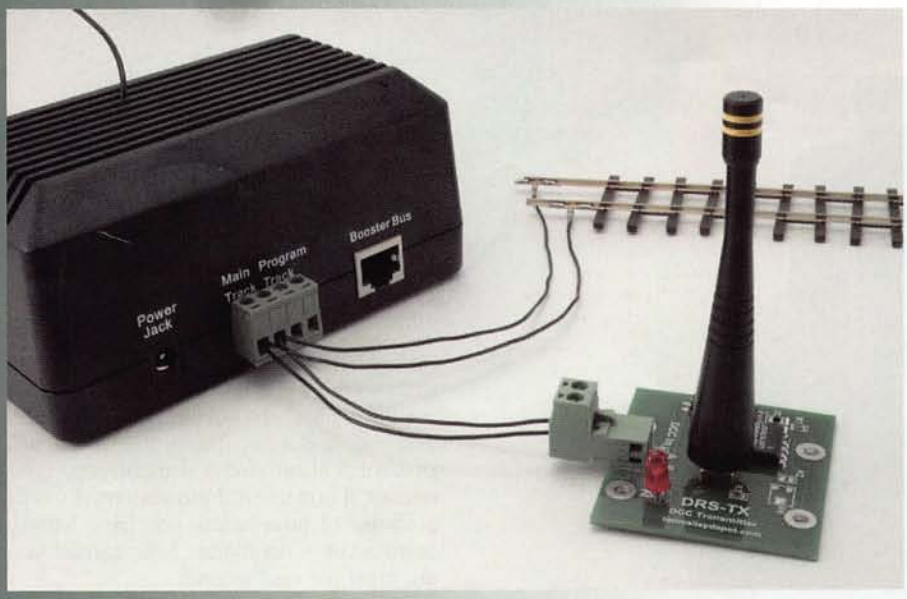
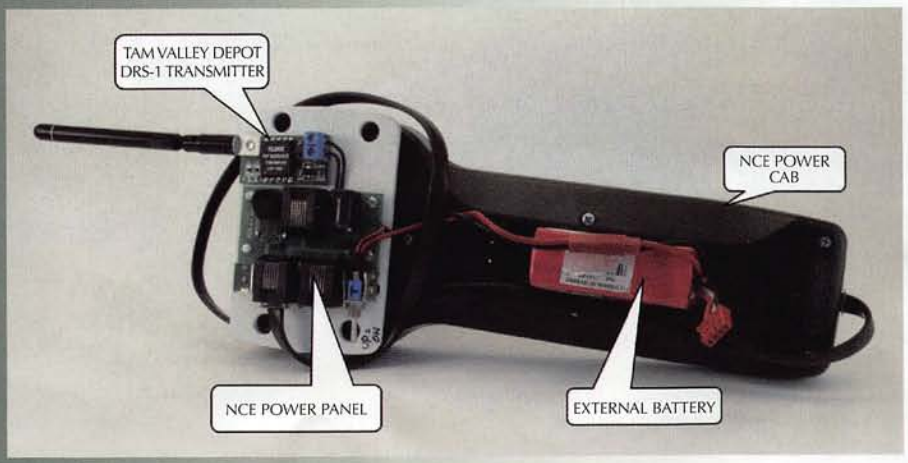


Photo 3: This power supply has been hooked to a Tam Valley DRS-1 system and directly to the track so track-powered DCC locomotives and RC battery-powered locomotives can be operated simultaneously.

Photo 4: An NCE Power Cab modified for RC battery-control.



SYSTEMS

There are several systems available; however, I have only worked with and installed (from left to right in Photo 1) the Tam Valley Depot DRS-1, CVP T5000, Aristo Craft Revolution, and Stanton Cab. Photo 1 also shows the transmitters with their respective receivers in front of them. As you can see the receivers vary in size. I typically select a receiver based on the amount of room available in my locomotive. Since each system has different features, this article provides an introduction, and not an in depth review of each system. More details can be found on each manufacturer's web site.

Photo 2 shows how the components of a Tam Valley Depot DRS-1 system are connected together. The Tam Valley Depot DRS-1 is a DCC receiver that connects directly to the DCC decoder pickup leads going to the track (typically black and red). Once you connect these two wires, you're halfway done. The remaining half is the connection of a battery (with positive and negative wires) to the DCC receiver. These connections can be made directly to an 8-pin NMRA quick plug so the whole system can be tried in different locomotives (Photo 2 shows a DRS-1 connected to an MRC sound decoder). Any DCC decoder will work with the DRS-1 (at least all the ones I've tried), and the DRS system allows for the programming of any Configuration Variable (CV).

Most systems have a handheld transmitter. However, the Tam Valley Depot uses a transmitter that piggy-backs onto existing DCC systems as shown in Photo 3. The two wires that connect the DCC system to the track are connected to the transmitter – this is how the DCC signal is transmitted through the air. As shown in Photo 3, the transmitter can be installed while the DCC system is still connected to the track. This allows for both the continued operation of track-powered DCC locomotives, and simultaneous RC battery-on-board operation.

The DRS-1 system can also be connected directly to a handheld controller such as the NCE Power Cab. Photo 4 shows a DRS-1 transmitter connected to an NCE power Panel that is mounted on a piece of styrene. Normally, the power panel is connected to the layout because there is a power supply connected to 110 volts. Since I didn't want to be tied down, I simply added an 11.1 volt LIPO battery to the Power Cab, and created a wireless handheld NCE Power Cab.

If you don't want to piggyback onto an existing DCC system using the Tam Valley Depot DRS-1, you can buy a handheld throttle (transmitter) from CVP, Aristo

Craft, or Stanton – and use their associated receivers. When looking at the different systems, you should keep in mind the size of the handheld throttle, the size of the receiver, and if you want to reuse your existing DCC equipment. Finally, there are several web sources that share the experiences of other modelers who have used these and other RC on-board battery systems.

CONNECTORS AND SWITCHES

An RC on-board battery system requires an on-off switch, and a connector so you can charge the battery. Connecting it all together requires finding space for the on-off switch, and for the battery connectors. There are many different types of connectors such as micro connectors and servo connectors used by Radio Control hobbyists. Some of these are shown in Photo 5. However, these can seem to be quite large when you try to fit one of them and everything else into tight quarters. I like to make my own connectors starting with Integrated Circuit (IC) sockets. These come in all shapes and sizes – so I look for ones that have round pins. I cut up the rows so there is a linear 3-pin array. Having three pins, and soldering a positive on one end, and a negative in the middle will prevent a short circuit if incorrectly connected. If you use a 2-pin system, it's only a matter of time before you fry a battery or receiver – no matter how careful you are (trust me on this one).

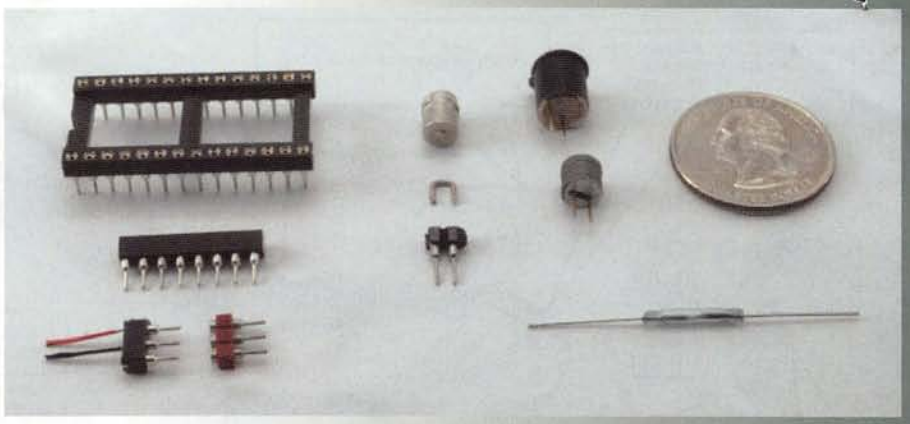
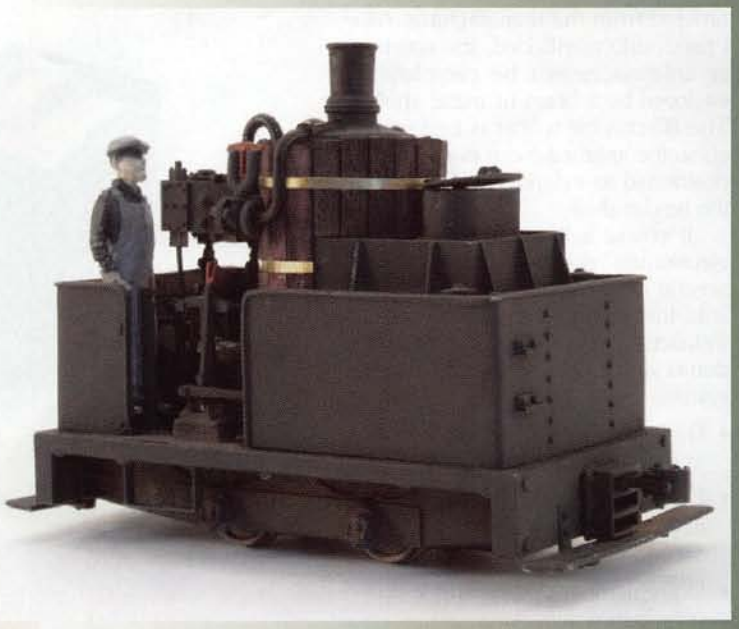


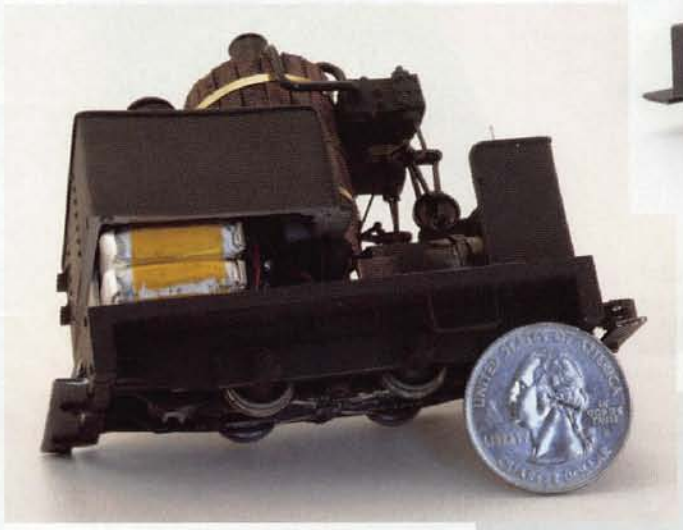
Photo 5: A selection of connectors and switches useful for RC on-board battery systems.

Photos 6 and 7: Here a bridge switch has been disguised as an oilcan on this On3 Shay.

Photo 8: Any one of these three On30 Bachmann locomotives can be controlled from the CVP RC on-board battery system in the single tender shown.

Finding a location for a switch on a locomotive can be harder than you might think. Small switches are available, but can be difficult to install. A common location is under the tender, but having to pick up the locomotive to turn the system on and off can be hard on the locomotive's details. There are alternatives to switches, such as magnetic reed switches to complete the circuit, or an IC connector with a wire shaped like a small staple that creates a bridge to complete the circuit. Photos 6 and 7 show a bridge switch "hidden" as an oil can on an On3 Shay.





Photos 9 and 10: An O Scale narrow gauge Backwoods Miniatures GNAT with a DRS-1 driving a micro Tsunami decoder. Both are stuffed in the boiler. The water tank hides the battery, while the speaker is up against the back bulkhead behind the engineer.

EXAMPLES OF INSTALLATIONS

So, where can you put that battery and receiver? Model steam locomotives typically have a cavernous tender that is perfect for hiding batteries, receivers, decoders, and speakers. Photo 8 shows a CVP receiver installed in an On30 Bachmann tender along with a battery, speaker, and sound decoder. The CVP receiver requires connecting four wires; the black and red (track input) wires from a DCC decoder, and positive and negative connections from a battery. Note that this tender is plastic providing no obstruction

Photos 11 and 12: An On30 Bachmann Porter with a tender for the DRS-1 and battery. The tender can be connected to any DCC decoder.

to the antenna receiving a signal. Another feature of the Bachmann tender is that you can use one tender with different locomotives because of the standardized plugs between locomotives. I call this "the one tender multiple locomotives trick." The tender shown in Photo 8 can be connected to (and control) the three different Bachmann locomotives shown.

How about HOn3? This is where RC on-board battery systems really shine because HOn3 users seem to have the most battles with electric pickup. Photo 14 shows a Blackstone K-27 with a Stanton Cab. The Stanton Cab receiver comes standard with a non-sound decoder, but does have the option of a sound decoder if

ordered from the manufacturer. As I previously mentioned, the receiver antenna cannot be completely enclosed by a brass or metal shell. The Blackstone tender is cast metal, so the antenna (seen in green) is positioned to extend slightly out of the tender shell.

If you're a little intimidated by electronics, don't worry because several of the manufacturers have links that direct you to professional installers. Here are some do's and don'ts with an RC on-board battery system:

- Do keep a second battery handy in case the first battery dies
- Do keep a charger nearby in case you don't have a second battery
- Do remember to turn off your locomotive
- Don't run on misaligned turntables, because you'll run aground
- Don't run on modules with unguarded track ends, your locomotive may land on the floor
- Don't bother cleaning the track

Photo 13: An On30 critter with an Aristo-Craft 2.4 GHz Revolution system and an 11-volt 600 mAh LIPO battery in a boxcar locomotive. The receiver includes motor and light control, but does not have sound. The Revolution system does not use CV's, rather it has an easy interface to change motor control functions such as momentum.

Photo 14: The original Tsunami Sound Decoder was removed from this Blackstone HOn3 K-27 to make room for the Stanton receiver and battery.