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The Stanton radio throttle is one way to operate a battery-powered HO locomotive. See p. 36

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Bernie Kempinski installed the Stanton S-Cab Radio DCC control system components in the tender of an O scale 4-4-0. One of the advantages to battery power is no concerns about power pickup from short-wheelbase locomotives.

BATTERY POWER AND RADIO CONTROL

Try it without altering your existing layout wiring

By Paul J. Dolkos • photos by the author

Many HO, N, and even O scale modelers probably have thought at one time or another, "Wouldn't it be nice to have battery-powered motive power and not have to deal with layout wiring or electrical pickup issues?" This portable power source is commonly used on larger scale outdoor garden railroads, but is seldom found in smaller scale models because of a lack of space inside the locomotives.

But today, smaller and more powerful batteries are readily available. Paired with various wireless radio-control components, battery power is becoming practical for many smaller scale locomotives. Battery-equipped locomotives can be run along with conventionally powered units on a direct-current (DC) or Digital Command Control (DCC) wired railroad. No changes to existing layout wiring are required, allowing experimentation with one or two battery-powered locomotives.

There are a few modelers who have converted their railroads to total battery power and say they wouldn't go back to a wired layout. But the technology still has its limitations for smaller locomotives and large rosters. For example, small diesel switchers have very limited space for components; keeping batteries charged in a couple dozen locomotives requires discipline; batteries don't charge instantly; and at the end of the session, each locomotive has to be turned off

individually – you can't just flip off a master power switch and walk away.

System characteristics

Systems for operating battery-powered locomotive have three main components:

- A wireless radio-control throttle that transmits instructions controlling the locomotive.
- A receiver and antenna in the locomotive to link up with the throttle. In some systems, the receiver may be smaller than a typical DCC decoder.
- A battery or battery pack. The higher the capacity of the battery supply, the longer the run time, and operation for a couple of hours or longer without recharging is typical. Heavier trains and steep grades reduce run time by perhaps 20 percent.

In the most basic system, the locomotive's receiver takes the wireless throttle's commands and regulates the battery power to the motor for speed, and polarity for direction.

There are also battery systems that work with DCC decoders, allowing sound and the adjustment of configuration variables (CVs) just like any other DCC system. These installations require space to accommodate the onboard wireless receiver and battery in addition to the decoder and speaker.

The number of locomotives that can be operated simultaneously is only limited by the number of throttles available. Digital Command Control-based battery-powered systems use the same locomotive addressing scheme as track-powered pick-up does. The Del Tang system described below uses a wide range of frequencies to link the throttles to the locomotives.

Battery considerations

Battery selection is a balance between physical size and capacity rating – which is stated in milliampere hours (mAh), current draw of the locomotive, and the system installed. The 240 mAh output from an 11.1 volt battery back provides two or three hours of operation. The Stanton S-CAB system utilizes a 3.7 volt, 850 mAh battery connected to its battery power supply (BPS) circuit board to step up and regulate the voltage. With all systems, lithium polymer (LiPo) batteries must be handled with care and the warnings must be heeded.

There should be easy access to the batteries so they can be removed from the locomotive for charging or replacement. As with a cellphone or other battery-powered device, a dead battery is no good when you want to operate.

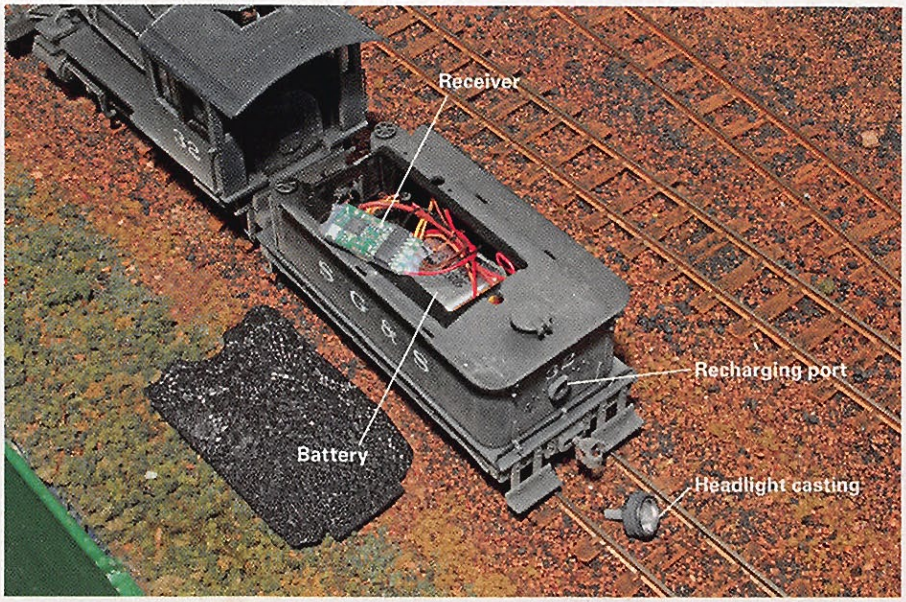

Fig. 1 From planes to trains. Steve Sherrill installed Del Tang wireless components and a lithium polymer (LiPo) battery in a Bachmann On30 2-6-0. A recharging port is installed on the rear tender wall. It's normally covered with a plug-in headlight casting (shown lying between the rails).

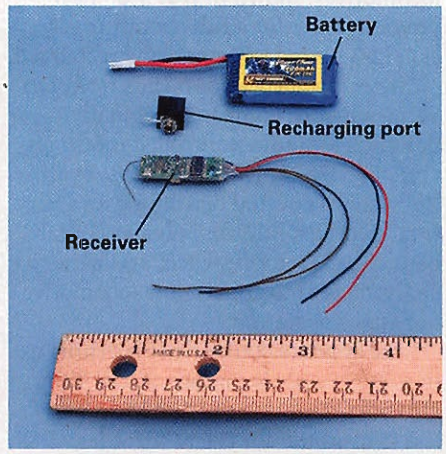

Fig. 2 Del Tang components. The Del Tang receiver is very compact — about an inch long. One pair of wires is connected to the battery and the other to the motor. The short wire on the receiver's left end is the antenna.

Fig. 3 Del Tang controllers. The Del Tang Tx22 controller can be programmed to store up to 12 different switch-selectable locomotive addresses. The Del Tang Tx21 can only store a single address at a time.

Recharging with track power isn't quite as simple as it might appear. Typical 12-16 volt track power isn't normally compatible with the batteries used with these systems. An external recharger unit is usually required. An on/off battery switch is also required so batteries are not over-discharged and damaged during periods of non-use.

Challenges of battery power

Converting locomotives to battery operation isn't a plug-and-play project, but the work is similar to installing a decoder. The major obstacle is fitting the pieces into the available space. For modelers who aren't comfortable removing locomotive shells, integrating the components, and soldering, NorthWest Short Line, which sells the Stanton S-Cab system, and Tam Valley Depot, which sells its own battery system, recommend specific independent installers who do the work. The installers take the basic system components and select appropriate batteries and connectors for the job.

The cost of the electronics and batteries installed in each locomotive is $60 to $220, depending on the system and whether the required components include a DCC decoder. External components for controlling the engines (throttles, transmitters and chargers) range from $100 to $170.

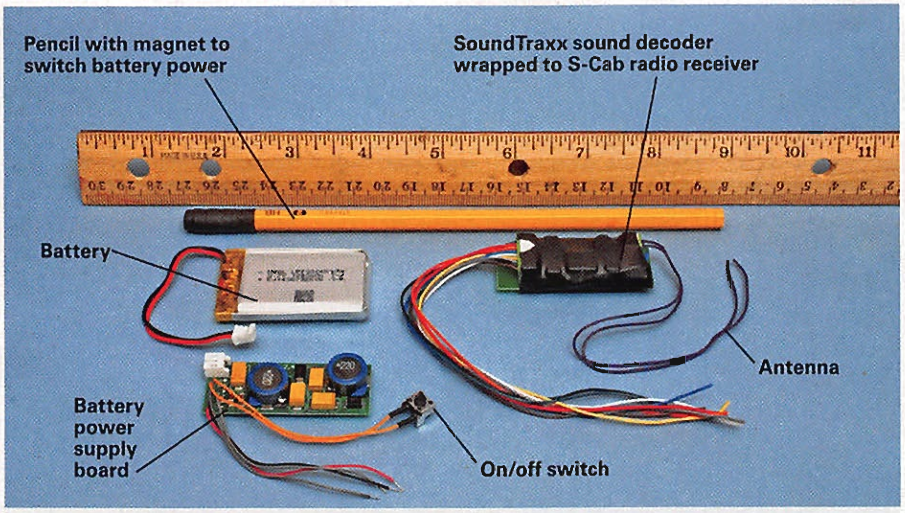

Fig. 4 S-Cab components. The Stanton S-CAB Radio DCC control system is the creation of retired power systems engineer Neil Stanton, who supplies the system directly and through NorthWest Short Line.

Going 'dead rail'

Modelers with battery-powered locomotives often refer to themselves as members of the "Dead Rail Society." Here are some modeler experiences, using three different manufacturers' systems. Two installations are on 1/48 scale railroads using small-boilered steam locomotives. The third system described is on two HO scale railroads, one in a large steam locomotive and another in a small engine.

The most basic system

Steve Sherrill first looked at battery operation because too often operators were creating shorts when running through switches set against the train on his DCC-powered railroad. Also appealing was knowing that dirty rails or wheels wouldn't cause problems. Steve runs short trains (three to five cars) on grades up to 4 percent on his On30 mountain railroad. The batteries in the locomotives, shown in **fig. 1** on page 37, provide power for a full operating session (2-3 hours) without being recharged.

Steve installed components from Del Tang, a British company, originally designed for radio-controlled model aircraft. See **fig. 2**. It's the simplest of all the systems covered here and uses a very small receiver, lithium polymer (LiPo) battery pack, on/off switch, and battery charging port to convert the locomotive to battery operation.

The system's compactness permits use in some N scale locomotives. Del Tang also offers two types of handheld wireless transmitter for use as throttles, shown in **fig. 3**. They control speed, direction, inertia, lights, and locomotive selection. This system doesn't provide an option for sound.

Steve said installation can be accomplished in less than an hour. Battery recharging is done with an external unit that plugs into a battery charging port on each locomotive. This is a female 3/32" diameter phone jack receptacle that can be mounted anywhere on the locomotive, as long as the external male jack can be easily inserted.

Steve installed them on the back wall of tenders and on the roofs of diesels. They're unobtrusive when painted the same color as the adjacent area. They can also be hidden in a coal pile or under a hatch. He avoided installing ports under locomotives so he didn't have to turn an engine on its side to charge its battery.

An on/off switch allows power to be shut off if the locomotive sits idle for extended periods during a session, when not in use, or between sessions. The type of switch used is optional. The choice of magnetic, reed, or push on/off depends on the mounting and access options. In some DCC decoders, a function output can be used to turn batteries off. Including an on/off capability with any battery system is mandatory.

21st century Civil War engines

Bernie Kempinski's O scale layout depicts U.S. Military RR operations in Virginia during the Civil War. He used light 4-4-0 locomotives that didn't have all-wheel power pickup, and the running quality was compromised. He began adding pickups where possible, but thought battery power would provide a more reliable power source.

He selected the Stanton S-CAB Radio DCC control system. It's the creation of a former Purdue University engineering professor and retired power systems engineer, Neil Stanton, who supplies the system directly and through NorthWest Short Line.

It consists of a wireless receiver shrink-wrapped with either an NCE or a SoundTraxx Tsunami sound decoder. See **fig. 4**. There's also a power supply adapter board. These components, a battery, and a speaker for sound systems must be installed in each locomotive. Stanton offers a handheld wireless radio transmitter to control the locomotive.

Another throttle option is a CVP Products AirWire controller. See **fig. 5**. CVP offers battery-power systems for garden railroads. It provides the ability to fine-tune DCC CV options. Bernie uses the AirWire throttle to program the

Pros and cons of battery power operation

Advantages

- Dirty track or wheels don't inhibit smooth running.
- Polarity reversing circuits are eliminated for wyes, reverse loops, and turntables.
- A short or derailment caused by another train doesn't effect battery-powered units.
- If all layout locomotives are battery-powered, most or all track wiring can be eliminated.

Concerns

- Battery-power components may not fit into small motive power.
- No low-battery warning with current systems.
- Run time is reasonable, but recharging may be required during long operating sessions.
- Maintaining battery charge requires discipline, especially for a large locomotive fleet.
- Derailed locomotives won't stop until the throttle is turned off. – *P.J.D.*

Fig. 5 S-Cab controllers. The S-Cab-equipped locomotives can be controlled with either the Stanton Radio Cab throttle, or the CVP Products AirWire T5000 throttle. Bernie uses a conventional CVP DCC system on his layout in addition to the battery-powered locomotives.

locomotives and the Stanton throttle to run trains for day-to-day operations. Locomotives not equipped for battery operation are operated on the layout with a CVP DCC system.

Bernie found room in the tenders to install the electronics, but had to use a heaping, but prototypical-sized, pile of firewood atop the tender to conceal everything. See **fig. 6**. The speakers in his locomotives are usually installed in the boilers.

One feature currently unique to the S-CAB system is the ability to charge the batteries with rail current using the internal power supply adapter. This adapter prevents overcharging the LiPo battery and provides both over-current and low voltage protection. But one has to be careful to not park the locomotive on dirty track, which would interrupt charging, or forget to turn on the track power. It can be maddening to discover when you want to run something that the battery is depleted. "While these should be infrequent occurrences, these things happen," Bernie said. "With a normal battery charge, I can run trains with the rail power turned off for three hours or more, and virtually continuously with rail power."

Bernie's trains are just four or five cars, but the scratchbuilt Civil War-era equipment's trucks aren't especially free rolling, so this increases battery drain.

Using rails as a charging power source for some is a bit counterproductive if the ultimate goal is to eliminate track wiring. When rail power charging is an option, wiring could be reduced to spots where locomotives are normally

Fig. 6 S-Cab installation. Bernie installed the battery power supply control board with an on/off switch on top of the battery pack. Below that is the sound decoder and radio receiver. The speaker is in the locomotive boiler.

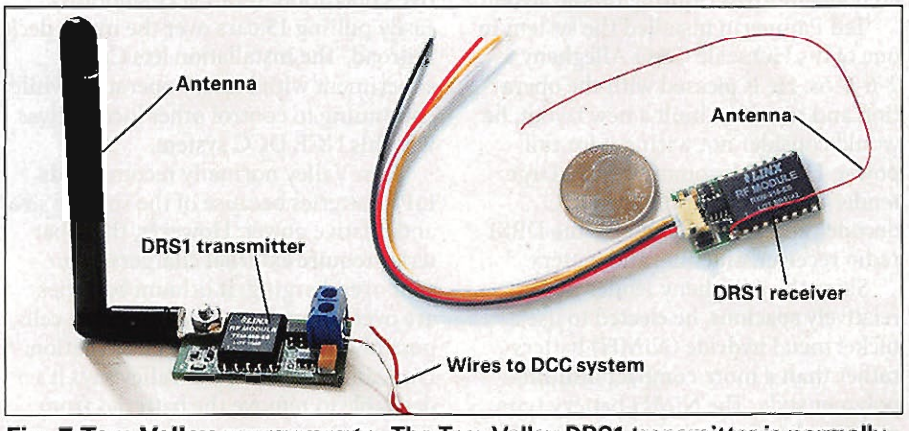

Fig. 7 Tam Valley components. The Tam Valley DRS1 transmitter is normally installed as an add-on to a conventional DCC system and high in a layout room to broadcast DCC signals to DRS1 battery systems in locomotives. This is the equivalent of a radio transmitter unit required for wireless DCC throttles. The receiver is wired to the decoder and the battery pack in the locomotive.
receiver photo, Tam Valley Depot

Keeping up with the technology

Because battery power use in smaller scale models is relatively new and the technology is evolving, online resources are important for learning about other modelers' experiences and keeping up with new developments. Here are some of the manufacturers and distributors of radio-control and/or battery products designed for model railroaders. Some products are better suited to large-scale modelers. – *P.J.D.*

CVP Products
www.cvpusa.com

Crest Electronics
www.crest-electronics.net

DT Control Systems (Del Tang)
www.deltang.co.uk

G-Scale Graphics
www.gscalegraphics.net

LocoLinc
www.locolinc.com

RCS America (RailLinx)
www.remotecontrolsystems.com

Remote Control Systems (Australia)
www.rcs-rc.com

Stanton Radio Cab
www.s-cab.com

Tam Valley Depot
www.tamvalleydepot.com

These user groups also provide information:

www.groups.yahoo.com/neo/

www.freerails.com

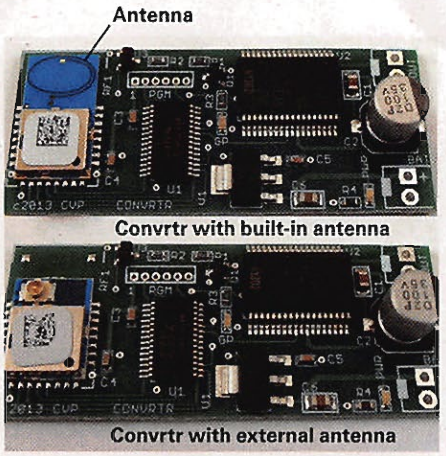

Fig. 8 CVP components. The CVP Products Convrtr allows modelers in the smaller scales to use the company's AirWire system developed for outdoor G gauge layouts.

parked, as in an engine terminal or at a water tank.

Using existing DCC systems

The Tam Valley Depot DRS1 (Dead Rail System) is designed as an add-on to an existing DCC system. See **fig. 7** on page 39. The small external DRS1 system radio transmitter module is attached to the DCC layout bus to provide a wireless link to locomotive receivers. This enables the use of the same throttles, either wireless or tethered, used with the rail powered locomotives running on the layout.

Ted Pamperin installed the system in one of his HO scale C&O Allegheny 2-6-6-6s. He is pleased with the operation and says if he built a new layout, he would consider not wiring it for rail power. His test locomotive has a large tender to house not only the DCC decoder and speaker, but also the DRS1 radio receiver, antenna, and battery.

Since the Allegheny tender is relatively spacious, he elected to use a nickel metal hydride (NiMH) battery rather than a more compact lithium-polymer style. The NiMH battery type permits charging using rail power with the Tam Valley system.

Being battery-powered doesn't affect the tractive effort of a locomotive. During a four-hour operating session, the locomotive hauls 25 loaded hoppers up 2 percent grades on three different runs across his large railroad. "The battery doesn't charge as fast while the engine is under a load, so the run time is probably not indefinite. But that has not been a concern," Ted said.

Another modeler, Craig Bisgeier, who is re-creating the 1892 Housatonic RR in HO scale using small steam locomotives, installed the Tam Valley system in an older IHC 4-4-0 powered with LiPo batteries. Inherent electrical pick-up issues and dirty track didn't affect the locomotive's operation. It ran very smoothly, easily pulling 15 cars over the multi-deck railroad. The installation lets Craig experiment with battery operation while continuing to control other locomotives with his NCE DCC system.

Tam Valley normally recommends LiPo batteries because of the smaller size and relative power. However, these batteries require external chargers to prevent overcharging. If lithium batteries are overcharged, it will damage the cells, possibly creating a hazardous situation. Duncan McRee of Tam Valley says it's desirable to remove the batteries from engines for charging.

Tam Valley sells a 42-page tutorial that not only describes the DRS1 system, but also many helpful basics of battery system installation and operation. The PDF can be downloaded by going to www.tamvalleydepot.com/deadrailsystem.html.

AirWire for the smaller scales

Another component available to set up small scale locomotives for DCC and battery power operation is the CVP Products Convrtr, shown in **fig. 8**. It's CVP's AirWire technology for controlling large scale garden railway equipment put into a smaller package. The Convrtr is a 0.3 x 0.8 x 2-inch printed-circuit (PC) board wired in series between a decoder and battery. It serves as a radio receiver for the commands from CVP's T5000 wireless throttles.

The Convrtr, in addition to running the locomotive, serves as the DCC system command station, and enables locomotive CVs to be programmed. The package is completely independent of any other control system, and requires no power to the rails, which of course, is the point of battery operations.

Changes coming

Obviously, technology and the change it brings is evident everywhere, and model railroading isn't exempt. Not long ago, locomotives weren't offered with decoders. Now, if a new locomotive offering doesn't have a decoder, it's at least equipped with a socket for one. Soon, manufacturers will be offering factory-installed "Stay Alive" capacitors to eliminate stalling on dirty rail or dead spots. So it could be only a matter of time before battery-powered locomotives will be readily available. MR

Paul Dolkos is a frequent contributor to Model Railroader. *He is building the HO scale Baltimore Harbor District layout at his Alexandria, Va., home.*