MAKING TRAINS RUN

A Clinic Presented by
BOB VAN CLEEF
of the North River Railway
A CLINIC in (4) parts

This clinic will be presented in (4) parts.

- **Part 1** will be a short history showing how the earliest toy trains were powered.
- **Part 2** will trace the development of model railroad power from simple track circuits to sophisticated miniature computer control.
- Part 3 are a few thought in the direction the future may hold for running trains.
- **Part 4** shows how to build a safe, old-fashioned basic power supply that has been in service for over 30 years.
WHAT MAKES MODEL RAILROADING SO INTERESTING?

• One answer in a word is: **MOTION**!

• Whether pulled by steam, diesel or even straight electric, there is nothing that catches the eye faster than at train winding its way along twin ribbons of steel.

• Of course something is needed to create this motion.
TODDLER POWER

• Robert Stevenson’s Rocket launched world wide attention in 1829 much like Alan Shepard’s first trip into Space.
• The Rocket inspired hundreds of simple toys like this cast iron toy train for years afterward.
• Energetic Young children and future engineers eagerly pushed and ran them across the floor and continue to do so to this day in one form or another.
BOILING WATER, the NEXT POWER SUPPLY

• Richard Trevithick used boiling water from a tea kettle, to power his model when patenting his first steam locomotive.

• Models that appeared shortly after like the Birmingham Dribbler shown here were self-contained and burned powdered coal or coal oil.

• The term ‘Dribbler’ was derived from the trail of water that they left behind.

Birmingham Dribbler, one of the first ‘carpet’ railway engines appeared in the 1840s were manufactured in Birmingham, England.
The next major advance was in 1868 when Edward Ives founded the ‘Ives Manufacturing Company’ in Connecticut.

At first he was a proponent of spring power as he wanted even those who lived in rural areas without electricity to enjoy his trains.

Later, he converted to electricity to power his trains.
While Murray Bacon patented the first electric toy train after the civil war in 1884 it was Robert Finch and Morton Carlisle who manufactured the first commercial electric trains in volume.

It was marketed as a ‘complete train set’ including a locomotive, tracks and a battery.

Both inventors originally thought to advertise their miniature motors through the use of miniature trains.

No. 1 Finch and Carlisle Trolley was the first electric engine.
The FINCH & CARLISLE BATTERY

- The plunge battery that came with Finch and Carlisle’s ‘Complete Electric Railway No.1’ was complete but it had to be assembled by the user.
- Zinc plates could be withdrawn or “plunged” into a chromite (FeCr$_2$O$_4$) solution between graphite electrodes.
- This allowed operation in rural areas that might not be wired for electricity.
- The tracks also had to be assembled by pushing tin strips into the grooves of wooden [tie] spacers.
- Children played with *this*?
WHO was JOSHUA L. COWEN?

• He built his first toy train at age 7 attaching a small motor under a model of a railroad flatcar.
• He designed “a fuse to ignite magnesium powered flashes”.
• It was a dud for photography but the U. S. Navy. bought 24,000 of them in 1898 to detonate underwater mines.
• He developed but did not perfect little metal tubes that were designed to illuminate flowers in their pots. He gave up and gave this invention to one of his salesman, Conrad Hubert who developed them into flashlights and founded the Eveready battery corporation.
• Meanwhile, this man developed his own multi-million toy manufacturing corporation.
LIONEL ENTERS THE MARKET

- Yes, that initial ‘L’ was for Lionel and appeared everywhere on his trains.
- He also started selling his toys with plunge batteries but soon realized the danger of using corrosive liquid batteries in the home environment.
- He began selling his toys with four much safer [Eveready] dry cells to provide the power for his trains.

Remember that he gave his salesman Conrad Hubert of Eveready Batteries his start.
Cowen also introduced the rheostat to control the speed of his trains. This helped compensate for various motor voltages, as well as the changes in battery voltage as they wore down. It was used to run trains at a reasonable speed but was designed to simply be set to a given speed.
• Thomas Edison, the ‘Wizard of Menlo Park’, developed the DC systems used for wiring homes up until about 1903.
• This however was only feasible in areas of high density of population as voltage was fixed.
• George Westinghouse developed AC systems to solve this problem.
• There was a bitter war between the two, but eventually Westinghouse won and AC is used in homes today.
AC WITHOUT A TRANSFORMER

- As America became electrified so did the toy train industry.
- Cowen was the first to sell a few devices to run trains on this new AC but without using transformers.
- One such system used a 50-candle power lamp and resister in series to lower the 112 volts to safer (?) levels.

![Diagram](image.png)

- This apparently worked but surely it was not exactly UL approved as track voltages could still rise to high levels if no train completed the circuit.
Transformers

- Cowen was also the first to use ‘multivolt’ transformers for his trains.
- These first, transformers were designed simply to make connecting to house power safer.
- Two or more could be and often were connected in tandem for greater power.
- Transformers however did not work with DC. Also some newer and smaller motors ran only on DC

Note that early transformers were taped (much like using dry cells) to run trains at certain discrete speeds.
MORE COMPLICATIONS

Note that while many voltages were possible there was no way to gradually increase or decrease the speed of a train.

- Yet another problem was with the wide range of voltages supplied to homes.
- Voltages for locomotive motors also varied wildly.
- The multi volt transformer provided a way to provide a voltage close to what was required by the motor used.
- Almost all Lionel transforms had some sort of multiple terminal arrangement both for motors and accessories.
RANGE OF VOLTAGES AVAILABLE

LIONEL "MULTIVOLT" TOY TRANSFORMER

110 VOLTS - 60 CYCLES - 150 WATTS TYPE K

CAUTION: USE ON ALTERNATING CURRENT ONLY

VOLTAGES OBTAINED WHEN USING SWITCH

1 TO U 2 4 6 8 10 VOLTS

2 TO U 10 12 14 16 18

A TO U 17 19 21 23 25

THE LIONEL CORPORATION, NEW YORK
SPEED CONTROL - (AT LAST)

• This was Cowen’s first speed control designed to smoothly adjust the speed of a running engine

• It along with the multivolt transformer allowed the operation of a train to start from standing still and gradually progress to full speed for the first time.
It wasn’t until much later in 1945 that Lionel made the first transformer with integrated speed control.

Toy trains reached their peak in about the 1950’s and began a slow but constant decline to a shadow of their former glory.

Note the “UL” symbol proclaiming this to be a safe device.
A PRIMITIVE AUXILLRY CONTROL

• This transformer was available a few years later and borrowed a few tricks from the model railroaders.
• Note that it featured the control of the train’s direction and whistle.
• Unlike most MODEL trains that used DC, the AC power was offset by 1-3 volts to operate the accessories like the whistle.
The transformer could send a signal to the whistle or the direction control but not both at the same time.

The direction simply interrupted the current to the tracks.

The whistle signal was passed through a rectifier and resister combination that caused a DC offset to the AC track voltage.

The DC relays simply ignored the AC and operated on the DC offset.

Not show are the relay contacts to the 1-3v whistle motor.
Lionel sold this radio control system for toy trains in 1945.

- The vacuum tube transmitter imposed a 3v [FM tone] signal on the AC track power.
- It controlled up to 10 devices including the engine. It could uncouple each car in the train and operate accessories.
- Dirty track and poor rail joints conspired to create a maintenance nightmare.
- This system enjoyed only a brief production run.
LIONEL 375 TURNTABLE

• By the way, the Lionel corporation made only one style of turntable shortly before going into bankruptcy.
• It had to be assembled, rested on the table top without a pit.
• Early versions ran in one direction only. There was no alignment mechanism and if the operator missed the table had to be rotated 180 degrees for another try.

The one and only turntable offered by the original Lionel Corporation from 1962 - 1964
The ZW Transformer (1945-1966 is shown here retrofitted with 3rd party digital volt and amp meters.

• Joshua Cohan passed away in 1965.
• By 1966 transformers were no longer manufactured.
• The LIONEL company filed for bankruptcy in 1967 and the company licensed its electric train manufacturing to General Mills in 1969.
• The Lionel name continued in existence for a short time later but branched out to other products.
A TIME FOR TRANSITION

• Back in the 1920s Toy trains were expensive and mostly for wealthy families. They were used most often under the Christmas tree.

• Trains and accessories were purchased as ready-to-run out of the box. Owners simply arranged everything on a table or floor and connected a few wires.

• Scenery lacked detail with very little actual modeling.

• Prototype operation was mostly by vivid imagination only.
THE START OF A NEW HOBBY

- As the roaring twenties turned to the big depression. A number of individual hobbyists began to “make do” and experiment.
- Some simply built their own models of boats, planes and trains from scratch. Others tinkered with radios and other disciplines.
- Hardware, Electrical and Specialty stores like Allied Radio, Lafayette and Radio Shack opened their doors for all hobbyists.
- Parts and supplies suitable for modeling became available outside of the established to train manufacturers through mail order stores like AHC and found in hobby magazines.
- W. K. Walthers began manufacturing parts exclusively for the railroad modeler and started an empire selling not only his own wares via mail but also those of dozens of other small time manufacturers in a single catalogue.
- A few hobby stores that specialized in the esoteric needs of modelers began to open locally to satisfy these new interests.
Eventually modelers who were more interested in true scale, actual detail, and realistic operation of model railroads began to gather together in clubs and social groups. These included the first true model railroaders.

Several hobby-oriented magazines began to publish modeling articles, first for all types of modelers, then more specifically targeted.

The Model Railroader was first published in January, 1934 exclusively for some of these hobbyists.

The NMRA was established the next year in 1935 to define standards of model railroads.
BEGINNING OF SCALE OPERATION

- Not all model trains were as detailed as their toy counterpart.
- Operation though was of high importance.
- Toys had two speeds, Fast and stop.
- Modelers began to demand a better slow transition from standing still to full speed and back.

Operation on a 1934 home model railroad
WHICH IS BETTER, A.C. or D.C.?

This common question was asked in the May, 1934 MR Remember that “O” scale and larger scales were common in this era. HO was more an experiment in miniaturization but had the same starting problem.

What are the respective advantages of A.C. and D.C. for propulsion current?


With the small low voltage motors used in model work the power factor is so low that D.C. gives almost twice the power A.C. does. However, unless a starting rheostat is used, the D.C. will reach its maximum current value so quickly that the train will jerk badly when starting. A.C. gives a much smoother and more realistic start, due to the impedance in the circuit. Also the transformer is a much more efficient and reliable power conversion apparatus than anything available in direct current.

—A. C. K.
• Larger and more complex layouts made the use of Dry cells no longer feasible.

• Homes first wired with DC were converted to AC by 1930.

• This left many modelers without a dependable source of DC.

• Other ways had to be found to supply DC to a railroad system.

• Remember that solid state devices did not exist yet.
RECTIFIERS – A HUGE ADVANCE

• Vacuum tubes however were a well-known common device used in radios to convert AC into DC inexpensively.
• Modelers began to salvage and use radio parts to build their own DC power supplies.
• It was soon discovered that inserting a switch to remove one half of this circuit would produce a pulse power that made engine starts even smoother.
OTHER USES FOR RADIO TUBES

- Tubes were also used in model railroads for many control applications such as shown by this block control system.
- These all used some combination of capacitors, coils or resisters to generate a specific frequency or “tuned” circuit.
- It was these separate frequencies that allowed independent control of various devices.
- This was a prevalent feature where multiple trains were operated on the same main line.
- Many model railroad articles featured this type of circuit.
SOLID STATE RECTIFIERS

- The introduction of Selenium or dry plate rectifiers in the mid 1930s made the conversion of AC to DC much easier and less expensive.
- DC yielded twice as much power as AC due to the power factor of DC but AC produced smoother starts.
- Complete power supply kits became popular in magazine advertisements.
DC PULSE POWER

Selenium and later the introduction of silicon and solid state devices made building smaller, and less expensive power supplies possible.

- DC with Pulse power became a popular option for operation for intermittent slow speed operation.
- It allowed extremely slow starts and had the advantage of actually burnishing dirt deposits from the wheels and rails thus further adding to even better operation.
- Engine motors, unfortunately, tended to overheat damaging the magnets. Also, running mechanisms in smaller scales could also suffer from excessive wear.
LEGACY DC

• It took many years for some urban homes to convert from DC to AC. Modelers had to cope with methods to convert high voltage DC to safe levels.
• The use of batteries and battery chargers was common on home layouts. (note the capacitor used to level line surges).
• Some Clubs and larger layouts used motor / generator pairs for power.
FIRST COMMON WIRING SYSTEM

• Very few changes were made in propulsion power supplies between 1935 and 1965
• Several simple Cab/Block control schemes came into vogue and was used by most modelers.
• Signals were more realistic looking but only very simple signaling systems were used on most home layouts.
Board games such as Avalon’s 1958 “DISPATCHER” became popular during this time. This game presented a reasonably realistic scenario of running multiple trains with possible conflicts of schedule.

The Microsoft Train Simulator followed several years later as computers began to become popular in 2001 to present the operation of a locomotive from the engineer’s perspective.
• It should be understood that many computer hobbyists have always been interested in computerized train control as shown by magazines such as this July ‘77 issue of BYTE magazine.

• Back then a typical system used a 8250 UART with a 8080 CPU to send packets of data to modems and hundreds of other devices. DCC uses this same scheme to communicate with decoders today.

• Many processors today maintain the same functionality as part of their architecture. The only difference is there are now a many more different types of devices in use.
COMPUTERIZED LAYOUT DESIGN

- Sandia Software created CADrail in 1992 to help design model railroads in both 2D and 3D views.
- Newer versions include simulators that allow a “cab ride” view of the resulting layout.
- Each track section or other object was defined mathematically with all features digitally stored in a database.
MORE LAYOUT DESIGNING TOOLS

- TrainPlayer is among many other computer-aided design (CAD) applications available today to design and simulate train operation. It has add-ons for all types of tracks, engines, cars and scenery.
- Complete virtual layouts are also available as is a control panel to run your virtual trains.
- Several other programs exist each with their own special features.
DIGITAL IMAGES

• Most COMPUTER ASSISTED DESIGN (CAD) systems used to design layouts and train simulators use INITIAL GRAPHICS EXCHANGE SPECIFICATIONS (IGES) to create images. (Remember these two terms)

• This world standard format was originally used with numeric control machines to fabricate parts.

• Today this allows the interchange of any computer generated 2D or 3D images into surprisingly realistic renderings.

• P.S. This technology is also used to produce cartoons.
Meanwhile, back in the 1960s, General Electric tried to enter the home automating market in the mid-60s with this Automatic Simultaneous Train Control system.

- It used frequencies in the range of 100-255kHz to control trains.
- Five channels were supported but it was still an analog system, not digital in nature. It used Silicon Controlled rectifiers (SCRs) to control the motor and was very expensive.
- Voltage spikes on dirty tracks had an unfortunate tendency to damage the voltage sensitive parts and the capacitance between the rails caused frequency drift problems over long distances.
DIGITRACK 1600 / CTC-16 / DIGIPAC 316

- The Digitrack 1600 was built from 1972 to 1976.
- Modelers could build the CTC-16 system (based on the Digitrack 1600) from articles appearing in the 1978 Model Railroader.
- Both used pulses riding on constant DC but were analog in nature.
- The article was the only one to show the modeler how to build their own command control system.
- Digipac 316 was the commercial version of CTC-16

CTC-16 as constructed from 1978 MR article.
SUNSET VALLEY

• One railroad club used the CTC-16 in conjunction with a Dispatcher and Heathkit H-8 Computer for operating sessions.

• Wireless throttles were used so the engineer could run by the signals.

• Note the switch position and track occupancy detectors used to provide feedback to the dispatcher and engineer.

From Bruce Chubb’s article of Sunset Valley system as explained in Feb ‘85 MR
Hornby ZERO 1

- The English Zero1 appeared on the scene in 1979 and was the first true digital system being based on a modified TMS1000 microprocessor.
- It was extremely versatile and contained most features found in DCC today including clocks and accessories. It was expandable although these features were all implemented in a different manner.
- Dirty track had only a very minor effect on its reliability.
- It did not gain wide acceptance mainly due to its high price but was a for-runner for the DCC system.
Onboard and PSI Dynatrol

- Two more systems soon followed.
- The Onbard system was more expensive than Dynatrol.
- It featured sound and wireless throttles used to eliminate the need for a control panel.
- Dynatrol featured momentum and brakes.
- Both became very popular systems but still were basically analog devices and considered to be command control systems but neither were true DCC systems.
COMMAND CONTROL

- This was a time when chaos reigned supreme.
- Dozens of various systems appeared with various features and success.
- Engines could no longer be used on one layout and brought to another.
- If a decoder needed installing or something went wrong it was difficult to get help.

Command control in the ‘80s
This digital system by Lenz Elektronik was developed under contract for two German manufacturers, Märklin and Arnold.

They were marketed in 1989 and later submitted to the NMRA’s DCC working group.

Digital Command Control proposed standard was published in the October 1993 issue of *Model Railroader*.
The NMRA eventually licensed the DCC protocol from Lenz and extended it as an open architecture.

NMRA **S-9.1** specifies the electrical standard while **S-9.2** specifies the communications standard.

DCC does **not** specify the protocol used between the DCC command station and other components such as additional throttles.

A variety of proprietary standards exist but command stations from one vendor are generally not compatible with another.
Like computers of old, DCC systems communicate with devices much like a modem.

Packets of information are broadcast to all connected devices. A device can be a locomotive, signal, turnout, sound generator or several other devices too numerous to mention here.

A device will respond only to a packet with a matching address.

Once packets have been sent the DCC controller will pause to see if there is a response request from any of the devices.

If so, the controller will process these responses before sending more packets of information.
Most modelers today are used to running multiple trains via remote control.

Controlling various lights and sound systems are also common additions.

There are also decoders for controlling turnouts, signals, reversing loops.

Just coming into use are train detectors used to add further control to the system.
One of many ways to control a turntable using DCC uses (2) decoders
In-System Programming (ISP)

• The introduction of inexpensive EEPROM [flash] memory in 1993 beginning with Microchip’s PIC devices made In-System Programming possible.
• This allows modelers to modify many characteristics of their DCC system.
• This programmer connects a computer to a decoder for direct programming to change some of the characteristics of its operation.
• Only certain manufacturer-defined properties can be changed in this way.
ADVANCED DCC CAPABILITIES

Some controllers include provisions for programming a decoder while engine remains on the tracks

• NMRA DCC standards are still open ended to allow advanced features to be developed.
• Actual standards have not yet been defined and vary between manufacturers, however ...
• One major advantage of ISP is in the programming of a locomotive.
• Here, a locomotive can simply be placed on a section of track and programmed without opening the engine or taking it apart in any way.
CHANGING THROTTLE VOLTAGES

- Motors speeds, for instance, are **NOT** a linear function of track voltage.
- Motors start at some voltage higher than zero due to friction and accelerate at different rates as their speed increases.
- Decoders can manipulate the translation between speed control and the actual speed of a locomotive to improve speed control.

Stand alone DCC programmer used for programming engines
ANOTHER DECODER FEATURE

One big advantage of DCC is built-in type of pulse power that blends to pure DC as the motor speed increases.

- Again, the transition from the AC pulse when starting to the pure DC once the train gathers speeds varies between motors.
- The magnitude and duration of the AC can be varied in some systems.
WIRELESS DCC

• Several radio/DCC throttles exist today.
• Some proprietary throttle systems are also compatible with DCC.
• Several radio control controllers are designed for signals, turnout control and other trackside accessories.
• There are even decoders to detect the passing of a train or other events.
CAMERAS IN RAILROADING

• **TOP** - Self-contained FLY camera takes movies or single frames at time intervals.
• **Middle** – audio and video images are sent to receiver.
• **BOTTOM** – Camera from cell phone capable of streaming video.
• All three can capture some unusual views of a layout.

Relative size of three popular cameras for model railroad use.
FIRST CAMERA USE

- Security cameras were first used to “see” tracks hidden in tunnels and staging yards.
- This image shows a 3-way split screen.
- This type of setup was used mostly on very large home or club layouts.

Cameras have been used in model railroading since about 1950 and finding more uses all the time.
The FLY-DV

This self-contained camera made an ugly carload but it took good pictures. Note the range of focus for different depths. This made it possible to take pictures that a visitor simply could not see such the inside of this lumber yard.
FIRST ENGINEER’S VIEW
Today, cameras the size used in cell phones can be easily mounted inside a locomotive with plenty of room to spare and will stream real-time pictures to a receiver as the train moves along the tracks.
INTERNET CONTROL

• A club in England set up a very simple layout sometime around 1980 to be run via the internet.

• Anyone from around the world could connect, and send commands to actually run the trains.

• The view from a camera was streamed back to the user.

• Simple commands were used to throw switches and control the engine’s speed and direction.

• No cars were used but this did set an interesting precedent in modeling via remote control.
This picture may show a garden railway but even HO scale *automobiles* can be run in this manner.

- Lithium batteries have recently made an old way of running trains more feasible.
- Clubs like the Dead rail society, as the name implies, use batteries, not the rails, to supply power for trains.
- Radio control (R/C) like those used to fly model airplanes provide the signals used to control the locomotives.
Commercial transmitters and receivers are available to form an alternate DCC signal connection normally provided through rails.
MOVING FREIGHT

• From simple push toys to electronic marvels model railroading has come a long way over the years.
• So far this clinic has concentrated on moving trains.
• Now let’s turn our attention to moving freight, first in the real world then in the virtual world.
• This was, after all, the whole purpose for railroads.
TOY FREIGHT MOVED AT WHIM

- Lionel manufactured many devices for loading and unloading all kinds of freight cars like this stock car.
- All of these however were manufactured after WW-II.
- Attempts to actually simulate the defined movement of freight or traffic were rarely used.
- These were, after all, just toys.

Cattle moved on and off the car with the push of a button.
MOVING THE FREIGHT

- Model railroaders, on the other hand, developed many systems for simulated traffic and car movements.
- As early as 1934 one primitive waybill system shipped a standard gauge box car from Belleville, N.J. to Milwaukee, Wisconsin via a waybill system.
- Granted, the move was assisted by 30 cents worth of Uncle Sam’s postage stamps but it was done with a very real waybill.

This HO box car travelled over 1000 miles on a single waybill thanks to the USPS.
REUSABLE WAYBILLS

• Dozens of systems for simulating traffic have been developed over the years since.

• Most movements were pre-defined or assigned at the whim of a dispatcher.

• These took many forms like the waybills shown here, Switch lists, tagging cars or some combination of all three.

Waybills generally defined the car type, Shipper and destination.
Each card shown here listed the shipper on one side and the destination on the other.
FIRST RANDOMIZING SYSTEMS

- This early traffic generation system used a roulette wheel to determine pickups and setouts as well as the car type to be used.
- Other systems were based on cards that could be shuffled and dealt to define consists.
CARS SOMETIMES TAGGED.

• Some systems identified cars to be set out or picked up using colored tags on the cars.

• These could be thumb tacks, tape or colored metal strips.

• One system even placed magnets inside the car that held the metallic bills of lading to the car side.

These cars to be set out or picked up can be identified by colored tags on the cars.
SWITCHLISTS AND WAYBILLS

• Today, computers are also used to generate waybills, switch-lists and other documents to simulate traffic.
• Commercial packages are available for non-savvy computer users to make their own.
• These cards usually follow the car as it travels from place to place.
RANDOMIZED TRAFFIC GENERATOR

- The main control panel of the North River includes a traffic simulator.
- The dispatcher steps through each move and places two or more color-coded tags on cars.
- The dispatcher must plan the most efficient use of available cars.
- Switching crews first spot, wait a day, then move the car to the next destination or return it to the nearest yard.

Simplistic switch-lists can be incorporated on computers using less than 4K memory. More sophisticated programs with fairly complex traffic generators use less than 12K.
WHAT DOES THE FUTURE HOLD?

• So far we have seen a lot of amazing technology in model railroading.
• What would happen if we combined all of these things in a single “super layout?”
• We could build a [virtual] layout to run our trains throughout all 50 states of the union and then some.
• Our trains could even travel world wide.

The following is one modeler’s concept of only a few of the future possibilities.
CONSIDER GAMES ON AN IPOD

• Games have a scene that simply scrolls along as Mario makes his way through the maze.
• Mario himself can move anywhere on the screen but remains almost constant in size.
• ‘Hitting’ the various boxes cause certain actions such as adding treasure of life to Mario.
• Following a train will use the same actions.

Poor Mario has to fight his way through a maze of poisonous mushrooms and leap to hit boxes and expose a whole range of prizes.
GAME vs. TRAINS

• The game scene would be replaced by a track schematic of course.

• We can replace Mario with a train or some simple symbol.

• Those magic boxes would become simplified controls to run the train.
PLAYING THE ‘GAME’

• Like any game, running a train by remote control would require some set-up.
• Users would have to connect to the system and Trains would have to be set up and identified.
• Dispatchers and yard hands would have to help train crews do the actual switching.
• Game setup screens would be replaced by traffic generators etc.
• There would also have to be a way to handle lost or missing trains.
ONE POSSIBLE APPROACH

- First, some sort of universal CAD system should be used to store the configuration of layouts.
- This system must be inexpensive enough for a user to create a track plan and place symbols to be used to trigger certain events.
- IGES is an international standard capable for doing this.
• Images from the visited layout are sent to the owner’s IPod.
• The owner’s IPod sends control messages to the Central Computer.
• The Central Computer sends DCC control commands to the visited layout and maintains any messages between the owner’s IPod and the visited system.
BUILDING A SUPER LAYOUT

- A database would have to be designed of course.
- The day of the lone developer is long past.
- This would have to be a team effort and gradually developed over a period of time.
Now ACCESS THIS WITH AN IPOD

• iPod Applications can be written to send and receive information wirelessly between three devices.
• This application can be programmed by the user to send control signals to a train (and trackside accessories) and view the track from both the engineer’s and the dispatcher’s viewpoint.
• A “conference” call would be used to connect both the owner’s iPod and the visited layout to the main database.
A Camera would download an ‘engineer’s view’ image in real time to provide a way to control trains miles away much like a game program. Touching the Red circle would throw the turnout.
SCHEMATIC VIEW

• Changing to a ‘dispatcher view’ would give a better “over all” view to control turnouts and to see the general surroundings.
• Note the red bar to indicate the train’s location and the short yellow vertical bar which when pressed would throw the turnout.
• Trains, with or without cars, would be shipped, mailed or hand carried from Owner’s layout and placed on an interchange track (if visiting a home layout) or in a small marshaling yard (for a club).

• Cars could also be shelved and ‘virtually’ shipped. The visited layout would use a similar surrogate car used instead.
OTHER EXCHANGES

• This would open up a renewal of several activities.
• Car exchanges could become actual car swaps such that the train could return to the “owner” with a whole new train of cars.
• Likewise the owner train Owner and visited club could swap passes, stock certificates or any other agreed upon “cargo.”
A visitor could simply watch from the engine’s camera while someone else takes control and enjoy the scenery. 2-way communication would allow the train crew and visitor to discuss the highlights and local operations.
AND FINALLY ...

- the visitor could run his train watching for trackside and signals from a train crew that follows the train
- Or help may be passed from one to another in sort of a tower control system from one yard crew to another.
- Either way, a whole new dimension would be open for model railroading.
THANKS FOR WATCHING

Thank you for watching this clinic. I hope you enjoyed watching one modeler’s daydreams. If you did, here are a few more you may like.

- STALL MOTORS
- TRAIN DETECTOR
- TURNTABLE HISTORY & OPERATION
- BACKDROPS
- BUILD A SIGNAL
- BUILD A HEAVY FLAT CAR
- KANGAROO QUIZ ON ESOTERIC INFORMATION

Please visit my website at:

http://www.northriverrailway.net

Running the Ultimate
For More Information...

- [http://www.dccwiki.com/DCC_History](http://www.dccwiki.com/DCC_History)
- [http://www.youtube.com/watch?feature=player_embedded&v=tR9Cwt03KIA](http://www.youtube.com/watch?feature=player_embedded&v=tR9Cwt03KIA) – Onboard Camera View
This presentation has been brought to you by the North River Railway

Bob Van Cleef
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Coventry, CT 06238
http://www.northriverrailway.net

THE END
MAKING MODEL TRAINS RUN

A HISTORIC CLINIC SHOWS HOW MODEL TRAINS HAVE BEEN RUN IN THE PAST, PRESENT AND A LOOK INTO THE FUTURE.

This clinic begins by following the various means of powering model trains from the earliest days. It then shows many innovations Lionel [toy] trains contributed to early days modeling and continues with some of the modern control systems touching on DCC. This clinic concludes with a look at a possible way to actually run your train from Boston to San Francisco with an IPod.

89 SLIDES, APPROX 45 MINUTES

See PDF or PP presentation on: http://www.northriverrailway.net/
BUILD THIS SAFE POWER SUPPLY

• Features include:

• Steel enclosure to reduce electrical shock hazard and fire prevention

• Modular construction to facilitate maintenance

• Easy inexpensive construction

10 transformers provide 450 watts of power.
3 REASONS FOR AN ENCLOSURE

- The wood in your layout is kindling for a bond-fire. One spark can destroy a layout.
- It reduces the chance for electrical shock hazard.
- It is a quick and easy way to mount and protect your transformers.
- Think of an enclosure as a sort of fuse box for the railroad.

Old-fashioned enclosure for a vacuum tube amplifier provides excellent protection
SHELVES

• Shelves are all the same size
• Separate modules are screwed in place and early removed.
• 5/8” lathboard is available in most lumber store and comes in handy for a multitude of projects.

Make the modules first, then make the shelves as required. Drill for screws that will hold the modules in place.
SHORT CIRCUIT PROTECTION

- The circuit breaker may cost a bit more but it gives the best protection. It also has the highest initial cost.
FUSE MODULE

- The 1.5 amp circuit breaker will trip at about 450 watts at 120v.
- The green LED lights when the breaker is set and current is flowing.
- The red LED lights when the breaker is tripped preventing current from flowing.
- Neither LED is on when no current is present at the input.

CAUTION!
120v AC exposed here
ABOUT TRANSFORMERS

TYPICAL SCHEMATIC
Of multi-tap transformer
PC BOARD MOUNT TRANSFORMER
POWER BOARD ON SHELF
STANDARD POWER SUPPLY

A standard power supply circuit is shown, which includes a transformer (T1), diodes (D1), a capacitor (C1), a resistor (R1), and a regulator box labeled "Voltage or Current REGULATOR." The circuit takes 112v AC input and provides regulated output.
SMALL POWER FOR WORKBENCH
12V POWER SUPPLY
BUZZER
DUAL SWITCHING SUPPLY
BATTERY TESTER
BATTERY TEST AND CAB CONTROL
SIMPLE BATTERY TEST CIRCUIT

NR-47 Battery Manager
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POWER FOR ENTIRE RAILROAD