Introduction to Model Railroad Operations

Based on original by: Dave Cochrun & Kathy Sparks
Revised by: Marshall Abrams

Visit the Abrams Railroad Empire at http://abrams-railroad.potomac-nmra.org/
Welcome!

- Why Operations?
  - You’ve built your empire, what do you do now?
  - Running trains around in a circle, switching cars aimlessly can get boring

- Today you will learn the basics of model railroad operations.
Agenda

• Model Railroad Operation Defined
• Car Forwarding Systems
• Railroad Traffic Control Systems
• Model Control Systems
• Communication Systems

• What an operator needs to know

• Resources
Model Railroad Operation

- Model Railroad Operation is a fun and interesting role playing game where the players (operators) use model trains to simulate the movements of real trains and the actions of real railroad employees
- Complexity and realism related to ease of use
  - Generally, the more realistic the freight forwarding system is, the more complicated it becomes
  - We are here to have fun – at some point the trade off between complexity and ease, realism and fun must be made
  - It’s your decision
What’s to Enjoy?

- Running trains
- Camaraderie — sharing experiences with friends
- Intellectual challenge
  - Conducting the least number of moves to drop off & pick up cars
  - Space on siding to hold some cars while moving others
  - When you have a string of cars temporarily sitting on the mainline and the through freight comes by, what do you do?
- Adds purpose to car movements
  - Understanding and simulating prototype railroad operations for specific era & RR
  - Focus on the railroad business and the business of railroading
  - Roles include engineer, conductor, dispatcher, yard master, ...
Real Railroad Employees

- **Executives**
  - Leadership

- **Administrators**
  - Records
  - Finance
  - Sales
  - Human Resources

- **Maintenance Workers**
  - Track gangs
  - Bridge Repair
  - Signal Repair

**Operations Personnel**
### Operations Personnel On Your layout

- Positions tend to get filled in following order
  - Depending on size of layout and number of people available

<table>
<thead>
<tr>
<th>Road Crews</th>
<th>Administration</th>
<th>Yard Crews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor</td>
<td>Dispatcher</td>
<td>Yardmaster</td>
</tr>
<tr>
<td>Engineer</td>
<td>Agent</td>
<td>Conductor</td>
</tr>
<tr>
<td>Brakeman</td>
<td>Towerman</td>
<td>Engineer</td>
</tr>
<tr>
<td>Fireman</td>
<td></td>
<td>Brakeman</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fireman</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hostler</td>
</tr>
</tbody>
</table>
Agenda

- Model Railroad Operation Defined
  - Car Forwarding Systems
  - Railroad Traffic Control Systems
  - Model Control Systems
  - Communication Systems
- What an operator needs to know
- Resources
Car Forwarding

- Car Forwarding is the purposeful movement of rail cars from one location to another.
- Prototype car forwarding is determined by customer needs.
- Types of model railroad car forwarding
  - Random
  - Car Card & Way Bill
  - Switch List
Random Car Forwarding

- Random Car Forwarding:
  - Pick up and deliver any car, anywhere, anytime

- Pros:
  - Easy to set up
  - Never make a mistake
  - No cost
  - “Outback” ops – no rules – just right

- Cons:
  - No purpose – boring
  - Does not simulate the prototype
Car Card & Waybill

Car Forwarding

- Car Card & Way Bill:
  - Each car has an associated envelope labeled with the reporting remarks of the car.
  - A multi-sided way bill is inserted into the envelope that shows the car’s destination.
  - Multi-sided way bills can show a sequence of destinations.
  - Cards for cars not in trains are kept in boxes located along the railroad.

- Pros:
  - Easy to see where to deliver a car
  - Easy to see which cars to pick up
  - Automatic Synchronization
  - Low cost

- Cons:
  - Decks of cards are awkward to handle/sort during operations
  - No “look ahead” capability
  - Requires holding boxes and sorting racks
Switch List Car Forwarding

- **Switch List Car Forwarding:**
  - A single sheet of paper lists all switching activity

- **Pros:**
  - Easy to see where to deliver a car
  - Easy to see which cars to pick up
  - Only one paper to handle
  - Easy “look ahead” capability
  - No racks or holders required
  - Follows prototype practice

- **Cons:**
  - Significant set up time (manual or computer)
  - Manual synchronization

<table>
<thead>
<tr>
<th>PickUps (4)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck Terminal</td>
<td>BELX</td>
<td>3654</td>
<td>Box</td>
<td>Yellow</td>
<td>RACO Bell</td>
<td></td>
</tr>
<tr>
<td>Truck Terminal</td>
<td>ARE</td>
<td>254</td>
<td>Flat</td>
<td>Tuscan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roy’s Place</td>
<td>GATX</td>
<td>39617</td>
<td>Tank</td>
<td>White</td>
<td>Michigan Akali</td>
<td></td>
</tr>
<tr>
<td>Roy’s Place</td>
<td>NJDX</td>
<td>1035</td>
<td>Box</td>
<td>Yellow</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SetOuts (2)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck Terminal</td>
<td>N&amp;W</td>
<td>44657</td>
<td>Box</td>
<td>Black</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck Terminal</td>
<td>ATSF</td>
<td>90306</td>
<td>Flat</td>
<td>Green</td>
<td>TOFC</td>
<td></td>
</tr>
</tbody>
</table>
Sample Switch List Printout

Manifest for Train 420 -- 7:57 AM 1/17/2008

Castle Rock and Pacific RR Co.

**MANIFEST for TRAIN 420**

Train -- Local North

NorthBound FROM: Gal Yard TO: CR Yard

Departing at 6:52 on Route GA-CR Local

INSTRUCTIONS TO CREW

- If you have or pick-up a car for Muleshoe, it must be the first car after the locomotive to make switching easy!
- Stock cars moved to the cow track in Santa Rosa go to the far end of the track, behind existing cars.

**Gal Yard**

- Engine(s)
  - {DRGW GP7 # 5101} Consist 5101
  - {DRGW GP7 # 5103} Consist 5101

**PickUps (8)**

<table>
<thead>
<tr>
<th>Track</th>
<th>RR</th>
<th>Consist</th>
<th>Consist Type</th>
<th>#</th>
<th>Car No.</th>
<th>Consist Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>ATSF</td>
<td>Tank</td>
<td>98016</td>
<td>to</td>
<td>IG</td>
<td></td>
</tr>
<tr>
<td>#1</td>
<td>GATX</td>
<td>Tank</td>
<td>16102</td>
<td>to</td>
<td>IG</td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td>CTIX</td>
<td>Tank</td>
<td>8506</td>
<td>to</td>
<td>IG</td>
<td></td>
</tr>
<tr>
<td>#1</td>
<td>NYC</td>
<td>Box</td>
<td>167003</td>
<td>to</td>
<td>MS</td>
<td></td>
</tr>
<tr>
<td>#1</td>
<td>DRGW</td>
<td>Box</td>
<td>69572</td>
<td>to</td>
<td>SR</td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td>RI</td>
<td>Box</td>
<td>262953</td>
<td>to</td>
<td>SR</td>
<td></td>
</tr>
<tr>
<td>#1</td>
<td>C&amp;NW</td>
<td>Box</td>
<td>108102</td>
<td>to</td>
<td>TRN</td>
<td></td>
</tr>
</tbody>
</table>

--Depart at 9:34,
10 Cars Out, 602 Ft, 998 Tons, Power 3500 Tons

**Santa Rosa -- Arrive at 9:40**

**Local Moves (6)**

<table>
<thead>
<tr>
<th>Track</th>
<th>RR</th>
<th>Consist</th>
<th>Consist Type</th>
<th>#</th>
<th>Car No.</th>
<th>Consist Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>ATSF</td>
<td>Tank</td>
<td>26417</td>
<td>to</td>
<td>Cow Track</td>
<td></td>
</tr>
<tr>
<td>#1</td>
<td>ATSF</td>
<td>Tank</td>
<td>26385</td>
<td>to</td>
<td>Cow Track</td>
<td></td>
</tr>
<tr>
<td>#1</td>
<td>ATSF</td>
<td>Tank</td>
<td>36485</td>
<td>to</td>
<td>Cow Track</td>
<td></td>
</tr>
<tr>
<td>#1</td>
<td>ATSF</td>
<td>Tank</td>
<td>39212</td>
<td>to</td>
<td>Cow Track</td>
<td></td>
</tr>
<tr>
<td>#1</td>
<td>DRGW</td>
<td>Tank</td>
<td>64124</td>
<td>to</td>
<td>Cow Track</td>
<td></td>
</tr>
</tbody>
</table>

**PickUps (2)**

<table>
<thead>
<tr>
<th>Yard</th>
<th>RR</th>
<th>Consist Type</th>
<th>Consist Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junk</td>
<td>MKT</td>
<td>Gondol</td>
<td>43001</td>
</tr>
<tr>
<td>Junk</td>
<td>P&amp;LE</td>
<td>Gon-sc</td>
<td>S47999</td>
</tr>
</tbody>
</table>

**SetOuts (2)**

<table>
<thead>
<tr>
<th>Transfer</th>
<th>RR</th>
<th>Consist</th>
<th>Consist Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRGW</td>
<td>MT Box</td>
<td>69572</td>
<td></td>
</tr>
<tr>
<td>RI</td>
<td>MT Box</td>
<td>262953</td>
<td></td>
</tr>
</tbody>
</table>

--Depart at 10:28,
10 Cars Out, 602 Ft, 998 Tons, Power 3500 Tons

**Trinidad -- Arrive at 10:40**

**PickUps (3)**

<table>
<thead>
<tr>
<th>Track</th>
<th>RR</th>
<th>Consist Type</th>
<th>Consist Type</th>
<th>Consist Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Marble</td>
<td>ATSF</td>
<td>MT Gondol</td>
<td>172249</td>
</tr>
<tr>
<td>#1</td>
<td>Marble</td>
<td>ATSF</td>
<td>MT Flat</td>
<td>297012</td>
</tr>
</tbody>
</table>

13
Agenda

- Model Railroad Operation Defined
- Car Forwarding Systems
  - Railroad Traffic Control Systems
  - Model Control Systems
  - Communication Systems
- What an operator needs to know
- Resources
Traffic Control

- Traffic Control is the purposeful movement of trains from one location to another
- Prototype traffic is determined by customer needs
- Some other scheme required for the model
Model RR
Traffic Control Systems

- **Random** – Run anything, anytime
  - Free Form
- **Sequential** – Trains run in a specific order
  - Track Warrant
  - Centralized Traffic Control (CTC)
- **Scheduled** – Trains run by time (usually by fast clock)
  - Track Warrant
  - Time Table & Train Order (TT&TO)
- **Real Time** – Trains are generated as needed
  - Train order
  - TT&TO (Extras)
  - CTC
Free Flow Model Traffic Control

- **Free Flow Traffic Control:**
  - Operators run trains freely, without permission from a central authority
  - Operators are responsible for avoiding collisions and coordinating track usage

- **Pros:**
  - Easy to set up
  - No cost
  - No personnel overhead

- **Cons:**
  - Does not simulate prototype
Time Table & Train Order
(Prototype & Model)

- Operators run trains according to a time table
- A fixed schedule is drawn up with which every train crew must be familiar.
  - Trains may only run on each section of track at their scheduled time, during which they have 'possession'
  - No other train is permitted to use the same section.
- Right of way is determined by train class (1<sup>st</sup> class has priority over 2<sup>nd</sup> and 3<sup>rd</sup> class; 2<sup>nd</sup> class has priority over 3<sup>rd</sup> class) and direction (East bound trains have priority over westbound trains of same class)
- Right of way may be superseded by written train orders, introduced in 1851 on advent of telegraph
- All unscheduled trains (extras) are run exclusively by train order
- Follows prototype rule book for many situations
Time Table & Train Order
(Prototype & Model) (2 of 2)

• Pros:
  – On-time scheduled trains run without oversight
  – Low cost
  – Simulates prototype operations for the chosen years

• Cons
  – Requires person to act as central authority
  – Lots of rules can be challenging
  – Paperwork intensive
  – Requires some pre-session effort
  – Error or malfunctions can cause extensive idle time
Track Warrant & Train Order

- **Track Warrant / Train Order**
  - Operators run trains with specific privileges over specified routes
  - Authority to move conveyed by tower operator
  - Written orders in telegraph/telephone era
  - May incorporate schedules
- **Direct Traffic Control (DTC)**
  - Oral order from central dispatcher by radio
  - Repeated by the train crew to confirm accuracy
  - May incorporate schedules and signals
Track Warrant & Train Order (2 of 2)

• **Pros:**
  – Can be easy to set up & low cost
  – Cost & complexity increase if communications added
  – Simulates prototype operations

• **Cons**
  – Requires person to act as tower operators or central dispatcher
  – Requires some pre-session effort
Car Forwarding & Traffic Control
Pairings

• Car forwarding
  – Random
  – Car Card & Way Bill
  – Switch List

• Traffic control
  – Random
  – Sequential
  – Scheduled
    • Track Warrant
    • Time Table & Train Order (TT&TO)
  – Real time
    • Train order
    • TT&TO (Extras)
    • CTC

• Any of the following car forwarding methods works with any of the traffic control methods
  – Pick one method from each column
Agenda

✓ Model Railroad Operation Defined
✓ Car Forwarding Systems
✓ Railroad Traffic Control Systems
  • Model Control Systems
  • Communication Systems

• What an operator needs to know

• Resources
Model Control Systems

- **Track Control (Analog — DC):** Sections of track are assigned to a controlling device.
  - All trains on that track are controlled by the assigned device.
  - Control of multiple trains requires independent control of multiple track sections.
  - Example: Multiple DC Power Packs

- **Train Control (Digital Command Control — DCC):** Trains are controlled independent of each other on the same section of track.
  - Requires:
    - Command station(s) and decoders in each locomotive
    - Examples: Digitrax, NCE, Lenz, Bachmann, MRC, ...

- **Both Track Control and Train Control** may support forms of walk-around control and wireless control.
Agenda

✓ Model Railroad Operation Defined
✓ Car Forwarding Systems
✓ Railroad Traffic Control Systems
✓ Model Control Systems
  • Communication Systems

• What an operator needs to know

• Resources
Railroad Communication Systems

Communications are required:

- To convey authority to occupy tracks
- To convey authority to move
- To report location (OS)
- To report problems or status other than location

Always keep communication clear and concise
Railroad Communication Systems

- **Verbal**
  - Telegraph
  - Telephone
  - Radio
    - 5-Channel (Maxon)
    - Family Radio Service (FRS), General Mobile Radio Service (GMRS)
  - Briefing operators, before and after session

- **Written**
  - Time Table
  - Train Order
  - Rule Book
  - Operators Handbook
Agenda

- Model Railroad Operation Defined
- Car Forwarding Systems
- Railroad Traffic Control Systems
- Model Control Systems
- Communication Systems

• What an operator needs to know

• Resources
What an Operator Needs to Know About the Model Railroad

- Car Forwarding System
- Railroad control system
- Traffic control system
- How to operate a throttle
- How to acquire & dispatch a locomotive
- How to terminate a train
- When to communicate
- How to communicate
- How to operate turnouts?
- Track names (fascia information)
- Sequence of towns/stations
- Railroad direction (N, E, S, W)
- Locations and capacities of sidings
- Locations of Operators and Registers
What an Operator Needs to Know About the Train

- Train Name/Number/Type/Class
- Starting point
- Destination
- Current location
- Can I go? How far?
- Location of next work? Next stop?
- How to couple and uncouple cars
- Any special actions for this train? Speed? Coal? Water?
- What to do in case of a derailment or other problem
Hints for Better Operations

- Always check the track alignment around your train
- Count your cars before leaving every station!
- Compare car count to manifest before leaving every station
  - Resolve differences before continuing!
- Check where you are permitted to set down your drink
Operator Etiquette

- Arrive on time & stay for the entire session!
- Eat before you arrive – don’t bring a meal!
- Tune radio before arrival – fully charged or install fresh batteries
- Follow communications standards!
  - Minimize chatter
- Monitor the communication system!
  - Listen for your call sign!
- Don’t visit with other operators and distract them!
- Stay with your train!
- Treat rolling stock and other equipment with care!
- If you make a mess, clean it up!
- If something breaks – notify the owner!
- “Thank you” is always appreciated!
- If you don’t know – ask!
Host Etiquette

- Make sure the system is fully operational
  - Check for DCC gremlins
  - Clean your track and engine wheels beforehand. Dirty track and dirty wheels will result in poor operation and operator frustration.

- Check all your turnouts and make sure they are operating properly
  - Make sure the points fully throw
  - Roll a few cars over them to make sure everything is in gauge
Agenda

✓ Model Railroad Operation Defined
✓ Car Forwarding Systems
✓ Railroad Traffic Control Systems
✓ Model Control Systems
✓ Communication Systems

✓ What an operator needs to know

• Resources
Internet Resources

- Operations Special Interest Group (Op SIG) – membership open  [http://www.opsig.org](http://www.opsig.org)
- Op SIG PRIMER (FAQ)  [http://www.opsig.org/reso/primer/](http://www.opsig.org/reso/primer/)
Products

- Car cards
  - Making your own car cards with Excel
    http://www.westportterminal.de/download/waybills_FREMO.xls
  - Also http://vanderheide.ca/blog/2018/01/04/excel-car-cards-and-waybills/
  - Micro-Mark https://www.micromark.com/CAR-ROUTING-SYSTEM
    Car card system
  - Ship It! Car Cards

- Book: Realistic Model Railroad Operation: How to Run Your Trains Like the Real Thing by Tony Koester, Kalmbach, 2013