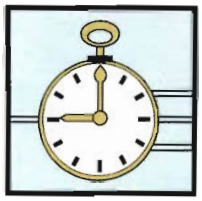
YEAR OF THE MMR
PART 9

Chief Dispatcher

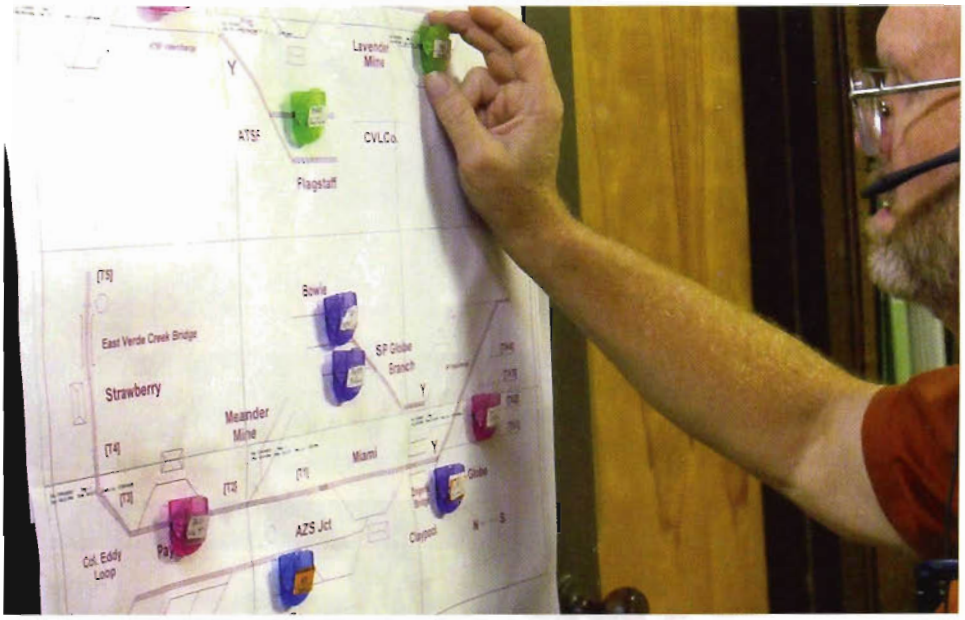
article by Fred Bock, MMR photographs by Tom Crosthwait and Fred Bock, MMR

Chief Dispatcher: The AP Certificate for Operators



For several years now, I've had the pleasure to serve as "Chief Dispatcher" on Tom Crosthwait's "Mogollon & Southwestern" (HO) railroad (M&Sw). If one of your interests in model railroading is operation of freight and passenger trains on a layout in a prototypical manner, then you will enjoy earning the AP's Chief Dispatcher certificate. Not only is earning the certificate fun, but it will also test your wits in both setting up the operating schemes and carrying them out on operating nights. You will learn a lot about making layout operations more enjoyable for all those who are operators on the layout in the process.

A synonym for the "AP Chief Dispatcher certificate" could be the "AP Operations certificate." Many of us misuse the word "operations" when we really mean "running my train around the layout," also known around here as "fun runs." This "model railfanning" — watching and photographing a well-detailed train running through realistic scenery with sound and lights — is both enjoyable and relaxing. However, it's not how the AP Chief Dispatcher certificate is addressed.



Above: **Chief Dispatcher Fred Bock plots an "OS" report on the M&Sw's "magnetic manual CTC" panel. The panel is a blown-up CADrail layout schematic mounted on a thin panel of sheet steel. Magnetic clips with train numbers (and occasional notations) are used to mark trains' locations. A system-wide telephone system has just replaced the earlier "simulated radio" communications net.**

"Operation" for our purposes is defined as "*simulation* in miniature of prototype-like railroad operations on a model railroad layout." As is true with *any* simulation, the most significant details of the prototype are adopted for inclusion in the simulation, while minor details and details that are not "fun" are left out or ignored. Of course, what is "significant" or "fun" lies in the opinion of the group of operators. For one group, including some of those "details" might be part of the "fun." But for another group, even on the same layout, having those details in an operating session might detract from their enjoyment.

One of the tasks of a layout's chief dispatcher in planning an operation strategy (in consultation with the superintendent) is to decide which details are "significant" — fun — and how many of them to include in operating sessions. There is no "right" answer. Each layout will be different, based upon its geographic setting, time era, the preferences of the superintendent (the layout owner), and the layout's operators.

The superintendent and the chief dispatcher are usually, but not always, the same person. My buddy, Tom Crosthwait, is the owner — the Superintendent — of the M&Sw, yet I serve as the M&Sw's Chief Dispatcher. Part of my job is to propose additions and changes to operating sessions

Left: **Superintendent Tom Crosthwait runs a Mogollon & Southwestern RS-2 with a short train at 10 mph over Adams' Bridge and the E. Verde River, just north of the train order office at Strawberry.**

Above: **The M&Sw line climbs the steep grade from Payson, Arizona, through Coconino National Forest to the top of the Mogollon Rim. Here, the route slabs along a canyon wall of the E. Verde River drainage.**

that I feel will add to the fun. In the end, the final decision is Tom's. (In this article, I'll be using the M&Sw — the "MUGGY-own" — for many of my examples. You can learn more about the M&Sw at http://www.sam-ratx.org/msw.htm).

For a club layout, there are as many "owners" as members. However, for a single scheduled operating session on a club layout, it is only feasible to have one chief dispatcher. It's the chief dispatcher who decides on the operating procedures for a given session. Of course, there's nothing that says all sessions must operate the same way. There may be several dispatchers interested in running scheduled operating sessions, and each dispatcher may choose to use a different operating scheme for the sessions for which they are scheduled to host: (examples: emphasis on freights versus passenger trains; card system versus computerized car forwarding; train sequencing versus timetable/train orders versus track warrants; 1930s-era versus diesel-to-steam transition versus contemporary railroading).

Getting Started I: Reference Materials

My own introduction to "operations" occurred about a year after I received my first O gauge Lionel train set on a 4x8-foot sheet of plywood. I came across a (now classic) Fawcett book on the local drugstore newsstand titled: *Frank Ellison on Model Railroading*. Frank and his O scale "Delta Lines" were well-known in the 1940s and 1950s, and Frank was one of the pioneers in integrating track planning, structures, scenery, rolling stock, and operating schemes into a realistic "whole." I devoured that book until I finally wore it out. (Fortunately, I recently found a gently used copy at a train show from a used-book seller and snapped it up.)

I grew up becoming an inveterate model railroading resource junkie. Before I start a new project, I prefer getting a hold of as many relevant resources as I can find and reading them all before I begin. Collecting reference literature has almost become a "hobby within a hobby" for me, and most of my references have been read through enough times to practically wear them out.

Besides Frank Ellison, other useful references include:

- Kalmbach books on model railroad operations by Bruce Chubb, MMR, and Tony Koester. (Bruce's book is out of print, but you may be able to find used copies on Amazon.com or at train shows),
- The late John Armstrong's books on track planning (Kalmbach)
- Prototype railroad books,
- assorted employee timetables,
- A 1967 edition of "The Consolidated Code of Operating Rules" for railroad train crews (developed and approved by a coalition of 19 Midwest and Western railroads), obtained through Amazon.com as a used copy.

· *Southern Pacific Lines Operating Manual*, which includes the 3rd Edition of the "General Code of Operating Rules, April 1994" (an update of the 1967 Code).

In this article, I'll touch on the basic concepts of model railroad operations with a primary focus on attaining the AP Chief Dispatcher certificate. For a more comprehensive look at the details of operations, the books by Chubb, Koester and Armstrong are a good start.

Getting Started II: The Operating Group

1. Have participated in the operation of a model railroad, either home or club, for not less than 50 hours. A minimum of ten hours each must have been served in three of the five categories listed below, one of which must be No. 5, Dispatcher:

1. Engineer (mainline freight, passenger, or way freight)

2. Yardmaster (or station master)

3. Hostler (or power desk)

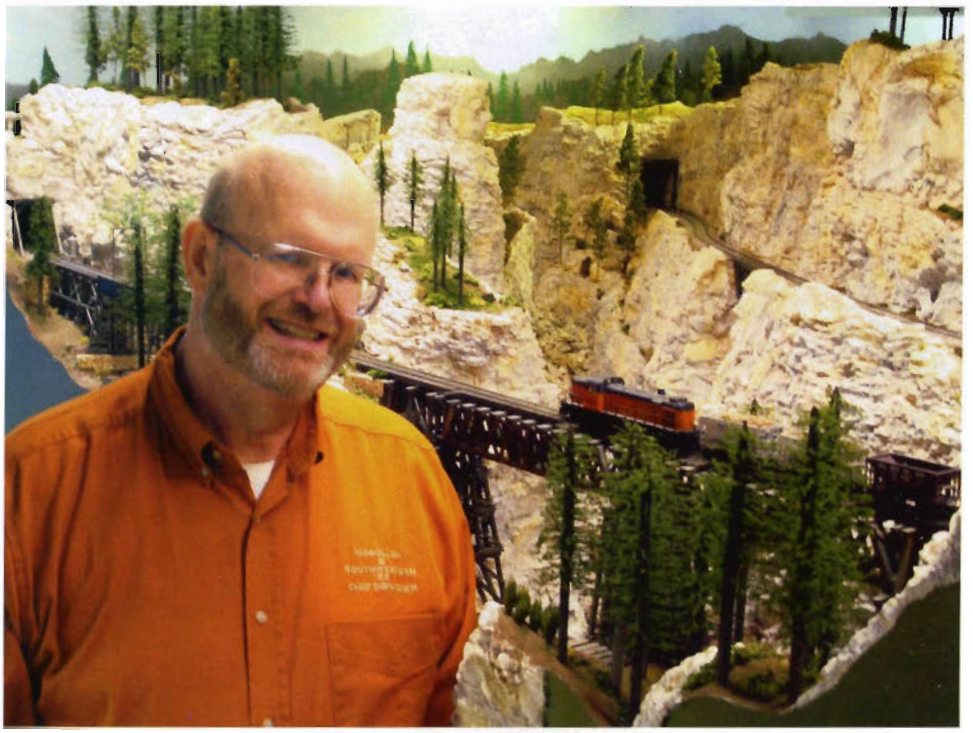
4. Towerman (or traffic manager, or road master)

5. Dispatcher

This experience shall be accumulated on one or more model railroads having at least two mainline trains plus yard switching in simultaneous operation. Some system of freight and passenger car movements, including road switching, shall be used for controlling train activity.

By its very nature, completing this requirement, including dispatcher, means being part of a group of like-minded, operations-oriented model railroaders. You can't earn this AP Certificate in isolation. One of the first steps is to get involved with a group that operates regularly.

If you are joining an existing group, you will find that they have probably decided on the type(s) of operating sessions they prefer. In that case, they will share with you the ways their group carries out operations. You will find it interesting — and educational — to participate in operating sessions with different groups who use different methods of operations and find out which approach you enjoy most.



Above: **Even the Dispatcher likes to take a "model railfanning break" from his office in Tom's workshop next door. "Any day you can run trains is a good day!"**

On the other hand, if you are getting a new group started from scratch, then you and the group members will have to make those choices up front, and it may not be an easy task to establish a scheme of operations that will satisfy most participants. The references noted above will be a big help in sorting out what appeals to you and what does not. Remember: a model railroad prototype-based operation is a simulation in which what you omit (for simplicity or for more fun) can be as important as what you include.

There are also some excellent opportunities to gain experience toward Chief Dispatcher by participating in operating sessions offered as part of an NMRA regional or national convention. Be sure to take advantage of these opportunities, particularly if they are on layouts with a different scale, gauge, era, emphasis, or operating scheme.

Keep a record of the dates you operated, the railroad(s) on which you served, the job you performed on each date, and hours spent. Be sure to get someone who can verify that you did this (often, the layout owner). The AP Chief Dispatcher forms include one for recording your experience

Left: **M&Sw Train 401 (northbound),** ***the Copper Queen*****, is the lowest-priority train on the timetable. Working it into the flow of traffic can be a challenge for the Dispatcher.**

chronologically, and a second form to summarize your experience. I found it helpful to keep a spreadsheet with this information, and then transcribe it to a clean form when I prepared the required paperwork.

Getting Started III: The Mission Statement and Concept of Operations

"What types of trains should be run? Between what points? When? Why?"

This was a topic that sparked many hours of late-night reflection and discussion while I was helping Tom on Friday night M&Sw work sessions. No two layouts — and no two layout operators — will have the same priorities. The M&Sw interchanges with three different railroads: Southern Pacific (at Globe), Santa Fe (at Flagstaff), and the (fictional) Arizona Southern (in Miami). This meant that at least one freight or mixed turn from each railroad (staging) would be needed. The M&Sw is a bridge route, so at least one through freight daily in each direction between Globe and Flagstaff was needed. Copper mining and smelting are the largest single industry on the M&Sw, so at least one dedicated train (turn) was needed each day to serve the mines.

For developing a scheme of operations for a layout — one already built or one in the planning stages — I like to begin by developing a "mission statement" and a "concept of operation." The mission statement tells *what* the railroad is trying to achieve (if it were a "real" railroad) and where and when it is set. The concept of operations tells *how* that is to be done. I develop these in writing. I find that if I can't write it down, then perhaps I haven't thought it through completely. Writing forces me to be clear about my thinking. The finished mission statement and concept of operation help to guide my thinking in developing the rest of the information required for performing as Chief Dispatcher on a given railroad.

A mission statement for the M&Sw might read: "The M&Sw, an Arizona-based railroad, serves as a north-south bridge route between the ATSF in Flagstaff and the SP in Globe. (It also has an interchange with the Arizona Southern (AZS) and Ferrocarril del Pacifico (FCP) in Miami). In addition, the M&Sw serves the copper mines, ore crusher, and smelter between Flagstaff and Globe. The M&Sw also serves as a common carrier for general freight and passenger service between Flagstaff and Globe."

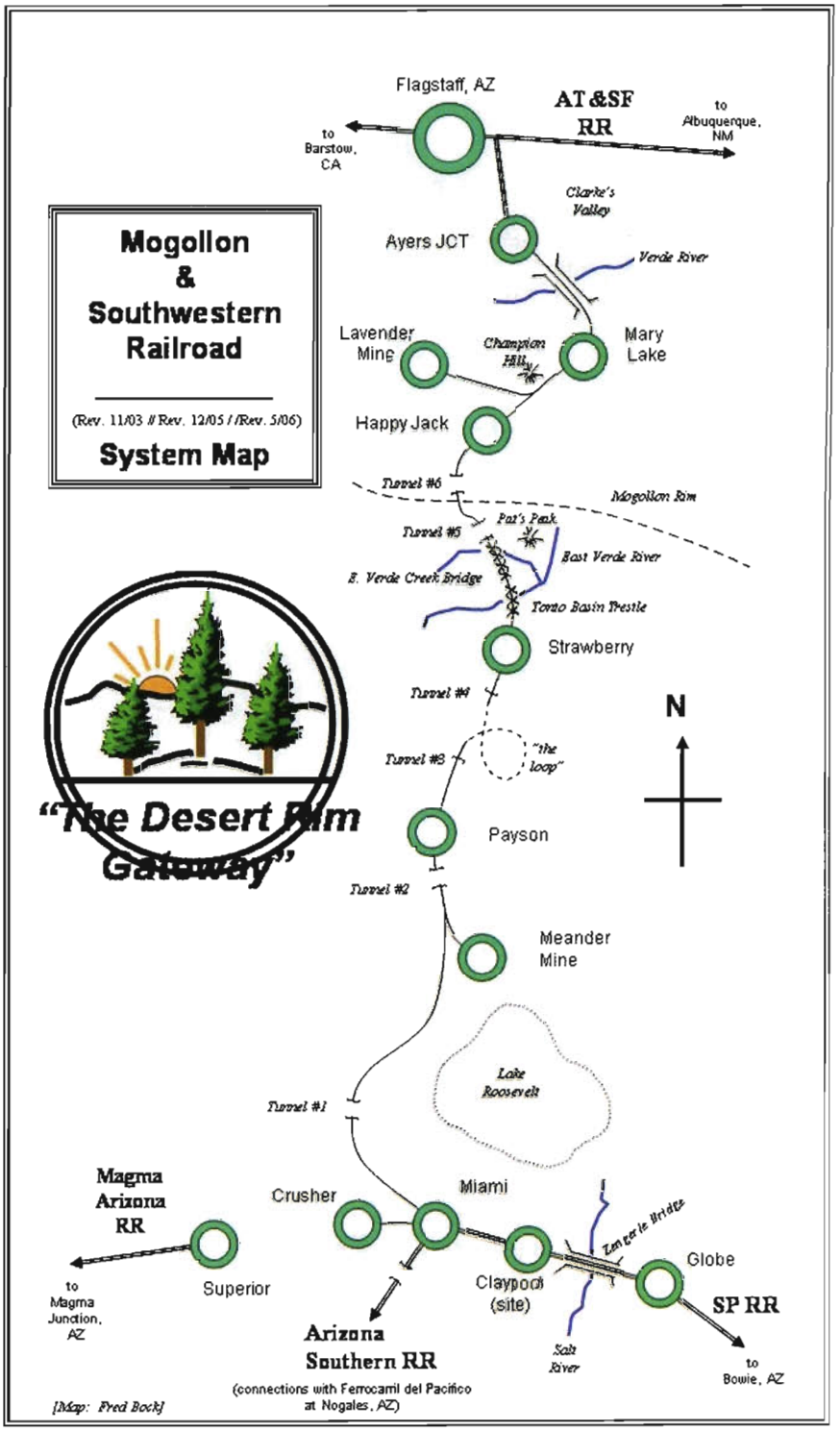


Figure 1: This system-wide map of the M&Sw is printed on the back of the timetable. It was built using Microsoft PowerPoint software.

Part of the mission statement should include a list of all the stations/towns, real and/or fictional, that will be served along the route of the (proposed) railroad. The principal stations for the M&Sw are located in central Arizona along the route of the proposed Arizona Mineral Belt railroad (for which construction was started in the 1880s but never got very far). See Figure 1: Map of the M&Sw

Now that I know *what* the M&Sw will do and *where* it will go, I can figure out *how* it will do it. The concept of operations statement for the M&Sw might look like this:

(1) The M&Sw interchanges traffic with the ATSF in Flagstaff, the AZS/FCP in Miami, and the SP (Globe Branch) in Globe.

(2) The M&Sw will provide through freight service between Globe and Flagstaff

Above: **Train 164, an RDC, stops at Mary Lake Lodge. It will return to Ayers' Jct. and Flagstaff with tourists and passengers making connections with Santa Fe passenger trains. Leased RDCs have temporarily replaced older "doodlebugs" on these high-priority "commute runs" to determine operating schedule time and cost savings compared to conventional equipment.**

in both directions (north and south) at least once per day.

(3) The M&Sw will provide local freight service (turn) once a day between Flagstaff and Happy Jack and once a day between Globe and Payson. The Globe–Payson turn will also serve the AZS/FCP interchange at Miami.

(4) The M&Sw will provide the crews and motive power for one turn a day between Globe and Happy Jack to serve the mines, crusher, and smelter located along the route.

(5) The M&Sw will provide morning and evening passenger accommodation trains between Flagstaff and Happy Jack, and between Globe and Payson, to carry mine workers to and from the mines. Runs will be timed to support two shift changes a day at each mine along the route.

(6) The M&Sw will provide continuing passenger service of SP's *Gila Tomahawk* (Train 381/382) from Globe to Happy Jack with connecting passenger service between Happy Jack and Flagstaff.

(7) The M&Sw will provide local passenger, mail, and express service between Globe and Flagstaff.

(8) The M&Sw will provide passenger and freight service from Flagstaff to support the Mary Lake Lodge at Mary Lake. When feasible, service will be timed to coordinate exchange of passengers, mail, and baggage with the westbound ATSF *Super Chief.*

(9) The Clarke Valley Lumber Company (CVLC) is granted trackage rights as extra trains between Happy Jack and its mill in Clarke Valley (Ayers Junction).

(10) Per agreement with AZS and FCP, there shall be a pooled-power timber train carrying creosoted ties, pilings, and trestle bent timbers between the CVLC mill (Ayers Jct.) and the FCP shops in Empalme, Sonora, Mexico, over the M&Sw (Ayers' Jct. to Miami), the AZS (Miami–Nogales, AZ) and the FCP at Nogales, Sonora, Mexico.

As a result of numerous late-night discussions with Tom, I also wrote down the industries that will be served at each of the above locations.

With this concept of operations developed, I can now begin to see what trackage, motive power, rolling stock, and schedules will be needed to meet the railroad's requirements.

Track Plans and Schematics

Prepare a schematic drawing of a model railroad layout meeting the operating conditions described in (A), and indicating all pertinent simulated distances.

Ideally, planning for layout operations begins prior to the time track plans are drawn for the new layout. In reality, too often the "plan for layout operations" begins to evolve after the track plan is completed and track-laying is well under way. But, let's look at the ideal way first.

The track plan for a (new) layout is a physical representation of the position of all track and track components drawn to scale. Drawing a track plan, as information, is one of the requirements for the AP Engineer-Civil certificate.

I find, however, it's easier to start by drawing a linear schematic of the (proposed or existing) layout first. It need not be to scale, but it should show the approximate relationships among the towns, sidings, and major features along the proposed route. Schematic sketches let you work out quickly whether the layout will meet your requirements before spending much time on scale drawings. For the M&Sw, I created three different layout schematics, each with its own use.

The first is a system map (Figure 1), which is also printed on the back cover of the M&Sw Employee Timetable for operators' reference (Figure 2). It shows Flagstaff (and its ATSF connection), Globe (and its SP connection to Bowie), and the planned

MOGOLLON & SOUTHWESTERN RAILROAD

Employee Timetable

4

Effective Sunday, July 16, 2006
at 12:01 A.M.
Central Standard Time

Mogollon & Southwestern Railroad

"The Desert Rim Gateway"

TOM CROSTHWAIT,
President and General Manager

PAT CROSTHWAIT,
Assistant General Manager

MICHAEL & JAMES CROSTHWAIT,
Information Management

SONDRA CROSTHWAIT,
Agent, San Antonio, Texas

Figure 2: Cover, M&Sw timetable.

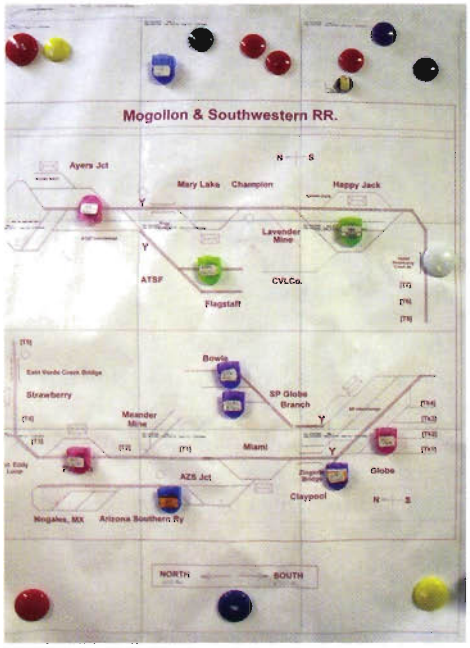
towns in between, roughly in the locations they are (or, would be) in the real world. A rough pencil sketch shouldn't take more than five to ten minutes, including erasures and major corrections. Since my handwriting is terrible, I tend to do my "sketching" using computer graphics software, either CADrail or PowerPoint. It takes a little longer for the first draft, but these computer-aided "sketches" are pretty handy when I go to make revisions and produce a final version. Remember: Draw these things once, but there can be numerous revisions, which are where the computer graphics software earns its keep. (Note: Until a project is completed, I keep *all* revisions on my computer hard drive labeled in chronological order).

The second schematic, the layout schematic, is typically a straight-line representation of the layout from one end to another. The schematic is similar to one found on a CTC panel. The schematic shows single or multi-track mainline segments and passing siding locations. (On the M&Sw, every passing siding has a name and thus becomes a "station" in the timetable). In developing the M&Sw, after reviewing the schematic and proposed operations, we added a couple of additional "stations" — Strawberry and Champion — which are little more than telephone sheds. There are no passing sidings or spurs at either of these; they serve as "control points." Strawberry is about halfway up a long grade between Payson and Happy Jack, a "tank stop" for steam engines, has a telegrapher on duty. Champion is a concrete "phone booth" and speeder set-out used to mark the mainline limits for trains switching in the adjacent stations of Lavender Mine and Mary Lake.

This same schematic, printed on a large sheet of paper overlaid on a piece of thin steel sheeting, is used for our "manual CTC panel" (with magnets used to mark train locations as they are reported by train conductors and "station agents"). We've also taken a second copy and sketched in the locations and orientation of spurs proposed to be added to serve the industries on the layout.

One of the values of a layout schematic is that it lets you "role play" at an early stage, the various operations you'd like to support. Can two trains meet at a particular location? Is a third siding necessary there due to heavy traffic or local switching? Is there

Below: **CTC panel graphic.**



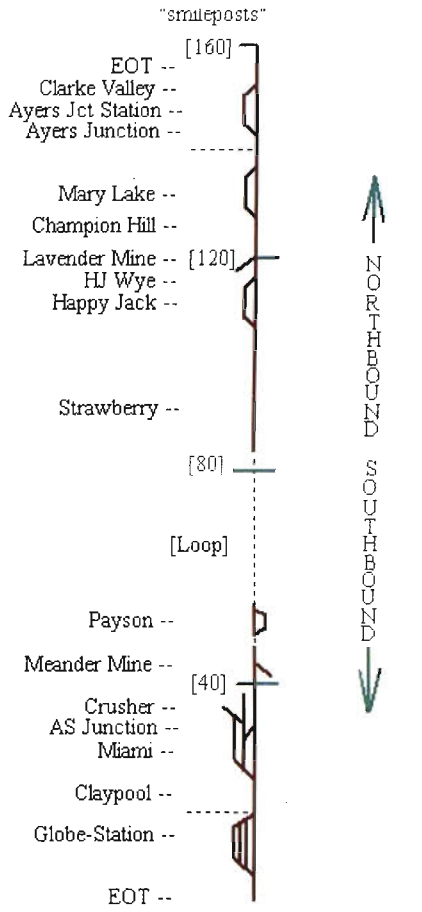


Figure 3: Linear layout schematic, drawn in scale mile distances.

a run-around nearby to serve facing-point spurs? Where would helper service be located? These and other aspects can be "gamed out" to see whether the proposed layout will be effective in meeting your goals.

The third schematic is similar to the layout schematic; however, I drew it to "scale" using CADrail software. The distance between stations in this scale schematic should be the same as the distances between those stations in the track plan. This schematic, a "train graph schematic" (Figure 3), is used to plan and develop the train graph used for scheduling multiple trains on the layout.

The Timetable and Train Graph

A timetable and a train graph show much the same information — train schedules — in different formats. An Employee Timetable shows the precise departure and arrival times of each scheduled train at towns or sidings on the railroad, plus other useful information such as distances between stations, speed limits, and siding lengths. A *train graph* is a graphic representation of the timetable information: train direction, speed, superiority to other trains, and times and locations of meets or passes.

Timetable No. 5 **MOGOLLON & SOUTHWESTERN R.R.** Sunday, July 16, 2006

NORTHBOUND												SOUTHBOUND	
HJ Turn (local frt) 311 / 321 THIRD CLASS	Flagstaff Express (freight) 101 FIRST CLASS	Scale Mileage North	Mile-post	sidings feet	cars	STATIONS station names/ distances	facilities	notes	Scale Miles	Scale Feet	Dist. [in]	Mileage North [feet]	Globe Express (freight) 102 FIRST CLASS	HJ Turn (local frt) 312 / 322 THIRD CLASS
<<start>>	<<start>>	0	0			*EOT*	Loop							
<< 311 >> 8:01 AM	<<101>> 9:17 AM	0.4	3.6	yard		0.4 Globe	P,To,YL,Yd,T,W	SP Intg	0.4	1914	264	22.0	<<end 102>> 11:45 AM	<<end 312>> 7:57 PM
		0.4	4	435 /	7	0.0 Smelter	Sp-N	Yd	0.0	261	36	25.0		
		0.5	5	-	-	0.1 Claypool	-	-	0.1	696	96	33.0		
8:29 AM	9:43 AM	0.7	7	566 /	9	0.1 Miami	P,To		0.1	761	105	41.8		6:31 PM
(fs)		0.8	8.03	479 /	7	0.1 AS Jct	P	AS Intg	0.1	609	84	48.8		6:03 PM
		0.9	9	174 /	4	0.1 Crusher	Sp-N		0.1	464	64	54.1		
(fs)		1.1	11.4	348 /	5	0.2 Meander Mine	Sp-S		0.2	1305	180	69.1		
11:01 AM	***10:35 AM***	1.3	12.9	696 /	12	0.2 Payson	P,To,W		0.2	797.5	110	78.3	10:41 AM ***9:45 AM***	5:45 PM
1:15 PM		2.3	22.8	-	-	1.0 Strawberry	P,To,W	-	1.0	5220	720	138.3		
3:25 PM returns as 312	12:17 PM	2.8	27.7	667 /	11	0.5 Happy Jack	P,To,W		0.5	2610	360	168.3		4:40 PM << 312>>
<<321>> 1:17 PM	(departs) 1:07 PM	2.9	28.7	-	-	0.1 HJ Wye	Wye - CVLCo		0.1	522	72	174.3		return as 321 11:15 AM
1:37 PM		3.0	30.1	305 /	7	0.1 Lavender Mine	Sp-S		0.1	739.5	102	182.8		
		3.1	31	-	-	0.1 Champion	P		0.1	-	-	-		
3:15 PM		3.2	32.1	160 / 464 /	3 7	0.2 Mary Lake	MOW Sp-S P,To		0.2	1392	192	198.8		9:37 AM
5: 23 PM	2:45 PM	3.5	35.5	yard		0.3 Ayers Jct	P,To,YL,Yd	ATSF Intg	0.3	1769	244	219.1	6:45 AM	9:03 AM
<<end 321>>	<<end 101>>	3.8	37.6	CVLCo yard		0.2 Clarke Valley	P,Yd,F,W		0.2	1131	156	232.1	<<102>> <<start>>	<<322>> <<start>>
		3.9	38.8			0.1 *EOT*	Loop		0.1	609	84	239.1		

Special Instructions as of 16 July 2006:

1. **Rule S-71(a):** Northbound trains take precedence over Southbound trains of the same class unless otherwise specified.

2. **Rule 805(a):** All freights -- must entrain empty flats, gons, and OT hoppers at end of train ahead of caboose.
3. **Rule 805(b):** Local freights -- may entrain *only* empty steel-frame ore cars for mine return.
4. **Rule 805(c):** Mine turns -- loaded or empty wood / truss rod ore cars to be entrained only at end of train ahead of caboose.

5. **Rule V(ii): Visitors:** do not distract the train crew while train is in motion.

SAFETY IS ALWAYS OUR #1 CONCERN

Figure 4: Employee Timetable early draft, showing Excel cells and grid lines.

It is used to plan and evaluate meets and passes between trains and time allocated for en-route switching.

From reading the AP requirements, you might infer that the timetable and the train graph are developed in that sequence: one after the other. However, as I developed these for the M&Sw, I found myself going back and forth between them. Information I discovered working with a timetable helped me refine the train graph initial departure and arrival times and speeds. The refined train graph showed me where proposed schedules in the timetable didn't allow enough time for a needed meet or pass, or switching, and the result of alternatives to fix that oversight.

Timetable

Develop a timetable appropriate to this model railroad, simulating prototype time, covering a period of eight hours or more, during which at least three scheduled mainline trains move in each direction.

I usually begin by developing a first draft of an employee timetable, and then cycling through a number of revisions until I am satisfied with the result. I use my laptop computer for revisions. I also save *each* revision as a separate file. Sometimes I'll get up to 20–30 revisions before the final product,

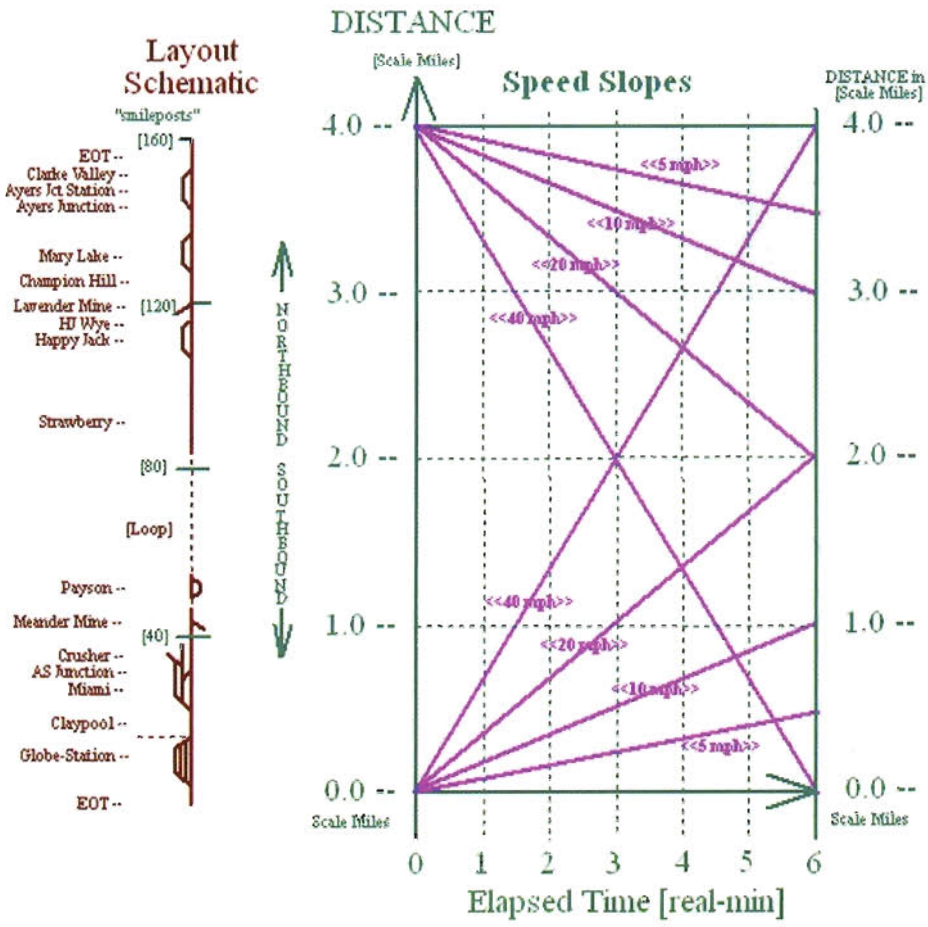


Figure 5: Train graphic speed slopes, both northbound and southbound. Drawn using CADrail, with X-axis in real elapsed time and Y-axis in scale distances.

but if I make a mistake, I can always backtrack to see what I did at an earlier stage. I use Excel spreadsheet software, because I have it, and it works pretty well: It updates distances and mileposts as I make changes. The program also has enough font and line sizes and styles to let me do a good job of building a document that looks and feels like the prototype. (See Figure 4).

I begin by listing all named stations in the correct order in one column. (I leave a blank row between each station name for the distance between a pair of stations). I choose one of the station termini as the end of track (milepost "0") from which all distances are measured. I then measure the layout distance between each pair of stations. (If it's a proposed layout, then I measure the distances in scale feet on the track plan; if it's an existing layout, I measure it in inches between each pair of stations on the layout).

For each station, I enter the distance from the previous station into the spreadsheet "cell" adjacent to the station name cell. I then create additional columns and build spreadsheet formulae to calculate distances in scale feet, scale miles, mileposts, distance traveled, and the like (see Figure 4 for M&Sw "Timetable No. 5").

I also measure and record the length of each siding in scale feet. I then let my spreadsheet calculate the maximum length of a train (in number of cars) the siding can hold (assuming one diesel unit, one caboose, and an "average car length." ("Average car length" is based on a sampling of cars in typical trains and the mix of car types on the layout; for the tight-radius 1950s-era M&Sw, the average car length is about 49 feet).

In displaying the results of spreadsheet calculations, I typically allow the software to display results rounded to a single decimal place: good enough.

At some point, I add in the codes at each station for things such as telephone (P), yard (Yd), refueling (F), water (W), telephone office (To), turntable (T), wye (Wye), or balloon turning loop (Loop). I also add any brief notes, such as "SP Intg" (interchange). *(At this point, different thoughts on operating restrictions or procedures begin to surface as I work with the timetable and train graph. I record these "notes" in a word processing document. After editing, they eventually become part of the "special instructions" found in the employee timetable).*

Some prototype railroads, such as my favorite Southern Pacific, did away with timetable and train orders (TTO) as more modern ways of dispatching and controlling (freight) train movements developed. SP in its later years treated all freights as "extras."

Right: **Train 401, the *Copper Queen*, crosses Upper Strawberry Creek just minutes from the ASARCO mines around Happy Jack and a meet with Train 22 southbound. [M&Sw publicity photo]**

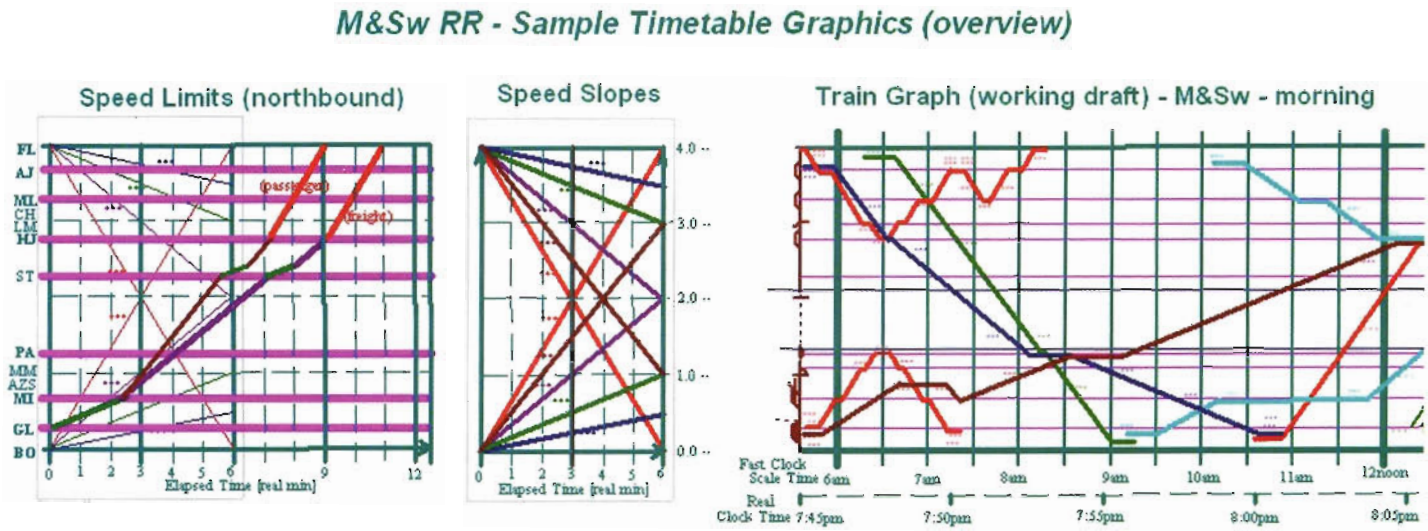


Figure 6a: Speed slope template, Speed Limits template, and Train Graph (draft).

Even so, developing an employee timetable is useful for a variety of purposes, even if you don't plan to use TTO. Particularly, the information collected on stations, distances, facilities, siding lengths, and the like is useful if you later on decide to adopt one of several computerized railroad operations software applications.

Because I favor TTO operations, I'm ready to schedule the trains themselves. I expand the spreadsheet to provide column space for each scheduled train, usually grouped by class. For each of them, I put in a train number, a desired initial departure time, and a *guess* at how they will interact with each other (meets, passes, and arrivals). I find, however, that my best guesses are not always feasible, given real time, scale time, and scale distances. But the train graph — covered in the next section — lets me get a more accurate picture of the way the railroad will run, and the impact of changes and adjustments in the schedule. The process of developing the final version of a timetable is a back-and-forth cycling between timetable and train graph until I am satisfied with the results of both

The Train Graph

Develop an operating train chart (graph) which interprets the above schedule for timetable operation of the model railroad. Indicate at least one train meet on the schematic drawing required in (B-1) above. Show the position of the trains involved and describes the action, giving pertinent time and movement data to affect the meet.

The train graph is more than just an interpretation of a timetable. It's a valuable tool to refine an initial draft of a timetable, or for changing an existing one. I do almost all my detailed train schedule planning and revision using the train graph, and then use the results to make up the published version of the timetable.

Let's look at a sample train graph for the M&Sw. (See Figure 6c). The horizontal scale (X-axis) on the graph represents elapsed clock time increasing from left to right. When I laid out my time scale, I showed both "scale time" and "real clock time" (in five-minute increments). Most of our operating sessions start at 7:30PM, and Tom wants one 3-hour session to represent about an 8-hour shift starting around 6AM. So the real-time scale starts at 7:45PM. The M&Sw provides "accommodation trains" — currently RDCs — to take workers to and home from the three ASARCO mines on the layout. Morning shift change starts at 7AM, so the "scale time" start point was adjusted to 6:45AM so that the morning RDC runs — Trains 151/152 and 162/161 — would reach their turn-back points at Payson and Happy Jack by then. (Northbound trains carry odd numbers; southbound trains carry even numbers).

The scale layout schematic — developed earlier — forms the vertical scale (the Y-axis). The Y-axis shows distance in scale miles northbound from the layout's "Milestone 0" — the "End of Track" or EOT — in the town of Globe. The horizontal lines across the graph show the location of each "station" on the layout.

Notice there is a large "gap" between the towns of Payson and Happy Jack (actual towns in Arizona). The distance between

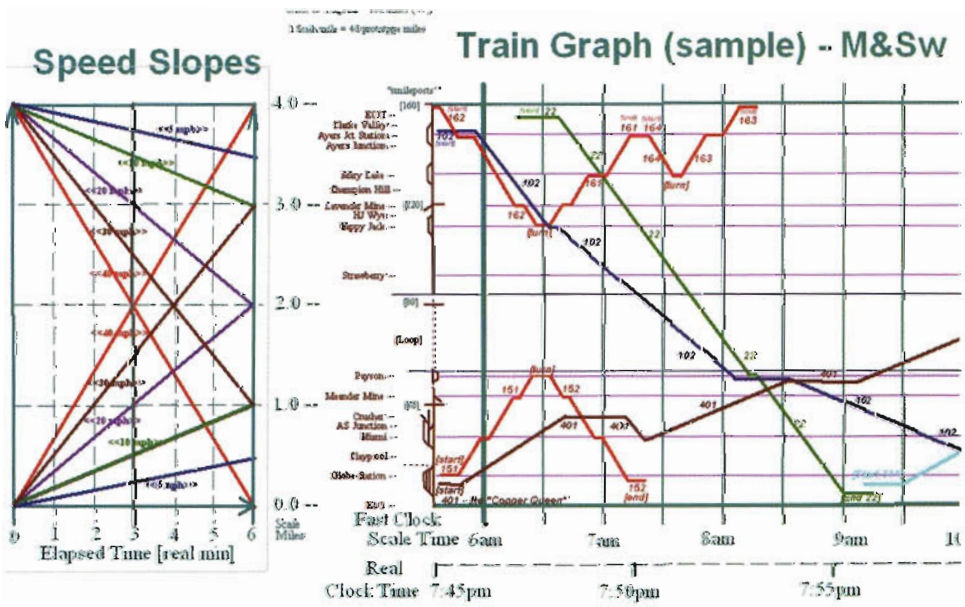


Figure 6b: The Train Graph is built using "copy and pasted" segments from the Speed Slopes template.

Right: Train 162 passes Champion, a concrete "phone booth" and speeder setout. This tiny station is key for coordinating freights using the main for switching at neighboring Lavender Mine and Mary Lake.

these two stations is about one scale mile of single track on a 2 percent grade, with no passing sidings, a tank stop at Strawberry, a helix, and a couple of bridges with a 10 mph speed limit. "The Hill" is a major operating bottleneck. Having the scale layout schematic along the Y-axis brings this challenge home in a way a regular timetable would not.

Each "slanting" line plotted on the graph represents one train as it moves along its route over time. The slope of the line represents the speed of the train: the steeper the line, the faster the train. A horizontal line (zero-slope) shows a train stopped for a meet, pass, or switching. Two "train lines" intersect at the point when and where they meet or pass each other.

The "Morning Rush" on the M&Sw

Let's take a closer look at the M&Sw train graph for the simulated "morning" hours. Train 162, an RDC, departs southbound from Flagstaff (staging) at a fast clip. It makes quick stops at Ayers Junction, Lavender Mine, and Happy Jack to pick up and drop off mine employees. At Happy Jack, at 7AM, it turns to become Train 161 northbound. While in Happy Jack, Train 161 holds for a meet with the *Globe Limited*, Train 22 southbound.

After meeting No. 22, Train 161 leaves Happy Jack northbound. It stops again at Lavender Mine to pick up employees coming off-shift, and then makes a stop at Mary Lake to pick up early-morning shoppers headed for Ayers Junction. Train 161 terminates in Ayers Junction. A few minutes later, it departs southbound once more as Train 164 for a quick run back to the tourist destination of Mary Lake. It returns as Train 163, stops at Ayers Junction, and then continues into Flagstaff (staging), where it terminates its morning runs.

Train 162's RDC counterpart at the "south end" — Train 151 — has a similar accommodation run between Globe, Payson, and the ASARCO entities between.

This simulated morning "commute" rush takes place within 45 minutes of scale time, or 15 minutes of real time. At first glance, this seems like a frenetic pace. However, each "stop" takes a slow count from 1 to 30, and these priority trains can easily accelerate up to the posted speed limit of 40 mph. The schedule was validated by actual operations. Now, it does get in the way of everyone else along the route, but it was designed to do so. We usually give the "commute runs" to newer operators to help them become acquainted with locations on the railroad before assigning them to something more challenging.

One other train is worth noting. Train 401, the *Copper Queen*, is a low-priority drag between Globe and Happy Jack. It drops empties and picks up loads in Miami (Crusher), Meander Mine (near Payson), Apache Maid Mine (in Happy Jack), and Lavender Mine, and then returns as Train 402 to the smelter at Globe. This is a surprisingly tough train to work (especially when Tom leaves just one short car at Arizona Southern Junction interchange to get in the way!), and is usually given to the most experienced operators. It runs at low speed, spends a lot of time switching en route, ties up "the Hill" between Payson and Happy Jack, and tries to keep out of everyone else's way. One of the values of the train graph is determining where to fit trains like the Copper Queen in the gaps among higher-priority trains.

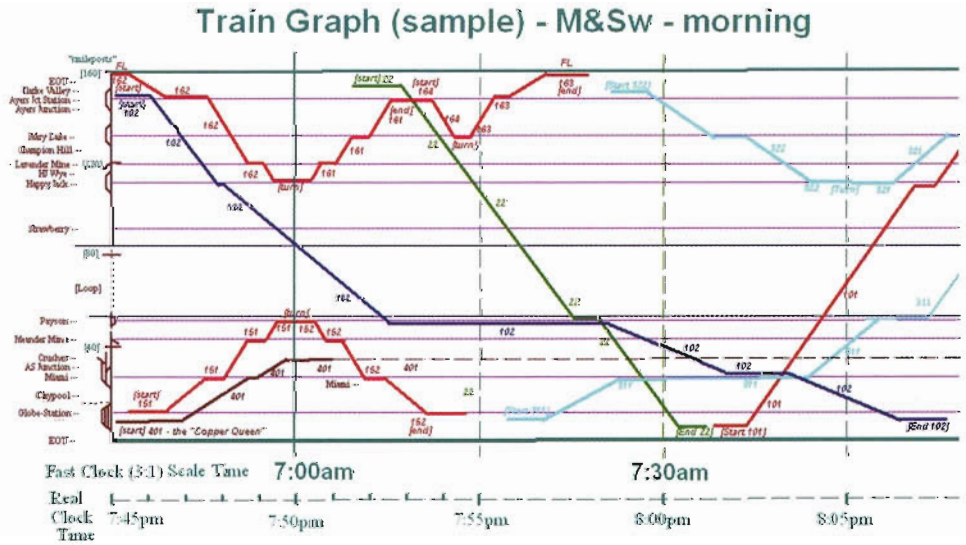


Figure 6c: The Train Graph used in the example

Scheme of Operations

Develop or adapt a system of operation for the layout in (A), including all the necessary forms and explanations for their use for controlling car movements, train makeup, and operation in a prototypical manner.

To meet this requirement, it's not necessary to devise an entirely new paradigm for carrying out prototypical operations on a layout. You don't even have to design your own forms, if you wish. There are many workable schemes and methods already devised. To meet this requirement,

Above: **M&Sw Train 163 (northbound) is only a few minutes away from the end of its "morning rush." After a station stop at Ayers' Jct., it will terminate in Flagstaff and a connection with the Santa Fe.**

it's only necessary to decide which existing approaches seem right for your railroad, and then create adaptations of the existing forms and procedures to fit. Finally, test them to make sure they work.

There is no one "correct" way of conducting prototypical operations on a given layout. Much depends on the concepts built into the layout and the preferences of owners and operators. So the two fundamental tests for a "system of operations for (the) layout" are (a) Does it simulate the operations of the prototype, and (b) Is it fun? There isn't space for a detailed discussion of these issues here, but this is a topic well-handled at length in contemporary references like Chubb, Koester, and Armstrong. I recommend them to you.

For illustration, let me address four schemes of operations topics: dispatching, signaling, communications, and freight management. Let's see how these were implemented on the M&Sw.

For dispatching, there were numerous choices: train sequencing, timetable, timetable and train orders, train orders only, track warrants, or CTC. We initially looked at timetable and train orders (TTO), as it seemed to be a good fit with the M&Sw's 1950s-era theme. However, the M&Sw is a railroad designed for a lot of on-line switching with a number of relatively short trains. The distances and time to run between towns, even with very low speed limits, are very short compared to the time spent switching in each town.

So we evolved to a rather relaxed hybrid of train sequencing and train orders. Prior to an operating session, Tom decides (we use RailOp software) which trains (by number) he wants to have run, and in what sequence. For a given session, we might have 12–15 trains scheduled for 4–5 operators, plus a dispatcher and superintendent. The session starts at 7:30PM, and the first 4–5 trains are assigned during the 15-minute crew briefing. Each conductor gets a printed train manifest (generated by RailOp) showing his locomotive number, cars assigned to his train, and the stops and drops/pickups in each town along his route. When a train terminates, the crew can take a break, and then be assigned to take another train.

For signaling, we have one (not yet operational) train order board at Strawberry, and one block signal on the line from Arizona Southern Junction to staging. We felt that electronic CTC would be overkill for this relaxed operation (although we have looked at ABS for "the Hill," part of which is a hidden elongated helix). Instead, we use our "manual CTC": A blown-up layout schematic (printed at our local Office Depot) mounted on a sheet of steel with magnets used as train markers to keep track of train locations. The dispatcher authorizes movements, and the crews communicate arrivals, locations, and requests to proceed to the dispatcher ("OS").

For communications, we have for the past few years used "simulated party-line radio communications": Stick your thumb in your ear, speak into your pinkie finger, and talk ... *loud!* The layout room is a converted two-car garage (a garage is a terrible thing to waste on an automobile!) The dispatcher has a good view of everyone involved, and people can hear each other talk if they speak up a bit (and they have to anyway). We do use standard radio procedures that anyone with military experience would recognize ("Train 151, this is dispatch, over"), and we try to keep non-railroad chatter to a minimum, so everyone can hear. We have not tried radios; they interfere with Tom's hearing aids. However, Tom is installing a telephone system after using them on other people's layouts, so our use of "simulated radio communications" may be phasing out.

For freight management, there were a number of historical choices (and variants) including John Allen's "tab on freight car," Ed Ravenscroft's "tack on freight car," "washer on freight car," Doug Smith's "car card order" system, and several different computerized systems, including RailOp.

We initially tried using car cards: Tom built waybill boxes mounted in each town,

and I designed and printed up some car card and waybill forms. Car cards are popular, well-understood, and easy to set up. You can even purchase sets of car cards, waybills, and other forms pre-printed from companies such as Old Line Graphics or Micro-Mark (in retrospect, a much easier choice for starting with car cards). One feature I like about car cards is that it is robust and self-correcting: if you forget to pick up a car, its card remains in the town waybill box until the next freight comes along. However, we also found that having to handle a radio throttle, a collection of cards and waybills, and an uncoupling pick got to be too much "stuff" with which to fiddle.

So, we tried using computerized systems and have had good luck with RailOp, as have many layouts in the Lone Star Region. RailOp (like other computerized systems) appeared to have a considerable amount of up-front set-up with it; however, if you've already built an employee timetable, then much of the work collecting the information is already done and the rest is about the same as with car cards. If you have someone in your area already experienced with the software you plan to use — and we were so fortunate — the learning curve goes much easier. And, as with many other facets of model railroad infrastructure, there are groups of users on the Internet quite willing to answer questions.

For yard switching, we sometimes use a variant of "tack on freight car" to sort cars. We've made up some rooftop markers cut from large styrene "I-beam" stock, spray-painted bright yellow, and numbered with makeup track numbers from "1" to "4" (about eight of each). When a train terminates in Globe Yard on the arrival track, we can go down the cars and decide which one of the four make-up tracks each car should be assigned, and then lay a track marker over the running board of each car. This is particularly useful for new yard operators assigned to Globe.

The Rulebook

Our "system of operations" evolved over a two- to three-year time period until we felt we had gotten enough of the kinks out to start hosting other operators. (I can't emphasize the need to actually try a new system of operations early and often, even if the layout is still under construction and only partially finished).

Over time, we discovered that there were certain "standard operating procedures and courtesies" we had adopted that make the operation go smoother. We added some of the most important points to the employee timetable as "special instructions."

Then we discovered that these "procedures and courtesies" had actually been codified in a "Standard Code of Operating Rules" agreed to by a consortium of prototype railroads.

So, for the M&Sw, I developed the "Standard Code of Operating Rules for Model Railroads" — the "Rulebook." I started with the 1967 edition of the "Standard Code of Operating Rules" that had been developed, published, and followed by a consortium of Western railroads. I drew from Bruce Chubb's and Tony Koester's books on operations for examples of adapting prototype rules to model railroad practice. We now give a copy of the M&Sw Rulebook and Employee Timetable to each new "employee" (operator) on the M&Sw. The "Rulebook" is merely a written version of the operating procedures that the road's superintendent uses in operating his railroad.

Most of the "rules" used on the M&Sw are the same ones used on the prototype, with some adjustments made for a model railroad. Some of the rules are common sense, such as: "Trains governed by timetable will not depart from a station prior to the time printed in the timetable." Other rules are a matter of courtesy to other operators: "Train crews will return turnouts back to their normal position after use." (This is usually the mainline; we use ground throws, and the "normal" route is marked with green paint).

Some rules are for safety, to prevent derailments or accidents: "Maximum speed limit over Zingerle Bridge and the East Verde Creek Trestles is 10 mph for all trains." (These wooden bridges are as much as 500 scale feet above a concrete floor). Or: "Locomotive engineers shall stay with or ahead of their locomotive consist while it is in motion." Even experienced engineers on a walk-around layout can get distracted while carrying on side conversations and fail to notice an unexpected hazard within or ahead of their train.

And some rules are humorous, just for fun: "Train crews shall not pick nits with each other while trains are in operation." (This also ensures the crew's attention is on their train and not elsewhere).

Conclusion

If you enjoy prototypical operations with multiple operators on a model railroad, then the AP Chief Dispatcher certificate isn't really "hard" to achieve. Most of the requirements are things you would have to decide or learn to do on your own railroad anyway. Give it a try!

Below: **Tom has completed most of the requirements for his AP Certificates (background) while building and operating his layout. The M&Sw was designed from the outset for operation by small groups of 4-8 operators.**