Under Pressure

Operating Pere Marquette 1225 on the Road

How do we get from this...

To this:

Money, Skills and Labor

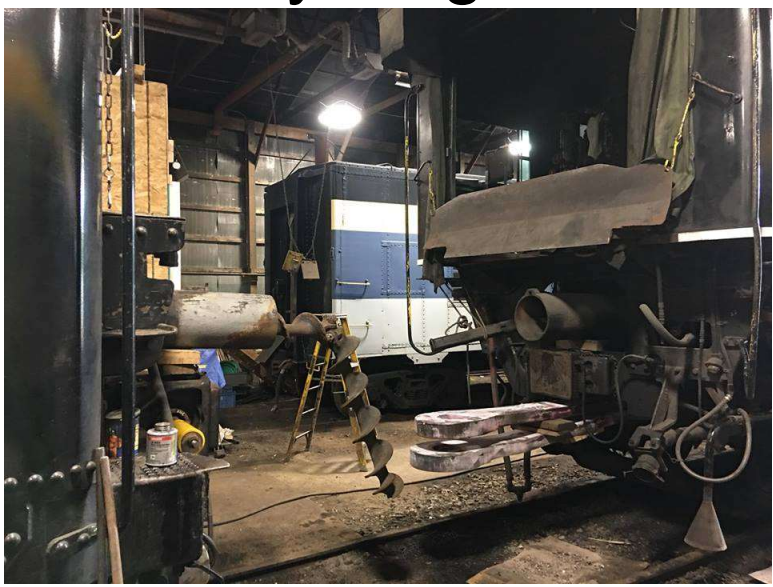
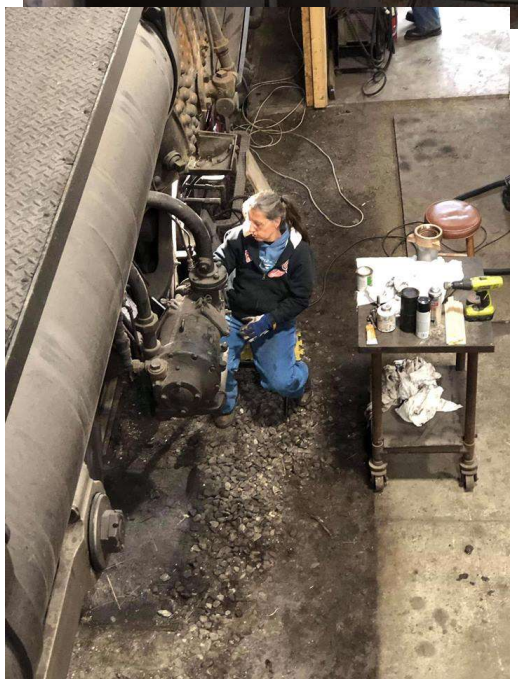
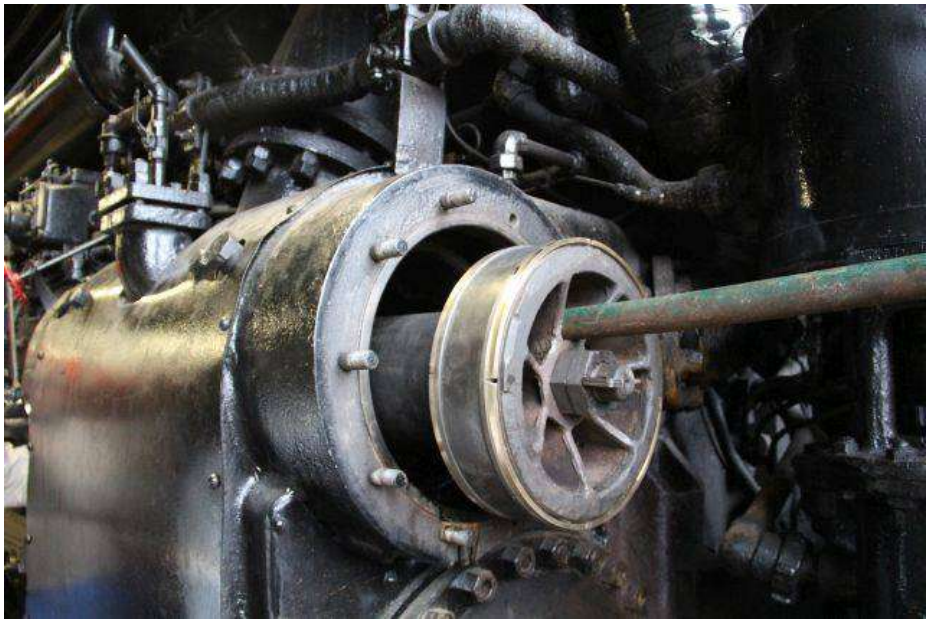
- Keeping it running takes resources
- Shop expenses can run $50K in normal year
  - $1M+ at 15 year inspection/rebuild
- SRI shop has 4 employees, plus 2 contractors who work as needed
- Spare parts – Some specialty manufacturers but most made in-house
  - Large machine tools – lathes, milling machines, etc
- Skills needed – machinists, mechanics, railroaders, and many laborers
- Some railroads allocated 30 men for each steam locomotive

Backshop Volunteers Keep 1225 on the Rails

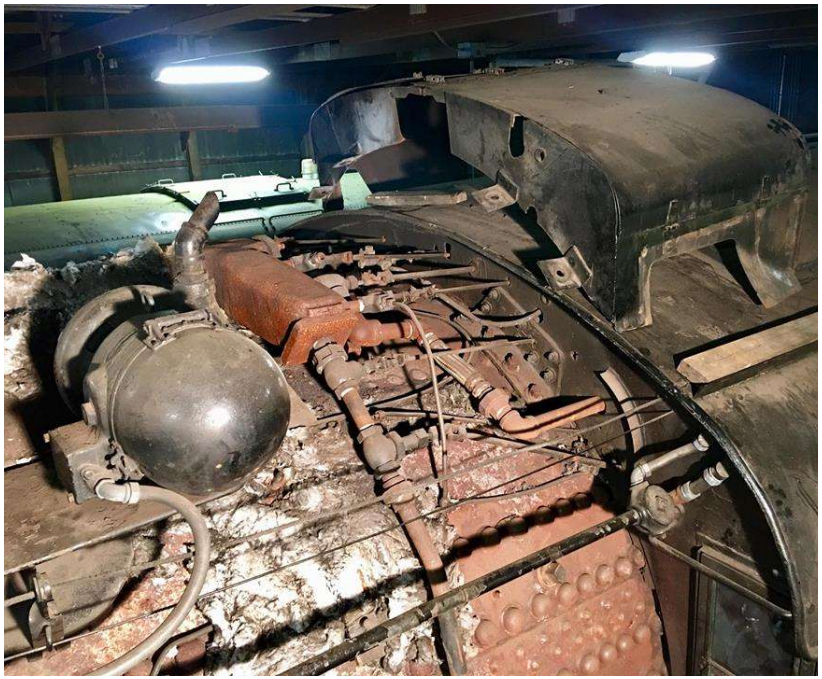
First, fix everything that is broken

- What breaks on a steam locomotive? Everything.....



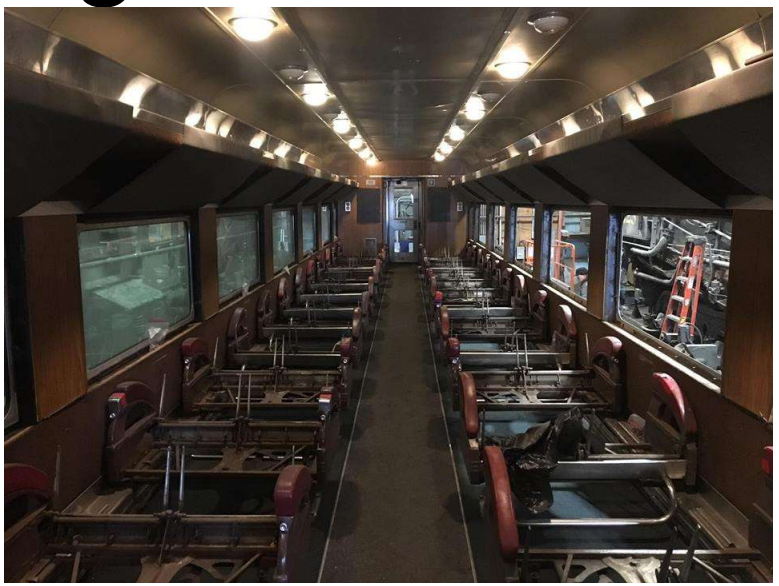




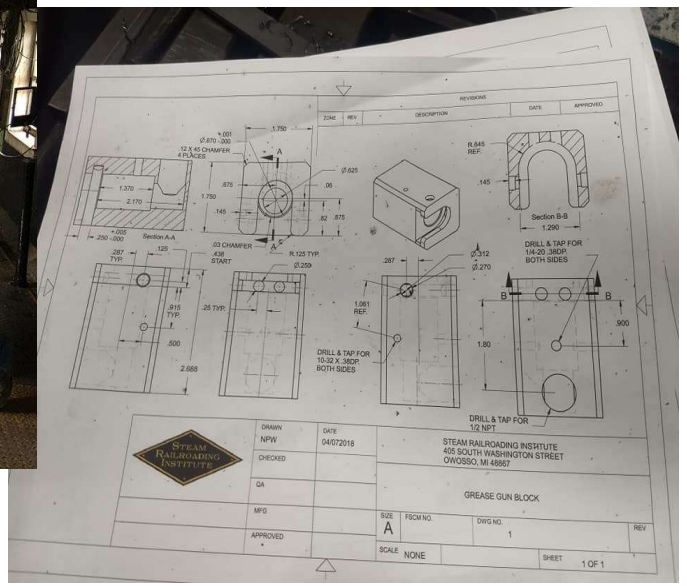

Repairs...



Rebuild worn out items

Rebuild rolling stock also ..

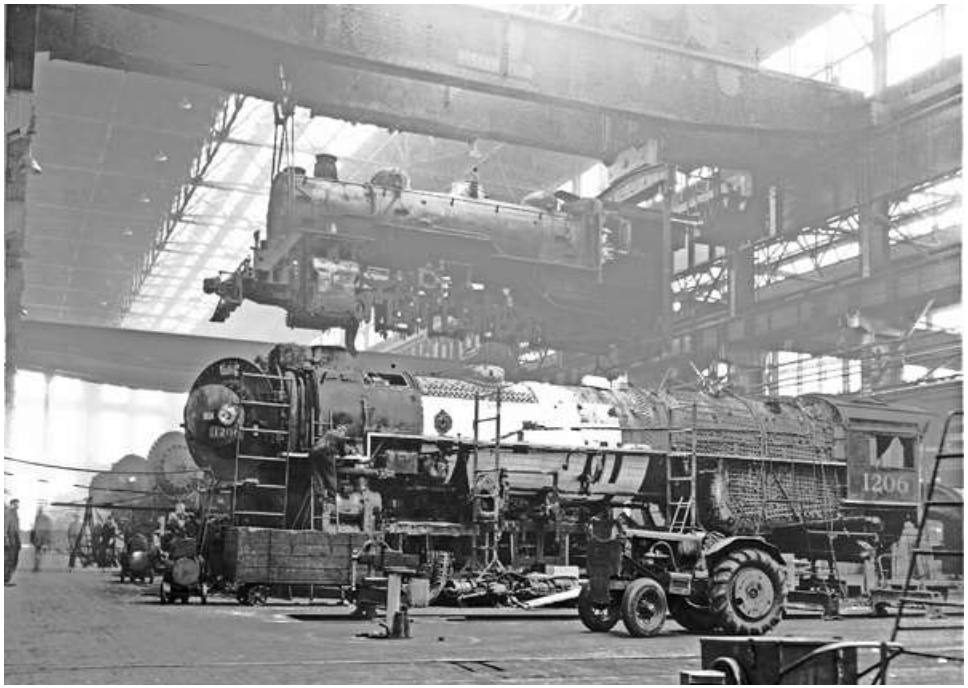




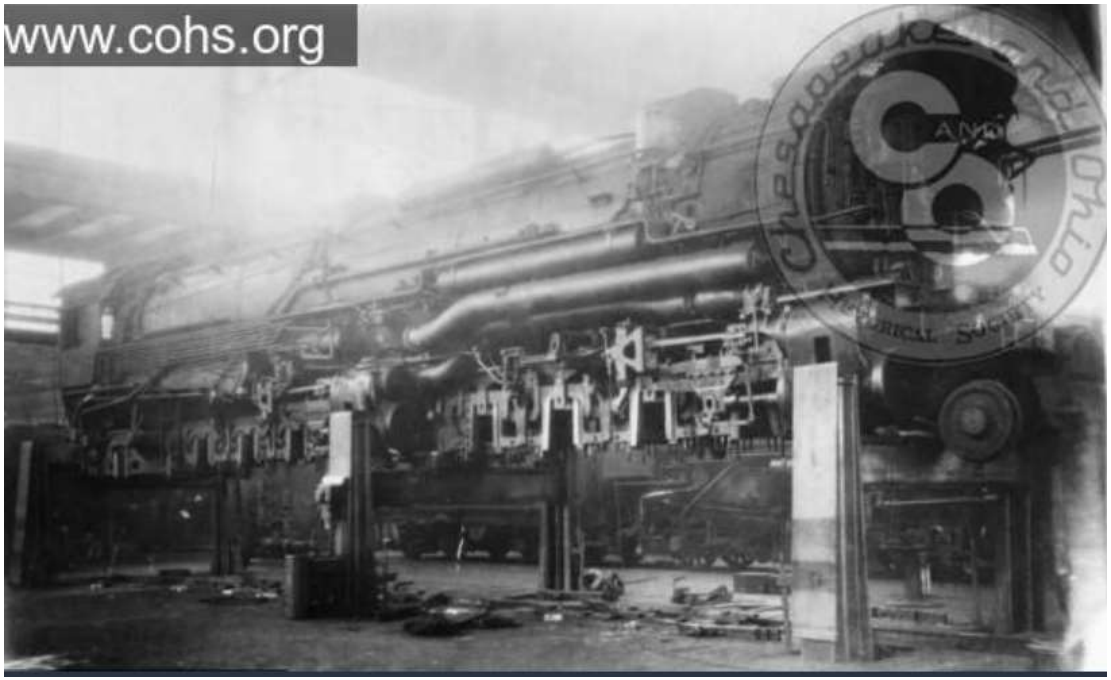
Sometimes Extensive Rebuilding is Needed

- Boiler flues replaced every 15 years
- At last 15-year inspection in 2010-13, tests showed a new firebox was needed.
  - New sheets fabricated at Strasburg
  - Staybolt holes drilled at SRI
  - 3000 new staybolts fabricated at SRI
  - Certified boilermakers performed installation

Locomotive Running Gear



- Back in the good old days, when you needed to fix the drivers you could…
- Pick up the locomotive with an overhead shop crane



- Lift it with jacks
  - This the the boiler and frame of an Allegheny!
- It is not true that locomotives were placed upside down on a foam cradle.

1225 Locomotive Driver Rebuild

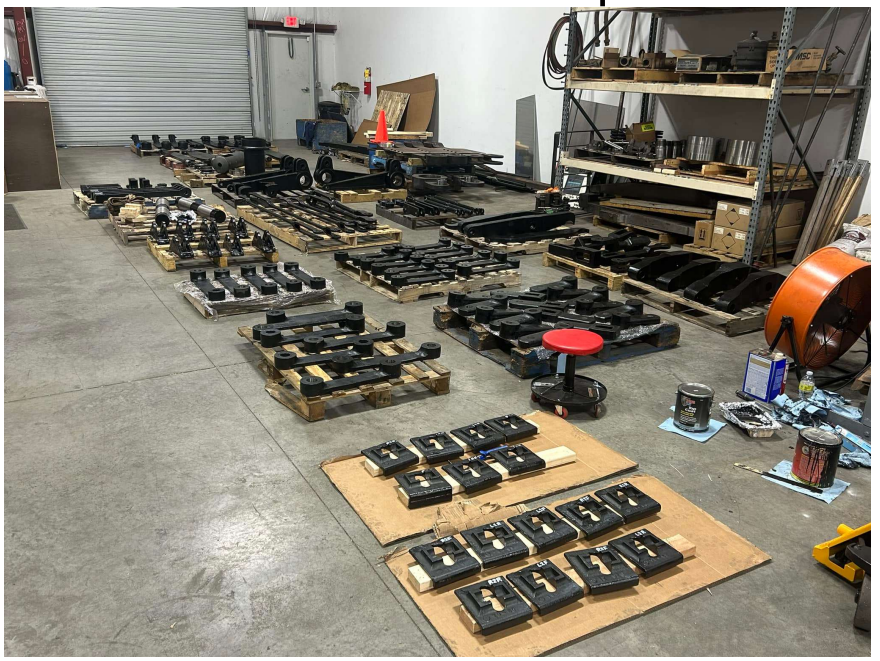
- Today, the locomotive is picked up with two cranes.. Two very large cranes.

- Work to be done:
  - Tires shaped to correct contour
  - New or rebuilt wheel bearings, driving boxes, wedges and shoes
  - New pins and bushings for main and side rods
  - New lubrication system (oil instead of grease packs)
  - FMW Solutions in Tennessee performed work on drivers
  - Various parts fabricated by SRI or specialty machine shops

1225 Locomotive Driver Rebuild

Reshaping driver tire on FMW wheel lathe

There sure are a lot of parts!



- New wedges and shoes in the frame
  - Fabricated in SRI machine shop
  - Provide a bearing surface for driving boxes on the axle to move up and down
  - Front piece (shoe) is vertical
  - Rear piece (wedge) is angled and can be adjusted so driving box moves smoothly

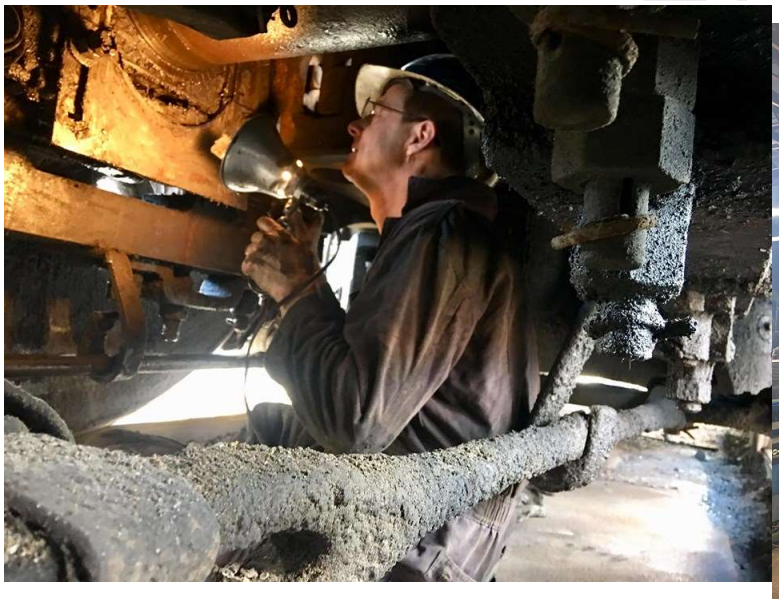
1225 Locomotive Driver Rebuild

Rods re-installed on drivers

How does it get back on the it’s wheels?

Re-installing Running Gear

Once That's Done, Inspect Everything...



Perform FRA Annual Inspection

- Boiler steam outlets to throttle are sealed in preparation for static test
- Staybolt “weep holes” are cleaned out to show if any are cracked. Staybolts hold firebox in place inside boiler shell

Annual Inspection

- Boiler filled with water for static pressure test. All air is pushed out through top of steam dome
- High pressure water pump pressurizes boiler to 150% of normal operating pressure.
- After static testing, steamup test is performed and safety valves are “fine tuned” to proper pressure settings

Yay! It's Boiler Wash Day!

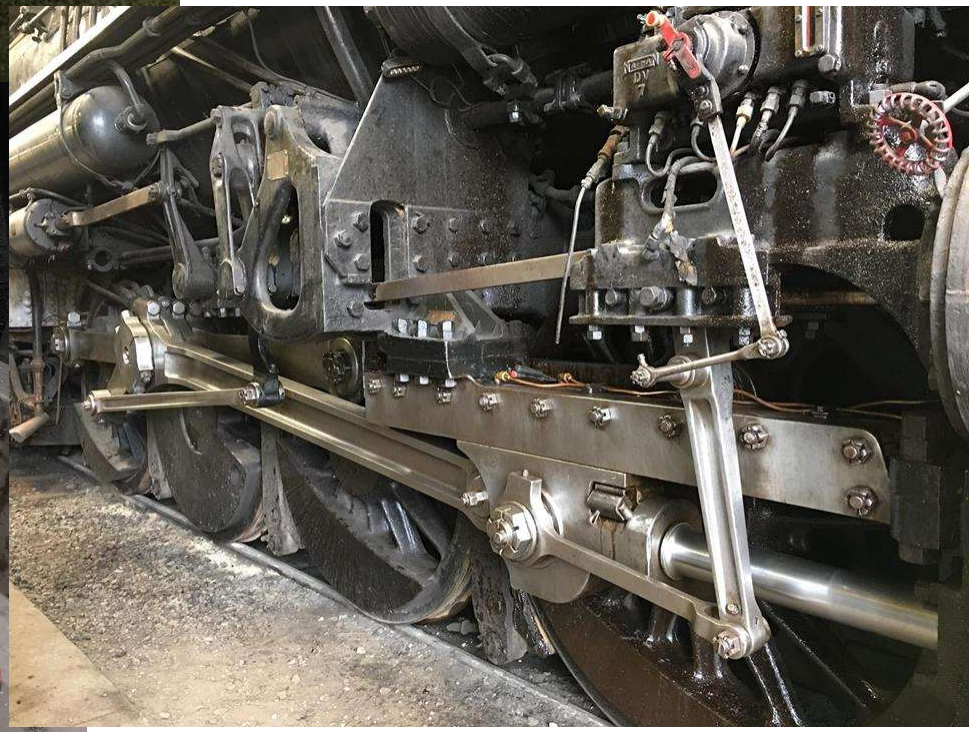
Can we run it now, finally?

Clean Firebox

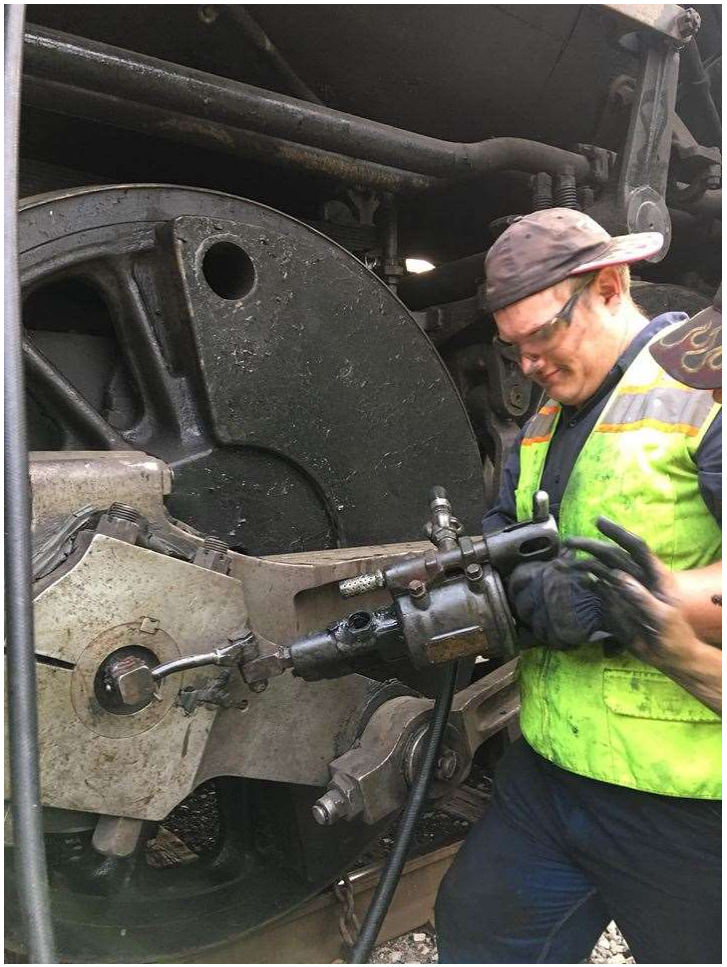
- Clear ashes from sides and throat sheets
- Open grates and sweep down into ashpan

Clean side rods

- All that oil and grease has to go somewhere
- Mineral spirits, scrapers, scotchbrite, rags, and elbow grease

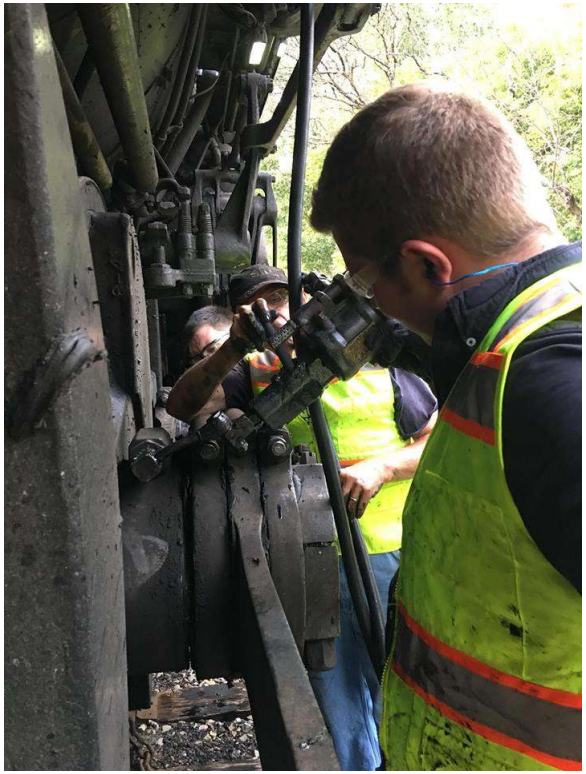


Operations Day minus 1 (or more)



Lubrication:

- Grease side rods with “hard grease”
  - Large, heavy, air-powered grease gun
  - Grease sticks – 3/4”x6” in size
  - Repeat every 100-125 miles
- “Soft Grease” on other moving parts and linkages
  - Similar to automotive grease
  - About 100 grease fittings
  - Repeat every other hard grease
  - All tools and supplies ca



Operations Day minus 1 (or more)

Lubrication Continued:
Fill Lubricators

- Located above cylinders
- A pump driven by valve gear movement
- Engine Oil on Fireman Side
- Valve Oil on Engineer's side
- Pressure cans used to pump oil up to reservoirs
- Repeat every 100-125 miles

Operations Day minus 1 (or more)

Lubrication:

- Oil wheel journals on some rolling stock which still has journals

- Oil bearings on pilot, trailing truck, tender, and tender truck pivots
- Small oil cups filled with engine oil
  - Hoses direct oil to pivot & bearings

Oil Air Compressors

- 2 small reservoirs on each compressor
- Repeat every 100-125 miles
- Also oil reservoir on power reverse unit

Operations Day minus 1 (or more)

- **Build Fire Bed**
- 2-3” of coal hand shoveled across 9'x10' grate
  - 100+ shovels!
  - It's a long way to the front of the firebox!
- Make a wood pile on top
- More coal on top of wood
- Fill Boiler and Tender with Water
  - 8000 gallons in boiler
  - 22000 in tender
  - May also fill aux tender depending on the trip
  - Add water treatments to treat for Scale, Oxygen, Acidity

Operations Hour minus about 11 hours

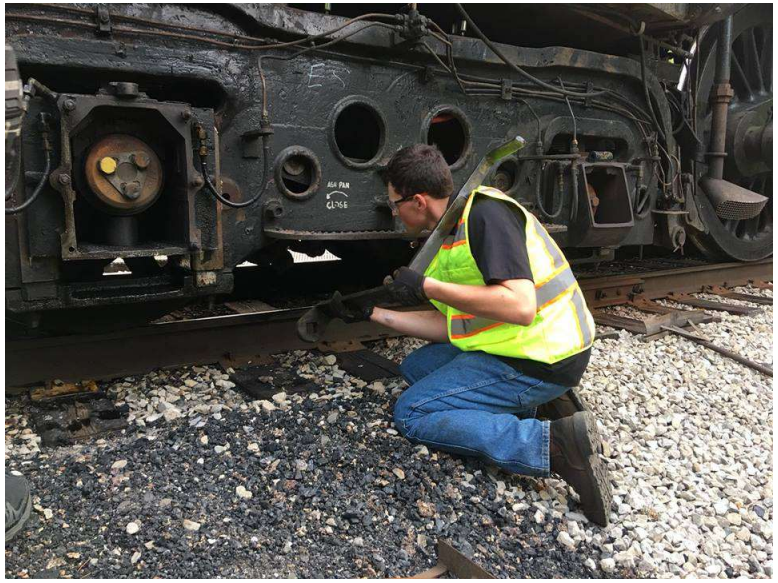
- **OK, finally, light the fire!!**
  - Toss about a quart of diesel fuel on the firebed
  - Use railroad fusees (like a highway flare) to
  - ignite fire

- **Close the firebox door and wait**
  - In 6 hours the steam pressure will be about 100 psi and the boiler warm enough to start building pressure
  - Boiler will lengthen a few inches as it warms!

Operations Hour minus about 4 hours

- **Build steam pressure**
  - Add coal by hand shoveling
  - Start blower (a ring of steam jets in the stack that increase airflow through boiler)
- As pressure builds:
  - Add water as needed once PSI above 160
  - Injector uses steam expansion to push water into boiler

Operations Hour minus 2 hours

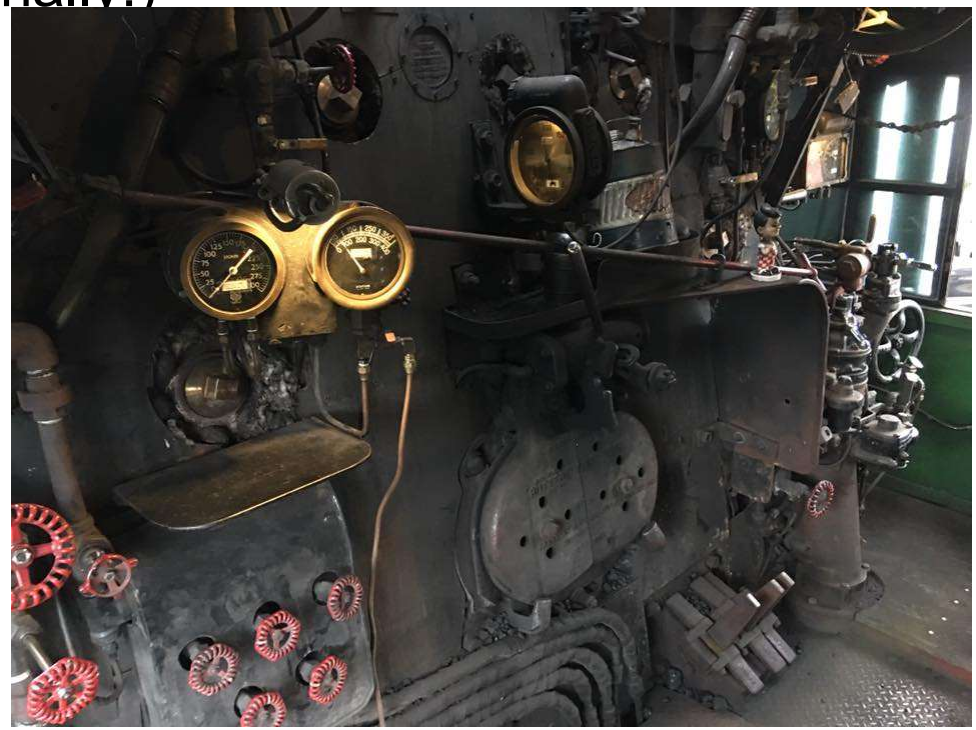


- **Road Crew or Qualified Hostler takes over**
  - Start compressors
  - Disconnect “shore power” and start dynamos
  - About 8 hours after fire starts the locomotive can move with 180-200 PSI steam pressure
- **Shake Grates and Dump Ashes**
  - Grate shakers allow fine ash to fall into pan
  - Open ash hopper doors
  - Air wands blow ash from pan into hopper
  - Must repeat every 100-150 miles

- **Fill Tender with Coal**
  - Pull locomotive ahead to the coal pile
  - Coal is loaded with excavator
  - Top off tender with water if necessary

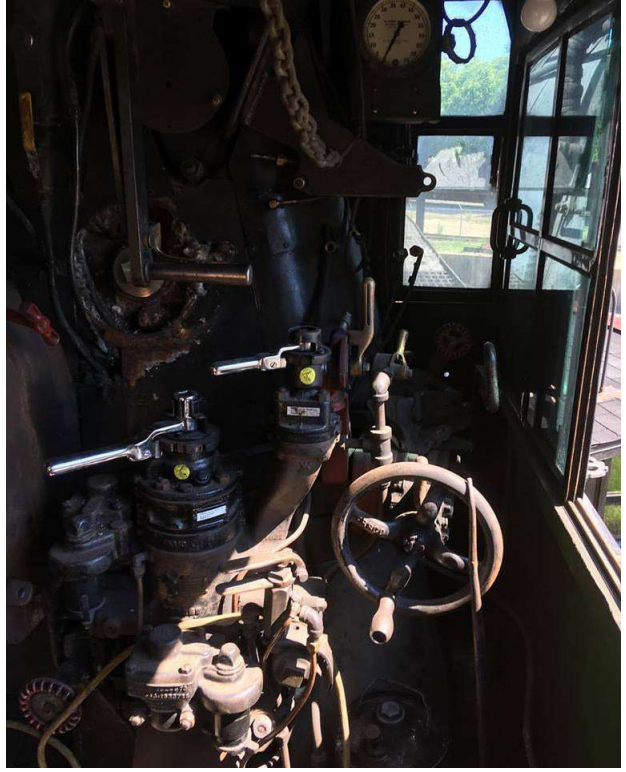
Make Train Ready

- Check pressure and water level
- Move to train and couple up
- Connect air hose tender to train
  - Engineer does “Three Step”
    - Throttle off, brakes set, reverse centered before trainmen go between cars
- Pump up brake line
- Check brakes
- Move to loading area (Whew! Finally!)

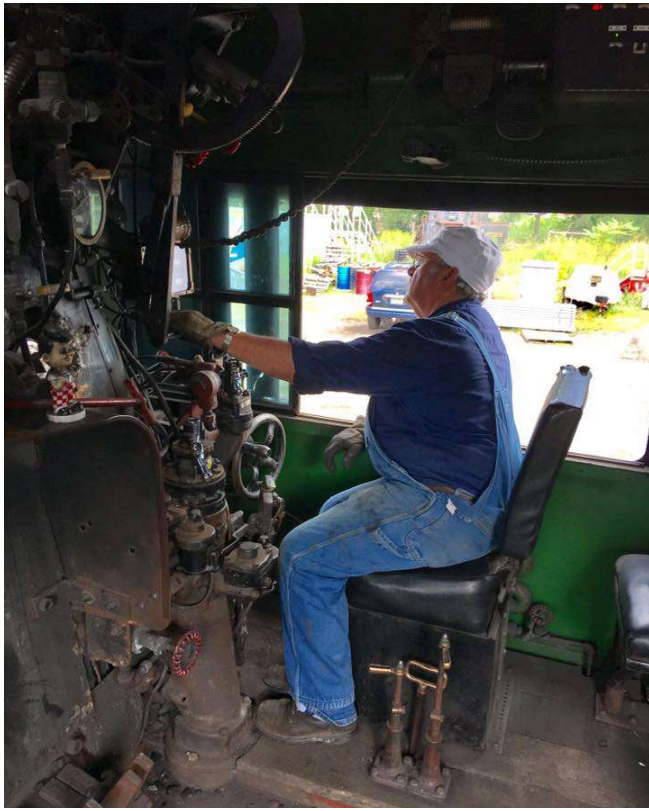


Highball!

- Passengers loaded?
  - Head car host turns train over to crew
- Conductor radios highball to cab
- Engineer:
  - Reverser at 100% forward
  - Release brakes
  - Start bell, two whistle blasts,
  - Open throttle

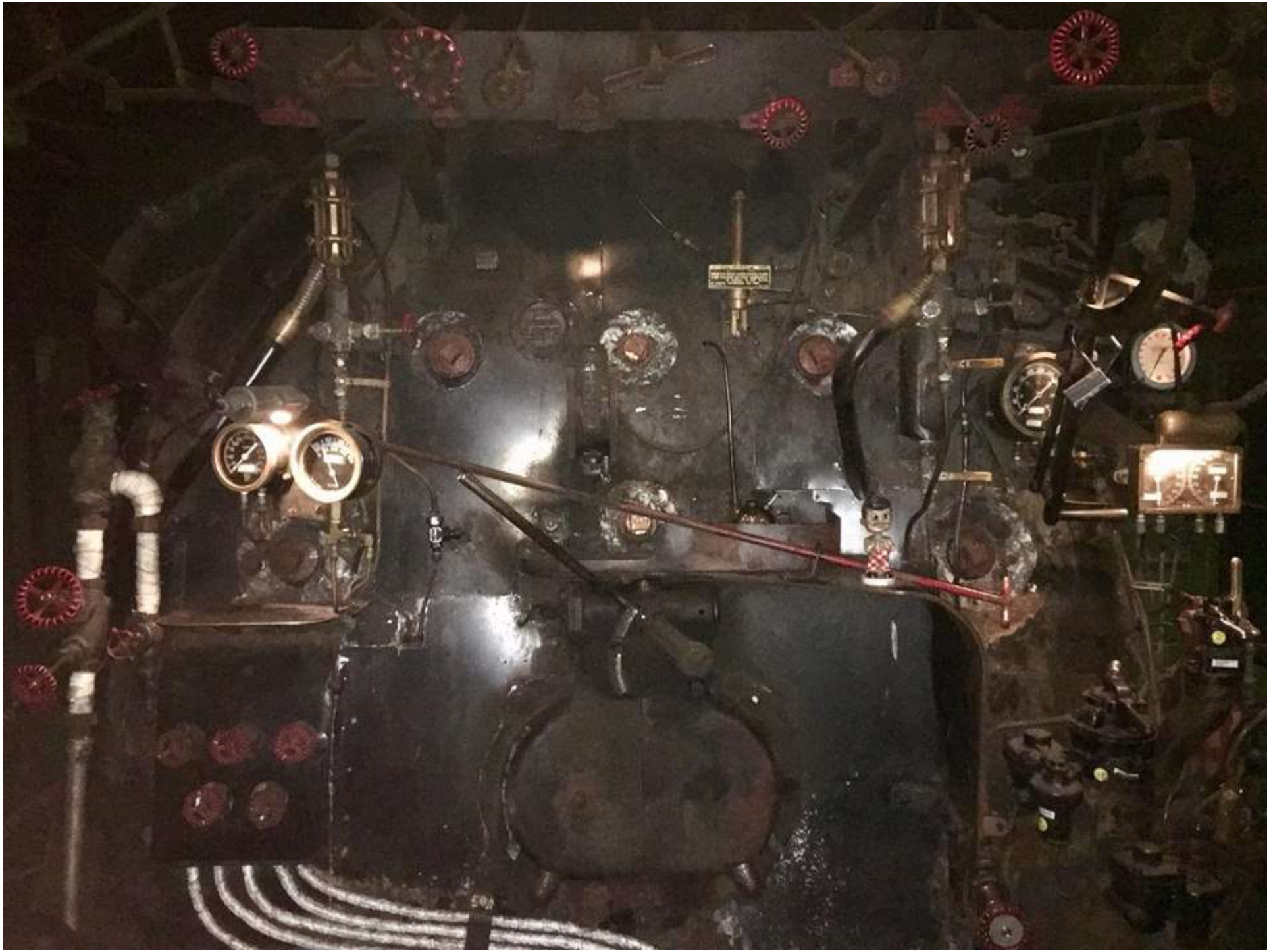


Minimum Elapsed Time Since Fire Lit: 10.5 hours



On the Road

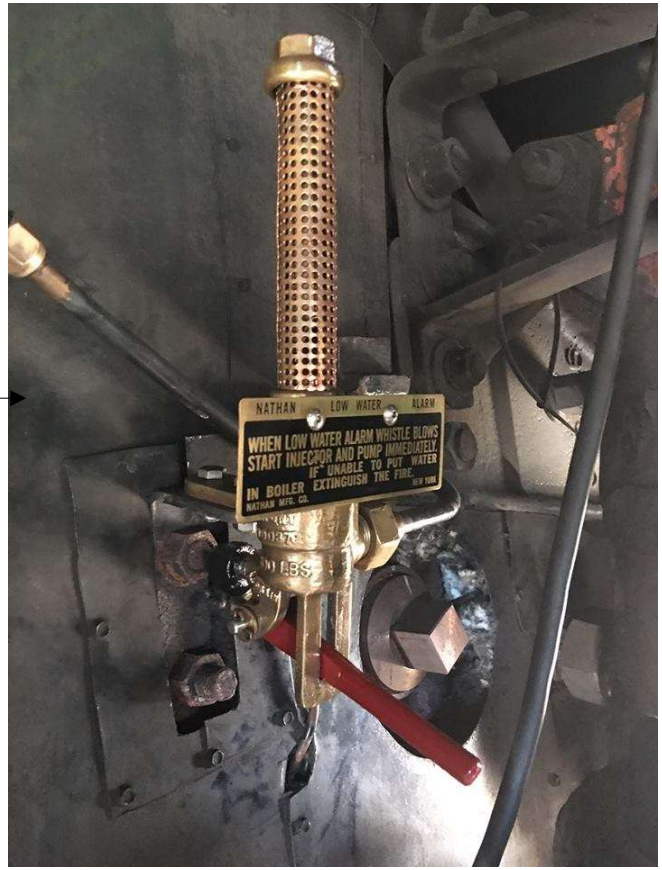
- Fireman monitors pressure, fire, water level
  - Constant balancing act for proper steaming
  - Upgrade, more steam (more coal) needed. Downgrade, less steam
- Fireman has to “lead” the steam requirements
- Fireman also “trims” fire by hand shoveling into the corners or to even out firebed
- Monitor water level.
  - Injector vs. Feedwater pump
- Engineer adjusts throttle and reverser depending on load – going up or down hill.



Overall view of cab interior

What can go wrong..

- Water level
  - Water glasses may get blocked
  - Feedwater pump may cavitate
  - Crew WILL hear the low water alarm
- Poor steaming
  - Low grade coal
  - Bad firing technique
    - Ash bed too thick, not enough air
    - getting to coals
    - Fire too thin, not enough heat
  - Something breaks
    - Firebox door hinge, stoker failure or a grate cracks and leaves a hole in the bed
    - Water glass breaks – need to shut valves immediately only you can't see anything because the cab is full of steam



In summary, road crew is working constantly – it's not cruising down the freeway

Servicing on the Road

- All servicing can be done on the road
  - Hard and soft grease, lubricators, oil bearings, dumping ash
  - All necessary tools and fluids carried in tool car behind locomotive
  - Locomotive air used for hard grease gun and lubricator tanks
  - Sometimes a challenge depending on ballast, roadbed, and ditches
- Tool car also has tools and parts for repairs

Night Watch

- Operations typically span 3-4 days
  - Maintain fire and boiler pressure at 200-210 PSI
  - Shovel coal or use stoker, pull injector to add water, manage blower, shake grates as needed
    - Beware of over or under firing, or over-shaking grates.
  - Fill tender with water and treat water if needed
    - Night watch can consume a ton or more coal and a few thousand gallons of water
  - Clean ashpan and dump ash before operation starts
  - Night supervisor starts compressors and dynamos
  - A qualified hostler may come on before road crew to move locomotive to coal pile and couple to train

Night Watch Crew

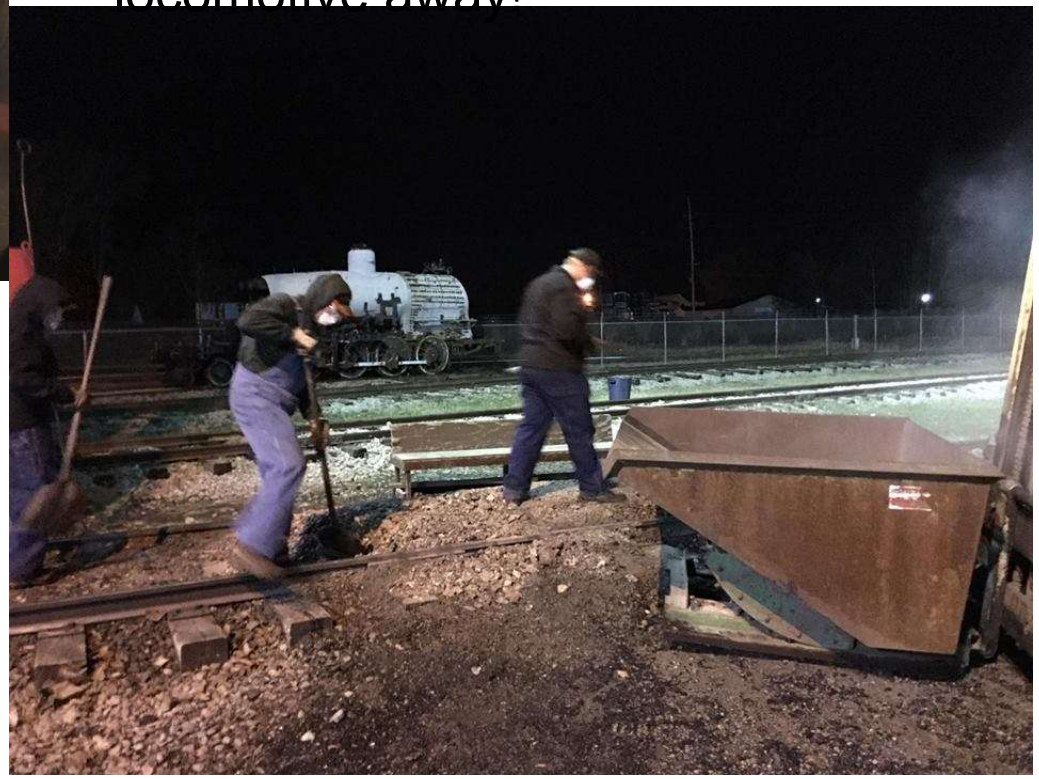
- Depending on operating schedule, servicing of locomotive and train may be done at night by maintenance crew
  - Grease, oil, lubricators, light repairs

After service complete.....

Night Servicing Crew

After Operations Complete

- Break up train and switch cars to storage tracks
- Dump fire on ash track
- Fire is not blazing hot – locomotive has been “idling” when unloading and switching cars
- But, need enough steam to put locomotive away!



- Clean ash track for final time
  - Normally cleaned after each dumping
- Hopper is moved with forklift to ash pile for dumping and later disposal.

Why We Do This

It's not just to look cool....

Travel by Rail Once was the Norm. Now it is the Exception

The Best Way to Understand History is to See, Hear, Feel, and Experience It

“Hands On Teaching” of Our Youth Connecting Past with the Present

Train Festivals & Other Events Attract Great Crowds & Can Be Significant to the Local Economy

2014 Governor's Award for Historic Preservation … May 7, 2014

Pere Marquette No1225
75th Birthday Celebration
Clare, Michigan November 5, 2016

SRI's Newest Project: Chicago & North Western 175

Built in 1908 by American Locomotive (ALCO), Schenectady, NY

4-6-0 "Ten-Wheeler" wheel arrangement, part of largest class of locomotives built for CNW

Hauled both Freight and Passengers, including on the CNW's UP lines

Powered the last CNW "Farewell to Steam" trip Sept. 9, 1957

Sold to historical societies & preserved for excursion service (although it never returned to service)

Now being restored by SRI

STEAM RAILROADING INSTITUTE

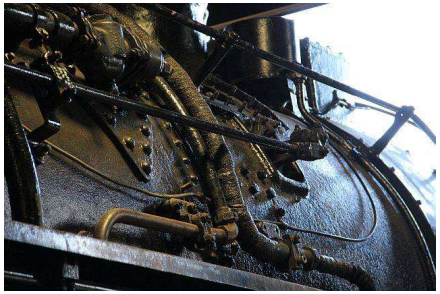
North Pole Express

Weekend Before Thanksgiving - Weekend Before Christmas

Call for Volunteers!
All Aboard!

Join SRI for Model Railroading in 1:1 Scale!

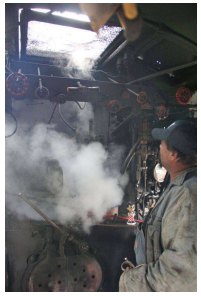
Our locomotive, rolling stock and facilities feature:



Finely detailed locomotive with separately applied details!

Working cut levers and underbody detail!

Flickering firebox lighting effects!



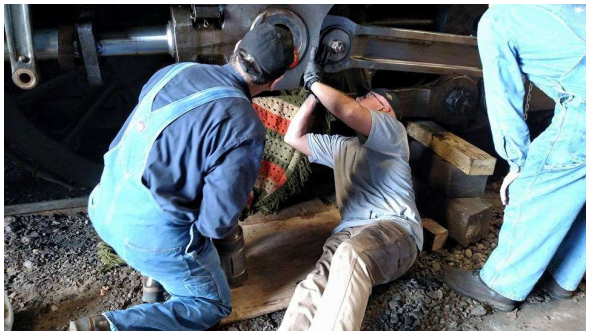
Detailed backhead and cab interior!

Working smoke unit!

Operating turntable

Prototypically correct <u>custom</u> paint, lettering and interior details on rolling stock!

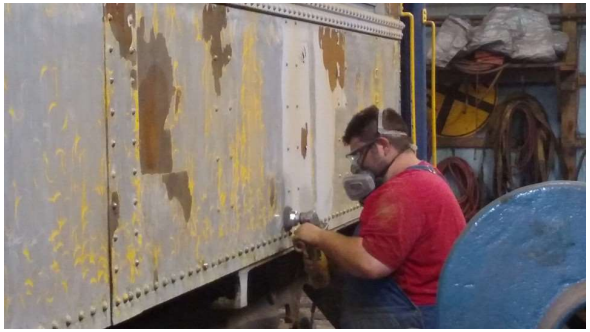
Use your modeling skills with us!



Assemble running gear!

Lube the running gear!

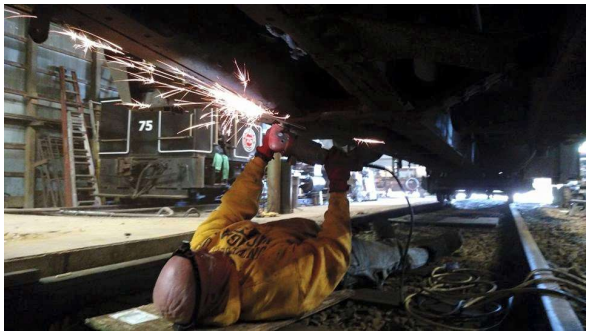
Replace plastic wheels with new metal wheelsets!



Strip off factory paint!

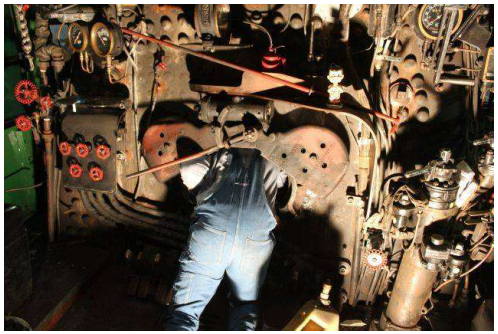
Hide seams with modeling putty!

Scratchbuild detail parts!



Remove bulky cast on details!

Handlay track!



Replace the flickering firebox lightbulb!!

And participate in our operating sessions!!!

Questions and Wrap-up