Lima Locomotive Works Inc.

2-8-0 “Consolidation” Type Steam Locomotive

Class 280-157

developed for Train Simulator 2013

by Smokebox

Version 1.0

Thank you for purchasing this model of the Lima 2-8-0 Consolidation type steam locomotive!

The model has been some nine months in the making, work having started in May 2012. It has taken this long because the amount of detail in the model is exceptionally high. A great deal of attention has been paid to attempting to recreate the look and feel of an early 20th century steam locomotive from the United States, both in the exterior model as well as in cab view. I hope I’ve achieved that.

Contents

Some information about the prototype

“Consolidation” is the type name given to American steam locomotives with a 2-8-0 wheel arrangement.

This particular Consolidation represents the Class 280-157, built in 1920 by Lima Locomotive Works Inc., in Lima, Ohio, U.S.A., for the Alabama, Tennessee and Northern (ATN).

The AT&N was a freight line operating between Mobile and Reform, Alabama with about 214 miles of track. It was purchased by the Frisco in December 1948.

http://en.wikipedia.org/wiki/Alabama,_Tennessee_and_Northern_Railroad

There isn’t a lot of information on the internet about this locomotive. It appears that only five were built, nos. 202 to 205 between 1920 and 1921, and then number 250 in 1925. The last one was actually built by Baldwin, to the Lima design but with piston valves instead of slide valves.

#202 was sold on to the Frankfort & Cincinnati, renumbered as #15.

#204 was sold on to the East Tennessee and Western North Carolina Railroad (ETWNC), keeping its original number. A section of the “Tweetsie” still exists today as the East Tennessee Railway.

Here are links to two excellent photos, of numbers 202 (date unknown) and 204 (taken in 1936).

http://frisco.demopolis.ws/atn_202_1.htm

http://digital.denverlibrary.org/cdm/singleitem/collection/p15330coll22/id/50718/rec/14

You might notice that there are subtle differences between nos. 202 and 204, such as the position of the headlight and the font used for the lettering and numbering. The model I’ve made is more similar to engine number 204 in that respect.

Features of this model

Detailed, highly authentic visual model

The model has many details that can be seen in both the exterior and cab views. In fact, everything you see in cab view can also be seen in the exterior views. Even the movement of the controls is the same in both views.

Many of the parts have been built using Lima's original 1/8th scale drawings and are accurate to within 1/64th of an inch. However, for some parts, in particular the cab elements, scale drawings are unavailable. In those cases, the elements have been created from other reference material, such as photos or period manuals.

Detailed controls and gauges

The cab includes the typical controls that are to be found in a steam locomotive, such as the regulator, reverser, cylinder cocks lever, blower, damper, injectors, air brakes, sander, steam throttles, light switches, etc.

The gauges are suitable for the period (late 19th, early 20th century) and provide indications for the braking system (air pressures in the main and equalizing reservoirs, and in the brake pipe and cylinders), the steam pressures in the boiler and steam chest, and there is a speedometer.

The cab doors and windows all open and close, as well as the ventilator hatch in the roof and the storm window in the right-hand cab door.

The loco has an electric DC generator (Pyle National) and a steam-driven cross-compound air compressor (Westinghouse). Both can be started and stopped from the cab, via the corresponding steam throttles, and have realistic sounds. The compressor also has a drain cock that can be opened and closed with a keyboard command.

All the controls can be operated with the mouse and have mouse-over labels. Most controls also have key assignments and can therefore be operated in both exterior and cab views (in fact, the only exception is the hydrostatic oil lubricator, which has to be operated with the mouse from within the cab view).

There are working air-operated firebox butterfly doors with both a foot pedal (to control the automatic stoking rate in manual firing mode) and a hand lever (for manually opening the firebox doors).

Different strokes for different folks

The loco is designed to be run in expert mode, with or without automatic fireman. For the best sense of immersion, it’s recommended to drive in expert mode without the automatic fireman.

However, the standard model, with its sophisticated scripting for things like the pick-up injectors, throttle retard and so on, renders it unable to be driven from the F4 HUD or Xbox controller. So, for those who prefer to drive using either of those methods, I’ve provided another version of the loco that uses alternative scripting which allows you to drive the loco using those means of control. This version also automates the activation of cab controls that have no corresponding button or lever in the HUD or on the controller, such as the various steam throttles (generator, compressor, blower, injectors). It also limits some of the other functions, such as only allowing the headlights to be off or on (bright) but not dimmed, or automatically selecting the correct sanders (front or back) depending on the direction of travel when the sander “button” is pressed. This version of the loco is identified with the suffix “HUD” in the selection menu.

All versions of the loco can be driven with the automatic fireman enabled. However, there is one important drawback to using the automatic fireman – he’s very inept. There was only one way to give the loco the ability to climb a steep grade (1.8%) with auto-firing as easily as it can when firing manually, and that was to give it double the horsepower and double the starting tractive effort. That´s what has been done with the HUD version, under the assumption that if you drive with the HUD, you’re probably going to want to drive with the automatic fireman too.

One more thing to mention about the automatic fireman is that the boiler pressure will never go below 65% of the maximum, that is 65% of 180psi, which is 117psi. That further compensates for his lack of skill.

Nevertheless, you can drive the HUD version with manual firing, using the controls on the HUD or Xbox controller, and you’ll see that it then has quite sparkling (although, frankly, unrealistic) performance! It’s fun though ☺

Detailed animations

The cab includes a detailed hydrostatic lubricator with working controls and animated oil droplets that can be seen rising, through the four sight glasses, when the lubricator is switched on.

The cylinder cocks are fully animated, from the lever in the cab, through the linkage, all the way to the slotted rod beneath the cocks. Next time you open the cylinder cocks, try doing it with the keyboard while watching, in outside view (F8), the control mechanism near the cylinders (go up close to see it).

The Walschaert’s gear is almost fully animated, as well as the reversing mechanism, including reverse rods, tumbler shaft, lifting links, radius rods, etc. Moving the reverser in the cab also moves

the mechanism all the way to the lifting links. However, due to the limitations of what can be done in a model, the lifting links are disconnected from the radius rods. Otherwise it would have been necessary to make a separate animation for every position of the reverser, because the radius rod would be lifted to a different position. Instead, it has been animated for the fully forward position.

The bell is animated (operated from a valve in the cab).

The coal level in the tender is animated.

All controls are animated, in both exterior and cab views, with the positions fully synchronized between both views. This includes the doors, windows and ventilator.

Rain, and smoke and steam particle effects

All windows except for those at the rear of the cab (protected by an overhang) have rain effects.

Steam is emitted from the cylinder cocks when they are open (but only if the regulator is not fully closed). The steam alternates between the front and rear cylinder cocks, synchronized (approximately) with the speed of the locomotive.

Steam is also emitted from the electric generator, air compressor exhaust, air compressor drain cock, cylinder relief valves (only when the regulator is fully closed), blow-down (safety pop-up) valves, whistle and even the injector overflow pipes (if an injector is actuated with the water valve closed). Water comes out of the overflow pipes when the injector water valves are open and the injector isn’t yet injecting.

The colour of the smoke coming from the stack gets darker as the tractive effort increases. The density of the smoke depends on the settings of regulator, reverser (cut-off) and blower.

Sand can be seen coming out from the sanders, near either the front or rear driving wheels, depending on the position of the lever in the cab.

Sounds

Most controls have associated sounds, even the doors and windows.

You can blow the whistle by pulling the cord in the cab.

Wheel slip sound is included.

For the most immersive sounds, especially in the cab, it’s recommended to drive always with the electric generator and cross compound air compressor running.

Lights

The locomotive has a headlight with two intensities, dim or bright, which can be selected using the keyboard or the control in the cab. When bright is selected, the headlight beam illuminates well ahead of the loco. In fact, it’s been tested to comply with regulations that state:

> Required illumination.
>
> (a) General provisions. Each steam locomotive used between sunset and sunrise shall be equipped with an operable headlight that provides illumination sufficient for a steam locomotive engineer in the cab to see, in a clear atmosphere, a dark object as large as a man of average size standing at least 800 feet ahead and in front of such headlight. If a steam locomotive is regularly required to run backward for any portion of its trip other than to pick up a detached portion of its train or to make terminal movements, it shall also be equipped on its rear end with an operable headlight that is capable of providing the illumination described in this paragraph (a).
>
> (b) Dimming device. Such headlights shall be provided with a device whereby the light from same may be diminished in yards and at stations or when meeting trains.

The tender also has a headlight that can be set to dim or bright, independently of the locomotive headlight. However, be aware that once the tender is coupled to a consist, it no longer obeys the headlight commands (they get sent instead to the rear of the train), so before coupling up, switch off the tender headlight.

The locomotive also has two 3-colour classification lights. These have to be switched on with the keyboard command (U or shift U). The colours and their meanings are:

- White - an “extra” unscheduled, i.e. not in the timetable, train;
- Red - the loco is at the rear of the train;
- Green - the train is part of a timetabled service that has been split into several consists, or sections, and another section is following behind it.

Note that the lights will not illuminate if the electric DC generator is not running.

Dynamically customizable detail level

To help in situations where an increase in FPS might be needed (for example, in busy yards), the details in the exterior model such as rivets, nuts and bolts, the details in the cab (as seen from the outside views), and the shadows cast by the cab lights, can all be toggled off and on.

Auto-numbering

The locomotive and tender have 3-digit auto-numbering, in the range 000 to 999.

Special scripting for added realism

The model has been scripted to simulate a limited amount of sand in each sandbox (sand dome), enough for about 2 hours of continuous operation. In addition, the script differentiates between the forward and rear sanders (the lever has three positions), and the sand helps traction only when traveling in the corresponding direction.

The operation of the regulator lever simulates the lag that occurs between moving the lever and seeing the effect on the speed, due to the time taken for the steam to get from the throttle in the steam dome (on top of the boiler) to the cylinders at the front of the locomotive. You can also see this in the F5 HUD. When you move the regulator in the cab, there is a delay of about one second before the corresponding value changes in the HUD.

The pick-up injectors are scripted to simulate pick-up failure if they aren’t operated correctly – there’s more about that further on.

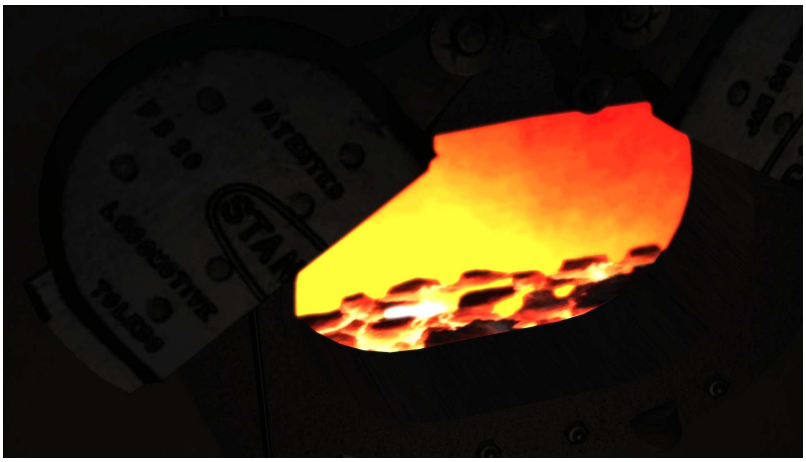
The safety valves (blow-down valves) are scripted to lift at 178.8psi. They close again when the boiler pressure drops to 175psi.

There is a lot of scripting to manage the electric generator and the various lights, which don’t illuminate if the generator isn’t running.

The compressor has to be activated (with its steam throttle) or else the air brake system will run out of main reservoir pressure.

The action of the cylinder cocks steam emitters is scripted to take account of there being two cylinder cocks per cylinder, one for the forward stroke and another for the backward stroke. The script controls the steam emission, alternating between the forward and rear cylinder cocks, synchronized with the rotation of the drivers (although it’s not guaranteed to be 100% synchronized at all times, because of limitations of the simulation).

If you open the firebox doors, you’ll see flickering flames and glowing lumps of coal. The level of the coal rises as more is shoveled onto the grate. To see if you have the ideal amount of coal on the fire, all you need to do is open the butterfly doors to look at the coal level, which I believe contributes to the overall sense of immersion in the simulation.



This is how the “ideal” fire mass (650lbs) looks.

Quick Drive consists

Several freight consists, using rolling stock from the Horseshoe Curve route DLC, and light engines are provided for selecting from the Quick Drive menu.

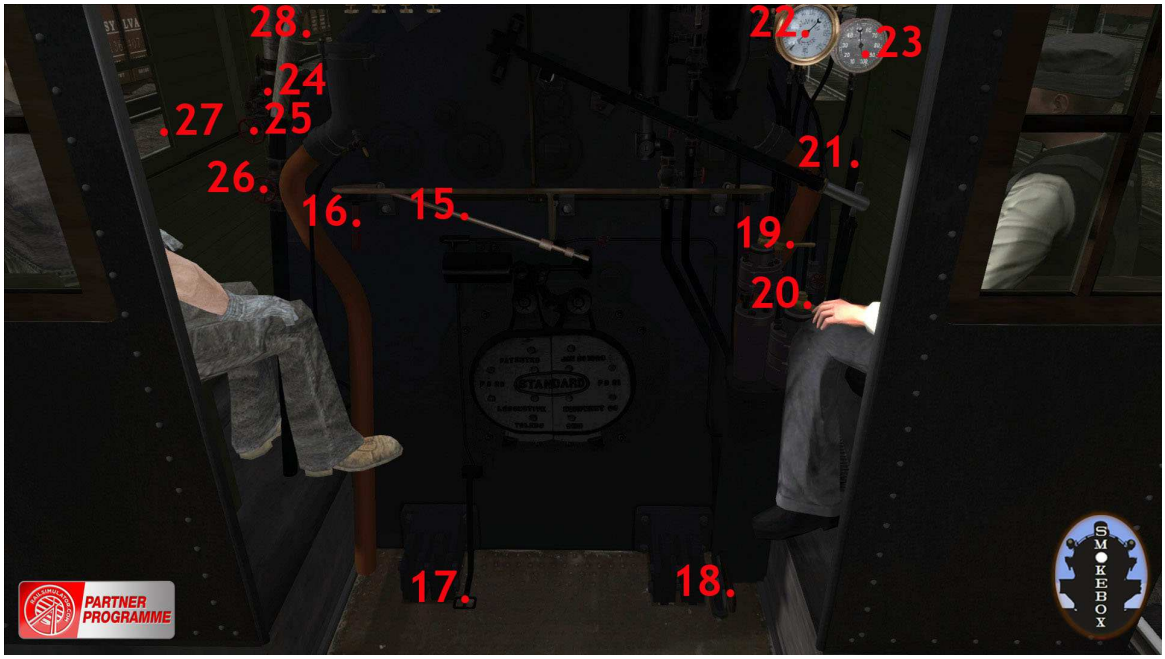
If you’re going to use the F4 HUD to run the train, remember to pick the locomotive (and tender) with “HUD” at the end of the name.

Positions of the controls and gauges in the cab

The diagrams below show the positions of the cab controls (all can be operated by dragging or clicking with the mouse) and gauges (or gages, if you prefer).

1. Hydrostatic oil lubricator steam throttle
2. Hydrostatic oil lubricator main valve (condensing chamber)
3. Hydrostatic oil lubricator feed control (shown here in “Closed” position)
4. Exhaust injector steam throttle
5. Blower steam throttle
6. Compressor steam throttle
7. Generator steam throttle
8. Water level sight gauge
9. Gauge light switch (press Ctrl-Shift-S to turn off shadows, if desired)
10. Whistle cord
11. Locomotive headlight selector switch
12. Tender headlight selector switch

13. Regulator
14. Cab light (press Ctrl-Shift-S to turn off shadows, if desired)



15. Firebox doors lever (push down to open)
16. Sander lever (three positions: up or down to apply sand from, respectively, the forward sandbox or rear sandbox, and centre to turn off both sanders)
17. Firebox doors foot pedal (drag downwards to increase stoking rate, upwards to decrease)
18. Damper door lever (pull upwards to open)
19. Independent (engine) brake (left to release, right to apply)
20. Train brake (from left to right: release, hold, apply, emergency)
21. Johnson bar (reverser)
22. Brake system air reservoirs dual-needle gauge (red hand for main reservoir, black hand for equalizing reservoir)
23. Speedometer (MPH)
24. Exhaust injector lever (to ram water, heated and accelerated by exhaust steam, at high velocity into the boiler)
25. Exhaust injector water valve (to allow water from the tender to enter the injector)
26. Blower control valve

27. Fireman’s cab side window

28. Fireman’s cab door

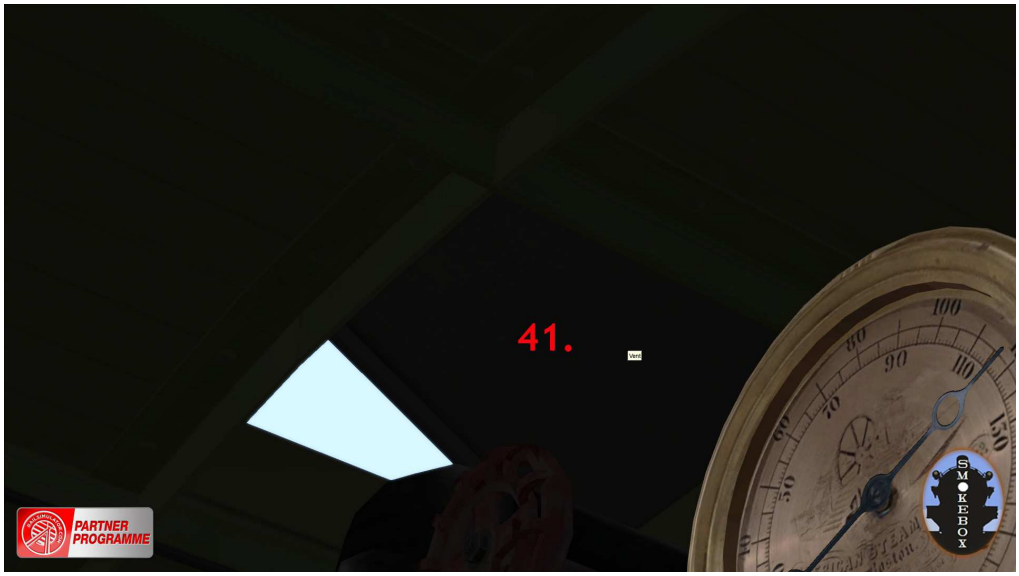
29. Air-operated automatic bell

30. Cylinder cocks lever (pull to open, push to close)

31. Boiler steam pressure gauge

32. Independent brake pressure gauge
33. Steam chest pressure gauge
34. Train brake dual needle gauge (red: cylinder pressure; black: brake pipe pressure)
35. Engineer’s cab side window

36. Live injector steam throttle
37. Live injector lever (to ram water, heated and accelerated by live steam from the boiler, at high velocity into the boiler)
38. Live injector water valve (to allow water from the tender to enter the injector)
39. Storm window (drag upwards to open)
40. Engineer’s cab door



41. Roof ventilator (drag upwards to open, down to close)

Key assignments

Item	Key	Action	Remarks
Regulator	A	Increase	
	D	Decrease	
Reverser (Johnson Bar)	W	Forwards	The is a one second lag between moving the lever and it having an effect on the locomotive (this happens when the throttle is located in the steam dome).
	S	Reverse (“Hook up”)	
Classification Lights	U	Off → White → Red → Green	There is no corresponding cab control. That is because in the real loco, the light was controlled by a lever under its casing.
	Shift U	Green → Red → White → Off	
Headlight	Y	Bright → Off → Dim	
	Shift Y	Dim → Off → Bright	
Tail Light	H	Bright → Off → Dim	When the tender is coupled to a consist, its head light cannot be controlled - the H key instead controls the tail light at the rear of the consist. The tender light will remain in the state it was in just before coupling. If you don’t want the tender light to be lit while coupled to a consist, make sure you switch it off before coupling.
	Shift H	Dim → Off → Bright	

Item	Key	Action	Remarks
Cab Light	minus	On	
	Shift minus	Off	
Gauge Light	=	On	
	Shift =	Off	
Dynamic Cab Shadows	Ctrl Shift S	Toggle on/off	Switching off the shadows cast by the cab and gauge lights can be useful as a means of gaining some extra fps when needed.
Rate of Stoking (Manual Firing Mode)	R	Increase	The butterfly doors will open and close automatically at a rate directly related to the rate of stoking. Coal is shoveled into the firebox whenever the butterfly doors are fully open.
	Shift R	Decrease	
Firebox Doors	F	Open	It is possible, but not recommended, to open the firebox doors manually at the same time as they are opening and closing when the rate of stoking is > 0. However, it can sometimes cause them to get stuck. If that happens, just reduce the stoking rate to zero, close the doors, and then increase the stoking rate again.
	Shift F	Close	
Engine (Independent) Air Brake	Right square bracket ( ])	Increase	
	Left square bracket ([ )	Decrease	
Train Air Brake	Apostrophe	Increase	Four positions: Release, Hold (Running), Apply and Emergency.
	Semicolon	Decrease	
Cylinder Cocks	C	Open	Steam will be expelled from the cylinder cocks only when they are open AND the regulator is not fully closed.
	Shift C	Close	
Steam-driven Cross Compound Air Compressor, Drain Cock	Ctrl V	Toggle open/ closed	
Steam-driven Cross Compound Air Compressor, Steam Throttle	V	Open	Opening the steam throttle starts the compressor and closing the throttle stops it.
	Shift V	Close	
Pyle National Electric DC Generator, Steam Throttle	Ctrl Shift G	Toggle on/off	The generator supplies electricity to all the lights. So, if the generator is stopped, the lights will be extinguished.
Cab Windows	comma	Open	

Item	Key	Action	Remarks
(LHS)	Shift comma	Close	
Cab Windows (RHS)	period	Open	
	Shift period	Close	
Roof ventilator hatch	T	Close	The ventilator hatch is open by default
	Shift T	Open	
Cab Door (LHS)	Home	Open	
	Shift Home	Close	
Cab Door (RHS)	End	Open	
	Shift End	Close	
Storm Window (RHS)	Pg Up	Open	The storm window allows the engineer a clearer view ahead when the door is closed and it’s raining.
	Shift Pg Up	Close	
Live Injector Steam Throttle	Shift 9	Open	Allows steam into the injector. The injector lever (see below) has no effect if the steam throttle is closed.
	Ctrl 9	Close	
Live Injector Water Valve	L	Open	Admits water from the tender into the injector.
	Shift-L	Close	
Live Injector Lever	O	Toggles Open/Closed	When opened, admits steam into the injector’s Venturi cone so as to pick up the water, heating it up and ramming it into the boiler.
Exhaust Injector Steam Throttle	Shift 8	Open	Allows steam into the injector. The injector lever (see below) is useless if the steam throttle is closed.
	Ctrl 8	Close	
Exhaust Injector Water Valve	K	Open	Admits water from the tender into the injector.
	Shift-K	Close	
Exhaust Injector Lever	I	Toggles Open/Closed	When opened, admits steam into the Venturi injector cone so as to pick up the water, heating it up and ramming it into the boiler.
Blower Steam Throttle	E	Open	Controls the steam throttle valve on the pipe leading from the boiler’s steam turret to the blower valve.
	Shift E	Close	
Blower	N	Increase	Increasing the blower helps to generate steam more quickly, although it also uses steam. The blower must also be turned on before entering a tunnel, to ensure sufficient draught to draw the fire away from the firebox opening in the cab, preventing a fatal blowback.
	Shift N	Decrease	
Damper	M	Open	The damper door is opened, feeding more air to the fire, when the lever on the floor, to the left of the engineer’s seat, is pulled upwards. Open corresponds to “On” in the F5 HUD.
	Shift M	Close	
Sander	X	Lift up	The centre position turns off both sanders. Fully up turns on the front sanders. Fully down turns on the rear sanders.
	Shift X	Push down	
Whistle	Spacebar	Pull handle	Note that the whistle handle is not released just by letting go of the spacebar. It’s an implementation specific to this loco.
	Shift Spacebar	Release handle	

Item	Key	Action	Remarks
Bell	B	Toggle on/off	The standard way to operate the bell from the keyboard.
Bell Air Valve	Shift B	Open	The valve for the air-operated bell piston is an alternative way of actuating the bell. The valve is a visible control in the cab.
	Ctrl B	Close	
Dynamic Detail Level	Ctrl Shift 1	Toggle detail on/off	Switching off some of the model´s detail can be useful as a means of gaining some extra fps when needed.

There are no key assignments for the **hydrostatic lubricator**. It is operated using only the mouse to open/close the corresponding valves in the cab.

What to do to after entering the cab for the first time

Before setting off down the track, there are several things to do. Note that valves are opened by turning them anti-clockwise. Here’s the checklist:

1. **When you first click on the locomotive in Free Roam, the train brakes are automatically moved to the 75% position (“apply”) and the independent brake is set to 100% (“full”). This is to stop the train from rolling away on an incline. You’ll hear the hissing of the train brakes being applied. To avoid losing too much air pressure, you should immediately move the train brake lever to the “hold” position (about 35%, where the hissing sound stops).**
2. If it’s not raining, open the doors, windows and roof ventilator;
3. Start the hydrostatic lubricator and check that you can see the oil droplets rising in the sight windows;
4. Check the water level in the boiler – the red ball should be near the top of the glass sight gauge;
5. Start the Cross Compound Air Compressor and check that you have 120psi in the main reservoir;
6. You can also open the compressor’s drain cock for a minute to drain out the condensation from its steam cylinders (Ctrl-V to toggle it on and off);
7. Start the Electric DC Generator;
8. Select the color of the classification lights, as appropriate (press U or Shift-U as many times as needed);

9. Switch on the headlights (dim or bright, as appropriate);
10. If it’s dark, switch on the gauge light and cab light;
11. Open the steam throttles for the exhaust and live injectors, and for the blower;
12. Turn on the blower a little bit, to maintain a draft from the firebox through to the smokebox while the loco is stationary;
13. Open the damper doors slightly (raise the saw-toothed bar in the floor)
14. Open the cylinder cocks (pull the small lever in the floor, near the door on the engineer’s side, towards you);
15. Crack open the regulator slightly – you should now see steam coming out of the cylinder cocks (in the real world, this helps to warm the cylinders and to expel any water that might have condensed in them while the loco was stationary) and the steam from the cylinder relief valves will stop;
16. If firing manually in expert mode, set the stoking rate (pull down momentarily on the firebox doors floor pedal) – the ideal fire mass is 650lbs (idle is 600lbs);
17. Turn on the sanders (move one of the red levers up or down for, respectively, forward or rear sanders);
18. Turn on the bell, if required, by opening the air valve;
19. Push the Johnson bar (the reverser) all the way forward (“into the corner”);
20. Blow the whistle (two blasts);
21. Release the train brake (turn it to the left) and then put it in the “running” position (where it doesn’t make any sound, or just a faint hiss);
22. Release the independent brake (turn it all the way to the left);
23. Open the regulator further to gather speed, but slack off if you hear the wheels slipping;
24. Close the cylinder cocks after about twenty seconds or three full revolutions of the driving wheels (12 chuffs);
25. As the steam chest pressure rises and gets nearly as high as the boiler pressure, pull the Johnson bar a bit closer to you (this is like changing gear in a car before you redline the revs, to be able to go faster);
26. Turn off the sanders (unless you still need sand because of conditions);

27. Once out of the station area, turn off the bell. Rules and regulations require that the bell be sounded before a locomotive begins to move, as well as in congested areas, like yards, that have no public crossing. The bell is also used when approaching an area where there are likely to be members of the public or other employees around the tracks, like stations or industrial spurs. Trains passing other standing trains on sidings will also use the bell to let any workers on the ground know that the train is continuing on the main. In addition, there are a lot of traditional uses for the bell, like a courtesy signal when a train on the main is passing a rail yard or large industry.

How to operate the injectors in expert mode when firing manually

This model includes one extra control for each injector – the steam throttle. It’s a valve on the pipe that carries steam from the boiler’s steam turret down to the injector. The throttle is closed by default and has to be opened before using the injector. You can leave it open while running the loco.

You also need to be aware that the water valve and the injector lever have to be operated in the correct order (and assuming that the steam throttle is already open):

1. Open the water valve. You’ll see water coming out of the overflow pipe under the cab, which is perfectly normal;
2. Pull the injector lever towards you;
3. Check the level of water by looking at the sight gauge (or check it with the F5 HUD). Try to avoid going higher than 1.0 to prevent priming;
4. Push the injector lever away from you;
5. Close the water valve.

If you pull the lever while the water valve is closed, steam will be emitted from the overflow pipe under the cab, and no water will go into the boiler.

If you pull the lever and then open the water valve, the injector will fail to “pick up”, and no water will go into the boiler. You’ll see water coming out of the overflow pipe under the cab. To reset and try again, simply push the lever forwards, close the water valve and then follow steps 1 to 5 in the correct order.

How to operate the hydrostatic oil lubricator

Inside the cab, there is a hydrostatic oil lubricator mounted on the top left hand side of the boiler back face. This supplies oil to the cylinders and valve gear. In the model, the running of the engine is not affected at all by the lubrication, but the lubricator does have a visual effect – if you turn it on and then look closely (zoom in) at the four sight windows, you’ll be able to see the oil droplets rising up as the steam condenses and the water pushes the oil to the top.

Activating the lubricator is simple:

1. Turn on the lubricator’s steam throttle (rotate the valve cock anti-clockwise);
2. Turn on the lubricator’s main valve, located at the top of the condensing chamber (rotate the valve cock anti-clockwise);
3. Set the lubricator’s oil control valve to the “All Open” position (rotate the bottom lever 180 degrees so that the handle is at the top).

Some notes on the simulation of the air brakes

The operation of the locomotive air brakes is modeled and simulated fairly accurately, with a few unavoidable exceptions. While it hasn’t been possible to simulate the bail-off position of the independent brakes (“bailing off the air”), nor the real-world operation of the emergency brakes (which would leave the brakes unable to be released for at least two minutes), it has been possible to simulate the following:

- When the train brakes are applied, air from the main reservoir is used to raise the pressure in the brake pipe (or train line). This causes a drop in the main reservoir (MR) pressure, which starts at 120psi. When the MR pressure falls to 110psi, the steam-driven air compressor is switched on (in real life by a single-head governor) and you can hear it cycling (pumping) as it raises the MR pressure up to 120psi again, then it stops.
- The compressor throttle has to be opened for the compressor to work. If you forget to open it, you’ll see the MR pressure falling below 110psi, as you repeatedly apply the brakes, and eventually you’ll have no brakes!

- “Pissing away your air”! This is a term used to describe what happens when a novice engineer applies and releases the brakes rapidly several times in succession, such as when going down a hill. It is simulated in this model. Try it!

  To understand this, you must first understand that the brakes are applied by lowering the pressure in the train’s brake pipe (in simple terms, by letting air out of the pipe through a hole in the brake control stand) and the brakes are released by pumping compressed air into the train’s brake pipe (again, via the train brake control in the cab) until the pressure in the brake pipe is higher than in the auxiliary air brake reservoirs under each car (these are normally pressurized to 90psi).

  When the brakes are applied, the brake pipe (train line) pressure drops. When it falls below the pressure in the auxiliary air brake reservoirs of each car, the brakes are applied on the cars by means of pressurized air (from those auxiliary reservoirs) going into the cars’ brake cylinders. However, that in turn means that the pressure in the auxiliary reservoirs drops.

  The cars´ auxiliary reservoirs are recharged with air from the brake pipe (which comes from the locomotive) when the train brake handle is in the running or release position, but it takes time, especially on a long train. If the engineer has not left the handle in running or release for sufficient time before again applying the brakes (making a “service application”), the auxiliary reservoirs might not yet have recharged to their nominal 90psi pressure. That leads to two effects: first, the brake pipe pressure has to drop even further before it is lower than the pressure in the auxiliary reservoirs, so it takes longer for the brakes to come on, and secondly, when the brakes do come on, they do so with less force because the pressure in the brake cylinders, which comes from the auxiliary reservoirs, is lower.

  The more often the engineer does this, without giving the auxiliary reservoirs a chance to recharge, the worse it gets, until eventually there is hardly enough pressure left in the reservoirs to feed the brake cylinders and apply the brakes. At that point, the engineer has “pissed away his air” and could have a runaway train on his hands.

  Fortunately, he might still be able to stop with the emergency brakes, using air from the emergency air reservoirs under each car.

  The lesson is, try to avoid applying, releasing, applying, releasing the brakes rapidly, and after releasing the brakes, leave the handle in the “running” position, to keep recharging the brake line. A good way to release the brakes smoothly (and slowly) is to put the handle in “running” rather than “release”.

Scenarios

The package includes several Free Roam and Standard scenarios for the Horseshoe Curve (HSC) route, available on Steam as a separate DLC.

Apart from the HSC route and its included assets, the scenarios don’t require any other DLC.

You should begin with the extended tutorial. This starts in one of the smaller yards in Johnstown, where you first pick up two flat cars and a caboose. Further along, you build up a larger consist that has to be taken to South Fork, but only after refueling in Johnstown. The scenario is more than one hour in duration but it does give a useful explanation of how to operate the locomotive while at the same time being fun to play, combining various switching activities with a high speed (35mph is quite high speed for the Consolidation!) run to let the loco stretch her legs a bit.

Note that, apart from the expert tutorial scenario, there are two versions of each scenario. When the scenario uses a loco made to be run in expert mode without the HUD or Xbox controller, in order to have access to the complete set of controls, it is prefixed “[Lima 2-8-0]”, otherwise it is prefixed with “[Lima 2-8-0] (HUD)”.

In all the scenarios, the locomotive can be run with the automatic fireman enabled or disabled, as you prefer.

❖ Standard Scenarios

- **[Lima 2-8-0] Extended Tutorial for Expert Mode – Freight to South Fork**

  Move some freight from Johnstown to South Fork, while learning how to operate this 1920 steam locomotive.

  Duration : 60 mins
  Difficulty : * * *
  Weather : HSC Cloudy
  Season : Autumn
  Start Time: 06h00

- **[Lima 2-8-0] Slippery Slope**
  [Lima 2-8-0] (HUD) Slippery Slope

  December 1953, the ground is covered in snow, and a trainload of boxes needs to be delivered to Cresson.

Duration : 100 mins
Difficulty : * * *
Weather : HSC Blizzard
Season : Winter
Start Time: 03h00

- **[Lima 2-8-0] Consolidating Power**
  [Lima 2-8-0] (HUD) Consolidating Power

  An unexpected surge in power consumption means an extra load of coal needs to be delivered to Johnstown.

  Duration : 120 mins
  Difficulty : * *
  Weather : Cloudy Showers
  Season : Spring
  Start Time: 09h00

❖ Free Roam Scenarios

- **[Lima 2-8-0] Free Roam at Cresson**
  [Lima 2-8-0] (HUD) Free Roam at Cresson

  Two steam-hauled freight trains are paused opposite each other at Cresson. Choose one, for the run East to Altoona or West to Johnstown.

  Weather : HSC Cloudy
  Season : Spring
  Start Time: 16h00

- **[Lima 2-8-0] Free Roam at Johnstown**
  [Lima 2-8-0] (HUD) Free Roam at Johnstown

  Engine #205 is sitting at Johnstown, almost ready to go, but with only 50% fuel and water in the tender. So, before going anywhere, you might want to fill up first.

  Weather : Clear
  Season : Summer
  Start Time: 11h00

Pop-up text from the extended tutorial scenario

1. Welcome to this extended tutorial on the Consolidation Class 280-157, built originally by the Lima Locomotive Works Inc in Lima, Ohio, and brought to TS2013 by Smokebox. Let's climb up into the cab ("1" key).

2. The text of the pop-ups that appear during the tutorial can also be found in the manual (Smokebox Lima 2-8-0 Consolidation Manual.pdf which is in your railworks/Manuals/EN folder).

3. Let's ventilate the cab. To open and close the doors, mouse drag or use the (Shift-)"Home" and (Shift-)"End" keys. To open and close the windows, mouse drag or use the (Shift-) "," and (Shift-) "." keys. You can also raise and lower the vent in the roof by dragging with the mouse or pressing the (Shift-)"T" key. The storm window in the middle of the engineer's cab door can also be opened and closed with the mouse or using the (Shift-)"Page Up" key.

4. Move over to the fireman's position (left arrow) where you can see the hydrostatic oil lubricator more easily. Find the lubricator's steam throttle and rotate it anti-clockwise. Then do the same with the valve at the top of the lubricator. Finally, rotate the handle at the bottom of the lubricator into the All Open position (handle pointing upwards). Then zoom in to look at the sight windows and check that you can see the oil droplets rising.

5. Switch on the air compressor and the generator by turning the steam throttle valves located above the boiler. Then turn on the cab light (click on the bulb holder hanging in the middle of the cab, or use the "-" key) and put the forward headlight on dim. The switches for the headlight and tender light are above you on the right. You can also use (Shift-)"Y" for the headlight and (Shift-)"H" for the tender light.

6. The classification lights can be set using (Shift-)"U" repeatedly to choose between off, white, red and green. At night you would also turn on the gauge light with the toggle switch to your left (or press the "=" key).

7. If you prefer a cab light that doesn't cast shadows, press CTRL-SHIFT-S to toggle them off. This is useful too if you need some more fps.

8. Apply the independent brakes fully (the brass handle furthest from you, turn it all the way to the right). Open the steam throttles for the blower and injectors. If you're not sure which valves to turn, just mouse over them and you'll soon see what's what.

9. When you're ready, open the cylinder cocks (pull that small lever, the one in the floor in front of you, backwards all the way). Then open the regulator just a bit to let some steam into the cylinders to warm them up and to start clearing out any accumulated water. Also

put the Johnson bar (the reverser) "in the corner" (all the way forward) by mouse dragging or pressing the "W" key.

10. You can turn on the bell by opening the small red valve near your left knee (mouse drag or "B" key). The whistle cord is above you. You can pull it up and down with the mouse, or use the spacebar. See if you can "quill" the chimes.

11. If you don't have the automatic fireman on, you can set the stoking rate manually now. Either hit "R" or put the mouse on the floor pedal and drag down a little bit. The more you drag, or the more often you do it, the higher the stoking rate. The doors will then open and close automatically. Reduce the stoking rate by dragging upwards on the foot pedal.

12. Notice that the mouse doesn't actually move the pedal - it moves when the doors open and close. You can also open the firebox doors yourself using the lever above them. The fireman will shovel in coal for as long as the doors are fully open.

13. Set the track switches ready to move forwards. First we're going to pick up the two flat cars in siding 2, just to your left.

14. To move off, release the independent brakes, then with a little bit of regulator she'll start moving. Remember to set the headlights and tender lights depending on which way you're moving. NOTE: Switch off the tender light BEFORE coupling a consist onto the tender.

15. *(After picking up at Johnstown Siding 2)* Now that you've got the two flat cars, pick up the caboose.

16. You can close the cylinder cocks now (push the lever all the way forwards).

17. *(After picking up at Johnstown Siding 3)* Set the switches for the path to Woodvale Yard and drop off the caboose in siding 16. You need to stop in the road next to Woodvale Yard 1 and then reverse into the siding.

18. Sound two long blasts on the whistle to warn the brakeman that we're moving forward and he can release the brakes in the caboose.

19. As you gather speed, "hook up" the Johnson bar. Keep the steam chest pressure (the lower of the big gauges) below that of the boiler (the big gauge above it).

20. *(After dropping off at Woodvale Yard 16)* We'll leave the caboose here while we take the two flat cars and hook up the rest of the consist that's been prepared for us in siding 7.

21. *(After picking up at Woodvale Yard 7)* Now push the consist backwards and join on the caboose we left standing in siding 16.

22. *After picking up at Woodvale Yard 16)* That's the consist completed. Next step is to drop it off in C Storage 3 alongisde the locomotive depot, while we go and refuel with coal.

23. You might need to use the sanders to get more grip at first. Lift the red handle near the brake stand. Don't forget to give two long blasts on the whistle before moving off.

24. If you're firing manually, keep an eye on the water level sight gauge. If the red ball goes below the middle test valve, you need to add more water.

25. When stationary, use the live steam injector on the engineer's side, but when moving, take advantage of the exhaust steam pressure and use the one on the fireman's side.

26. Make sure the injector steam throttle (the one on the pipe going into the top of the injector) is open. Open the water valve (facing you, at the front of the injector) to let in water from the tender. Then pull the injector lever slowly towards you so that the injector picks up the water and rams it at high speed into the boiler through the clack valve near the front of the locomotive.

27. When you let in the water, before pulling the lever, the water will escape through the overflow pipe under the cab. That's normal.

28. If you pull the lever before letting in the water, steam will come out from the overflow pipe. It indicates that the injector has failed to "pick up".

29. If that happens, reset the lever (push it away from you), open the water valve all the way (turn it anti-clockwise) and pull the lever again. You can hear it clearly when the water has been picked up successfully.

30. Don't let the water level go above about 1.1 (on the F5 HUD) or it'll start to go directly into the cylinders and you'll have a big problem ("priming")!

31. *(After dropping off at C Storage 3)* Let's get over to the coal tower first and fill the tender's coal bunker to the top.

32. *(After coaling at C Coal Loader @ C Engine Terminal 8)* That’s the coal taken care of. Now let's go back to our consist waiting in C Storage 3.

33. *(After picking up at C Storage 3)* We're now ready to go on up to South Fork. We need to drop off the entire consist in South Fork Yard 5.

34. As the speed builds up and the steam chest pressure (lower of the two big dials) rises to near the pressure in the boiler, "hook up" the Johnson bar (drag it towards you, or press the "S" key) to reduce the steam chest pressure. Keep doing this for as long as the steam chest pressure continues to rise.

35. Think of the position of the reverser as being like the gears in a car, with 1st gear being fully forward and 5th or 6th gear being close to the center. Fully forward to get moving, but move up the gears (hook up) as you gather speed so that you can continue to accelerate.

Push the reverser forward if you've slowed down and need more power to keep going on a rising grade, just like going down a gear in a car to climb a steep hill.

36. There are two ways to increase the rate of steam generation. One is to open the damper (a door at the front of the ash pan that allows air to flow through the grate and into the fire). This works best when the locomotive is moving. The damper lever is situated to the left of the engineer's seat. Pull it upwards to open the damper doors - mouse or (Shift-)"M".
37. The other way to increase steam generation, best used when the locomotive is stationary, is to open the blower valve, which sends steam into the smokebox and out the stack, drawing more hot air through the boiler tubes. Make sure the blower steam throttle, near the top of the boiler, is open - mouse or (Shift-)"I". The blower control valve itself, is lower down on the left hand side of the boiler backface - mouse or (Shift-)"N".
38. Great job! That should've taken about an hour from start to finish. You can rate yourself against that!

Liveries

In the editor, the models belong to the provider called “Smokebox”.

Four liveries are included. All are variations for the Alabama, Tennessee and Northern (AT&N).

- The default livery is all black:
    - Lima Consolidation ATN
    - Lima Consolidation Tender ATN

  There is also a variation of this livery with exterior weathering:
    - Lima Consolidation ATN Weathered
    - Lima Consolidation Tender ATN Weathered
- Another is black but with pale white lining for the running boards and wheel rims, with red-painted doors and windows:
    - Lima Consolidation ATN Lined
    - Lima Consolidation Tender ATN Lined
    - Lima Consolidation ATN HUD

    - Lima Consolidation Tender ATN HUD

- Another livery differs from the first in that the tender sides carry the AT&N identification instead of the locomotive number. The reason for including this livery is that it allows re-skins to be made with other road names on the tender (the road name is in the alpha channel of the 280RR texture file – white lettering on a black background, while the actual colour of the lettering is in the RGB channels):

    - Lima Consolidation Tender ATN Named

AI helper (pusher) engine

The package includes a locomotive called:

- Lima Consolidation ATN AI Helper

This one has its red classification lights illuminated and is intended to be placed as an AI engine at the rear of a consist. It is based on Lima Consolidation ATN HUD (with the extra performance).

Technical Data

There isn’t much technical data available for this rare class of Consolidation, but here are the data that I’ve used from what could be found, or (in some cases) for which I’ve had to make an educated guess:

- **Driving wheel diameter**: 40” (approximately 44” with unworn 2” tires)
- **Pilot wheel diameter**: 30”
- **Maximum boiler pressure**: 180psi
- **Maximum permitted speed**: 50MPH (estimated)
- **Cylinder diameter**: 20”
- **Valve stroke**: 24”
- **Type of valve gear**: Walschaert’s

- **Calculated tractive effort (from standstill)**: 34,970lbs (assuming the standard figure of 85% for the amount of the boiler pressure that is available at the rails, and after subtracting 2” from driver diameter to allow for worn tires)
- **Weight on drivers:** 133,000lbs
- **Engine weight:** 148,000lbs
- **Tender light weight:** 100,000lbs
- **Tender water capacity:** 5000 gallons
- **Tender fuel capacity:** 8 tons
- **Firebox area:** 153 sq. ft.
- **Grate area:** 2133 sq. ft.

This locomotive was built without a superheater (before the “superpower” era that started a few years after this loco was built).

What I used to build the model

- **3DCrafter version 9.2.2** to create the model geometry and animations;
- **Photoshop** to produce the RGB 8-bit textures;
- The **Asset Editor** and **Blueprint Editor** of TS2013;
- **Power Sound Editor Free** and **Creative Wave Studio 7** to create the sounds;
- **HxD** (freeware hex editor) to edit the cab view exported geometry, changing the material name of the window textures to enable rain effects. The geometry file is too large to be compiled by the serz.exe application.

Credits

This model, including the associated sounds, effects and scripts, was developed by “Smokebox” (aka Mike Rennie), with the exception of the crew figures from the PRR K4s and the buckeye type E couplings, both of which were supplied, very kindly, by RSC.

Special thanks

This project started out as freeware, because I simply wanted to do something a bit more challenging in my hobby of making 3D models. I posted a request on the forums, asking for suggestions of what to make. The idea for the Consolidation came from Jonathan Peters Jr. (jpetersjr). I want to thank John for all the encouragement he’s given me ever since the start of the project. In fact, there are many more forum members who’ve encouraged me, as well as providing me with valuable information and insights into how American steam locomotives are operated in the real world, and I want to thank you all too. You know who you are ☺.

It was through a discussion on the forums, when this was still a freeware project, that I got talking to Rich Garber of All Aboard. My sincere thanks go to Rich for considering my model worthy of becoming payware and for introducing me to the people at RSC.

Thank you too to everyone at RSC, in particular to the QA team, all the beta testers, and Matt (third party relations), for all their work and the help they’ve given me in ironing out some problems along the way.

Special thanks also to the author(s) of the crew figures (engineer/engineman and fireman) that were kindly donated by RSC from the PRR K4s.

Mike Rennie

Madrid, March 2013

Well done for reading all the way to the end of the manual ☺

