OPERATING MANUAL

SD70ACU DIESEL–ELECTRIC LOCOMOTIVES

FOR NS ROAD NUMBERS:
7229 – 7273, 7278 – 7339

Based on an actual SD70 operating and service manuals.

These instructions do not purport to cover all details or variations in equipment represented in-game nor to provide for every possible contingency to be met in connection with operation. Should further information be desired or should particular problems arise which are not covered sufficiently for the user's purposes, the matter should be referred to Searchlight Simulations.

This document may not be reproduced.

THIS OPERATING MANUAL IS INTENDED FOR THE USE IN TRAIN SIMULATOR ONLY. SPECIFIC PORTIONS OF THE ORIGINAL MANUAL HAVE BEEN INTENTIONALLY LEFT OUT. DO NOT ATTEMPT TO USE FOR REAL-LIFE TRAINING.

█ Revisions are indicated by margin bars.

Contents

FOREWORD

This Operating Manual is arranged in sections: INTRODUCTION, OPERATING CONTROLS, OTHER EQUIPMENT, ALARMS, OPERATING PROCEDURES, OPERATION, ADVANCED FEATURES AND USER CONFIGURATION.

The INTRODUCTION Section describes the first steps when entering a new scenario and gives a general overview of the Locomotive, including general locomotive data and required keybindings.

The OPERATING CONTROLS Section continues this overview by identifying the associated hardware located in the operating cab.

The OTHER EQUIPMENT Section explain the basic steps on setting up the radio equipment and Head Of Train Device on-board.

The ALARMS Section lists, describes, and illustrates the various Alarms, Safeguards an operator may encounter.

The OPERATING PROCEDURES Section gives step–by–step instructions for locomotive operation as well as listing various functions available for use. The OPERATING PROCEDURES Section will guide the Operating Crew in operation of this locomotive.

The OPERATION Section explain the basic use of the dynamic brakes and use of the air brakes during dynamic braking.

The ADVANCED FEATURES Section gives insights on certain features found on this product.

The USER CONFIGURATION Section describes how configurable this product is and how the end user can configure it.

While it may not be entirely necessary to know all of the locomotive's functions running in the background, reading about them in the manual might save you the hard climb if you know what signs to look out for. We STRONGLY advise to carefully read through this Operating Manual before attempting to use this product.

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PRODUCT ACTIVATION / INSTALLATION

IMPORTANT INFORMATION

THIS PRODUCT REQUIRES AN ACTIVE INTERNET CONNECTION DURING FIRST RUN-TIME TO PERFORM A PRODUCT LICENSE CHECK. CONTINUOUS INTERNET ACCESS IS NOT REQUIRED.

64 bit   **THIS PRODUCT WILL ONLY RUN ON TRAIN SIMULATOR 64-BIT EDITION. TRAIN SIMULATOR 32-BIT EDITION IS NOT SUPPORTED.**

PRODUCT ACTIVATION

NOTE: YOU WILL UPON PURCHASE RECEIVE A SEPARATE EMAIL LABELLED "SEARCHLIGHT SIMULATIONS PRODUCT ACTIVATION" . ALL FURTHER STEPS ON HOW TO ACTIVATE THE PRODUCT ARE EXPLAINED WITHIN THAT EMAIL. CHECK ALL YOUR INBOX/SPAM FOLDERS IF YOU CAN'T SEEM TO FIND THE ACTIVATION EMAIL ON FIRST SIGHT. MAKE A BACKUP OF THE PRODUCT ACTIVATION EMAIL AND KEEP IT SOMEWHERE SAFE, DO NOT DELETE IT OR YOU WON'T BE ABLE TO RE-ACTIVATE YOUR PRODUCT. YOUR PRODUCT LICENSE IS VALID FOR TWO UNIQUE ACTIVATIONS. A THIRD ATTEMPT WILL DISABLE YOUR PRODUCT KEY.

PRODUCT INSTALLATION

This product is delivered in a packaged, ready-to-install archive (.ZIP file extension). In order to access the executable auto installer inside the archive, you will require a free or commercial copy of either WinRAR or 7ZIP, available from the links below.

 – *www.7-zip.org*

 – *www.win-rar.com*

Inside the archive you'll find a executable auto installer for the product. Double click the installer to run it and follow the steps to install your product.

NOTE: Make sure to adjust the default installation path on the installer to match your default Railworks install location if needed, otherwise the product won't show up in-game. Should you be unsure of your default Railworks install location, run a windows search for "Railworks" on your system. This will point you to the correct install location.

LIMITATIONS OF CORE SOFTWARE

AUDIO

Our locomotive simulations require a lot of game resources to deliver the all-around experience and as such it will consume most of the 256 available sound slots the game is capable to run simultaneously. This means that often you will "run" out of available sound slots and thus no longer hear certain sounds. This can occur when switching from the in-cab view to any of the external cameras. Since we require more external than internal sounds, you will run out of external sounds with too many locomotives running in your consist or with heavy AI traffic. Even though you won't always run out of sound slots in-game, it can happen from time to time.

In order to "reset" the sound slots, simply switch back into the cab view.

> *NOTE: TRAIL AND AI engines run on a minimum number of sounds to help improve performance. They do NOT feature internal sounds.*

> *NOTE: Do NOT place non-player-controlled/driven LEAD engines (See the following page of this operating manual) within your scenario. These engines utilize custom audio scripting and will result in external engine audio "bleeding" into the in-cab view of whatever player-controlled/driven locomotive.*

ANIMATION SPEED

Animations are unfortunately bound to in-game performance (fps). If you experience slow animations (wipers for instance), it's due to your low in-game performance.

3rd PARTY DLC COMPATIBILITY

Unfortunately due to limitations we can not offer compatibility to 3rd party locomotive DLCs. Our locomotives are only compatible among each other, locomotives released in cooperation with Jointed Rail, our enhancement packs and default locomotives.

GETTING STARTED

ENGINE INITIALIZATION

Upon scenario start you will notice a small alert message window come up in the top right hand corner of the screen. The message window display "INITIALIZATION IN PROGRESS..." and will stay visible for one to two seconds. During the initialization time, the core locomotive systems are automatically set-up and the locomotive functions are inaccessible by the player.

NOTE: The player may select the locomotive at any given time during scenario run-time. The initialization process will run only once the locomotive has been actively selected by the player in-game, provided a "driver" has previously been attached to it.

NOTE: During initialization, all available control surfaces within the operator cab will automatically be reset to their respective position. DO NOT ATTEMPT TO MOVE ANY CONTROL SURFACES DURING INITIALIZATION.

NOTE: In-game engine Initialization may fail for the following reasons.

- *Missing serial*
- *Serial verification failed*
- *Serial activation failed*

- *Key verification failed*
- *TS running in 32-Bit*

LOCOMOTIVE DESIGNATION WITHIN THE EDITOR

Within the editor, there's five specific locomotive types available to place within a player controlled or AI consist. They can be identified as followed:

1. *[Lead] – Place this engine as the leader of the player controlled consist.*

2. *[Trail] – Place this engine as the trailing unit of the player controlled consist. You can place as many trailing locomotives in your consist as you wish, mid-train or at the rear.*

3. *[AI Lead] – Place this engine as the leader of non-player-controlled consists ONLY. This engine can not be driven by the player.*

4. *[AI Trail] – Place this engine as the trailing unit of non-player-controlled consists ONLY. Position of placement of this engine within non-player-controlled consists does not matter. This engine can not be driven by the player.*

NOTE: Only the player-controlled [Lead] unit has to be set-up for operation. Trailing locomotives come per-configured, ready to run.

TRAILING LOCOMOTIVES

NOTE: Trailing locomotives do not have internal sounds. This was done intentionally.

GETTING STARTED

AI CONTROLLED LOCOMOTIVES

Non-player-controlled locomotives feature our in-house AIX simulation. In short this means that AI locomotives will dynamically throttle up and down, produce accurate sounds and light effects based on their acceleration. This was done to add more life to AI traffic and to ensure that AI controlled locomotives respond more natural to movement and speed. You will notice how headlights come on and off on AI controlled engines as they accelerate or come to a stop along with dynamic throttle changes which add to a better and overall more realistic running experience.

NOTE: Headlight light casting on AI locomotives will come on/off automatically based on the season and time.

Winter: *0600 - 1800 = OFF*
Spring: *0530 - 1830 = OFF*
Summer: *0515 - 2030 = OFF*
Autumn: *0530 - 1900 = OFF*

MU (MULTIPLE UNIT) REQUIREMENTS

Locomotives placed at the mid or rear of your train will respond to input from the lead locomotive provided the Isolation switch in the respective unit is set in "RUN", the Engine Run and Control/Fuel Pump switches are in the "UP" position. This will however require rolling stock that's set up to forward consist messages. Since most default rolling stock does not come equipped with consist messaging, we highly suggest you only use rolling stock provided by either Searchlight Simulations or Jointed Rail.

NOTE: Rolling stock equipped with consist messaging can be downloaded for free on our store.

SIMPLE CONTROLS AND EXTERNAL 3rd PARTY CONTROLLERS

This locomotive will not properly work with simple controls, or other external controllers such as Xbox or Playstation. Nevertheless, external controllers can be used in conjunction with this locomotive, however note that optimal results are achieved with expert controls and mouse/keyboard input only.

LOCOMOTIVE IN-GAME NOISE LEVELS

We've scripted our audio in a way to automatically lower overall external engine noise levels based on the total locomotive count in your consist. That way we can maintain healthy and balanced audio levels for accessory audio such as horn/bell, radiator/dynamic brake fans etc.. Internal noise levels will remain the same, no matter the locomotive count in your consist.

EQUIPMENT DEFECT DETECTOR COMPATIBILITY

The locomotives provided with this pack come equipped with our in-house Equipment Defect Detector capability.

NOTE: Our Equipment Defect Detectors can be downloaded for free on our store.

GETTING STARTED

TRAIN SIMULATOR GRAPHICS SETTINGS

DYNAMIC LIGHTING

This product does not specifically require dynamic lighting to be enabled, however for the visual, aesthetic value of the product we highly suggest you running it only with dynamic lighting enabled.

HEADLIGHT FLARES

This product requires headlight flares to be enabled in your main Train Simulator settings tab.

> ***NOTE: Without headlight flares enabled in your Train Simulator settings tab, the headlights flares will not be visible and the headlights will not cast any light on the ground.***

LIGHT CONTROL

TRAILING UNITS

Lights on player controlled trailing units have to be manually changed.

DAY VS NIGHT LIGHTING

Our SD70s come equipped with the ability to cycle between day and night gage lights provided the gage lights are turned on. See **Keybindings** Section of this manual.

HEADLIGHT LIGHT CASTING

You can control the headlight light casting through a keybind. This is in place to avoid the headlights spilling light during daylight. Thanks to this feature you can disable the light casting during daylight but toggle it back on in tunnels for instance. See **Keybindings** Section of this manual.

SHADOW CASTING LIGHTS

Certain external light sources can be toggled on or off to cast shadows. Shadow casting is extremely performance impacting and we do NOT suggest running with shadow casting enabled at all times. The ability to toggle shadow casting lights has been added so the user can take realistic night screenshots in-game. See **Keybindings** Section of this manual.

GENERAL LOCOMOTIVE DATA

Controls . . . . AAR
Wheel Arrangement . . . . C–C
Engine Data:
    Horsepower – Traction 4300
    Number of Cylinders 16
    Model . . . . EMD 710
    RPM 950
    Cycle 2
    Turbocharged . . . . Yes
      Type G3C
Traction Equipment:
    Traction Motors (6) A3432
Major Dimensions (Approximate):
    Length . . . . 80 ft. -2 in.
    Height . . . . 15 ft. -11 in.
    Width . . . . 10 ft. -03.75 in.
Driving Wheel Diameter (in.) 44
Weight (lbs, maximum) 420,000
Maximum Continuous Tractive Effort (lbf) / Speed (mph) 155,000/8.7
Maximum Starting Tractive Effort (lbf) 185,000
Peak Braking Effort (lbf/mph) 100,000/1.5
Gear Ratio 83/16
Maximum Speed (mph) – worn wheels 75
Supplies:
    Fuel Tank (usable gallons) 5800
    Coolant (gallons) 276
    Lubricating Oil (gallons) 415
    Sand (cu. ft.) 20
Compressor, Air:
    Compressor Drive . . . . Shaft Driven
    Maximum Displacement (cfm) 200

KEYBINDINGS

Throttle
    Increase . . . . **A**
    Decrease . . . . **D**

Dynamic Brake
    Increase . . . . **Period**
    Decrease . . . . **Comma**

Reverser
    Increase . . . . **W**
    Decrease . . . . **S**

Automatic Brake
    Increase . . . . **'**
    Decrease . . . . **;**

Independent Brake
    Increase . . . . **]**
    Decrease + Actuate . . . . **[**

Horn . . . . **Space**

Bell
    Increase . . . . **B**
    Decrease . . . . **Shift + B**

Front Headlight
    Increase . . . . **H**
    Decrease . . . . **Shift + H**

Rear Headlight
    Increase . . . . **Ctrl + H**
    Decrease . . . . **Ctrl + Shift + H**

Alerter Reset . . . . **Q**
Alerter Override (Toggle) . . . . **Backspace**
Engine Prime . . . . **Shift + P**
Engine Start . . . . **Shift + K**
Engine Shutdown . . . . **Shift + L**
Head + Rearlight Light Casting (Toggle) . . . . **Ctrl + Shift + L**
Gage Lights Day/Night (Toggle) . . . . **Ctrl + L**
Shadow Casting (Toggle) . . . . **Return**

Isolation Switch
    Increase . . . . **I**
    Decrease . . . . **Shift + I**

Engine Base Pitch Shift
    Increase . . . . **Shift + E**
    Decrease . . . . **Shift + Q**

Train Data Request . . . . **Ctrl + I**
Gradient Override (Toggle) . . . . **(Num) Enter**
Cab Signal Reset . . . . **E**

Cab Signal Mode
    Increase . . . . **M**
    Decrease . . . . **Shift + M**

Cab Signal Select (Toggle) . . . . **N**

OPERATING CONTROLS

REF	DESCRIPTION
1.	THROTTLE HANDLE
2.	DYNAMIC BRAKE HANDLE
3.	REVERSER HANDLE
4.	AUTOMATIC BRAKE HANDLE
5.	INDEPENDENT BRAKE HANDLE
6.	HORN VALVE
7.	BELL VALVE
8.	SAND PUSHBUTTON
9.	LEAD AXLE SAND PUSHBUTTON
10.	ALERTER RESET BUTTON
11.	RADIO EQUIPMENT
12.	NUMBER / GND / STEP LIGHT SWITCHES
13.	ENGINE RUN, GEN FIELD AND ENGINE CONTROL / FUEL PUMP SWITCHES
14.	FRONT HEADLIGHT SWITCH
15.	REAR HEADLIGHT SWITCH
16.	DITCH LIGHT SELECTOR SWITCH
17.	HVAC CONTROL SWITCH
18.	PRIMARY PTC SCREEN (CUT OUT)
19.	FIRE DISPLAY
20.	CAB SIGNALS
21.	CAB SIGNAL RESET PUSHBUTTON
22.	DITCH LIGHT FLASHER PUSHBUTTON
23.	DITCH LIGHT DIRECTION CONTROL SWITCH
24.	EOT REAR EMERGENCY SWITCH

FIG. 2.

REF	DESCRIPTION
1.	ENGINE START PUSHBUTTON
2.	EFCO/STOP PUSHBUTTON
3.	ENGINE ISOLATION SWITCH
4.	DYNAMIC BRAKE CUTOUT SWITCH
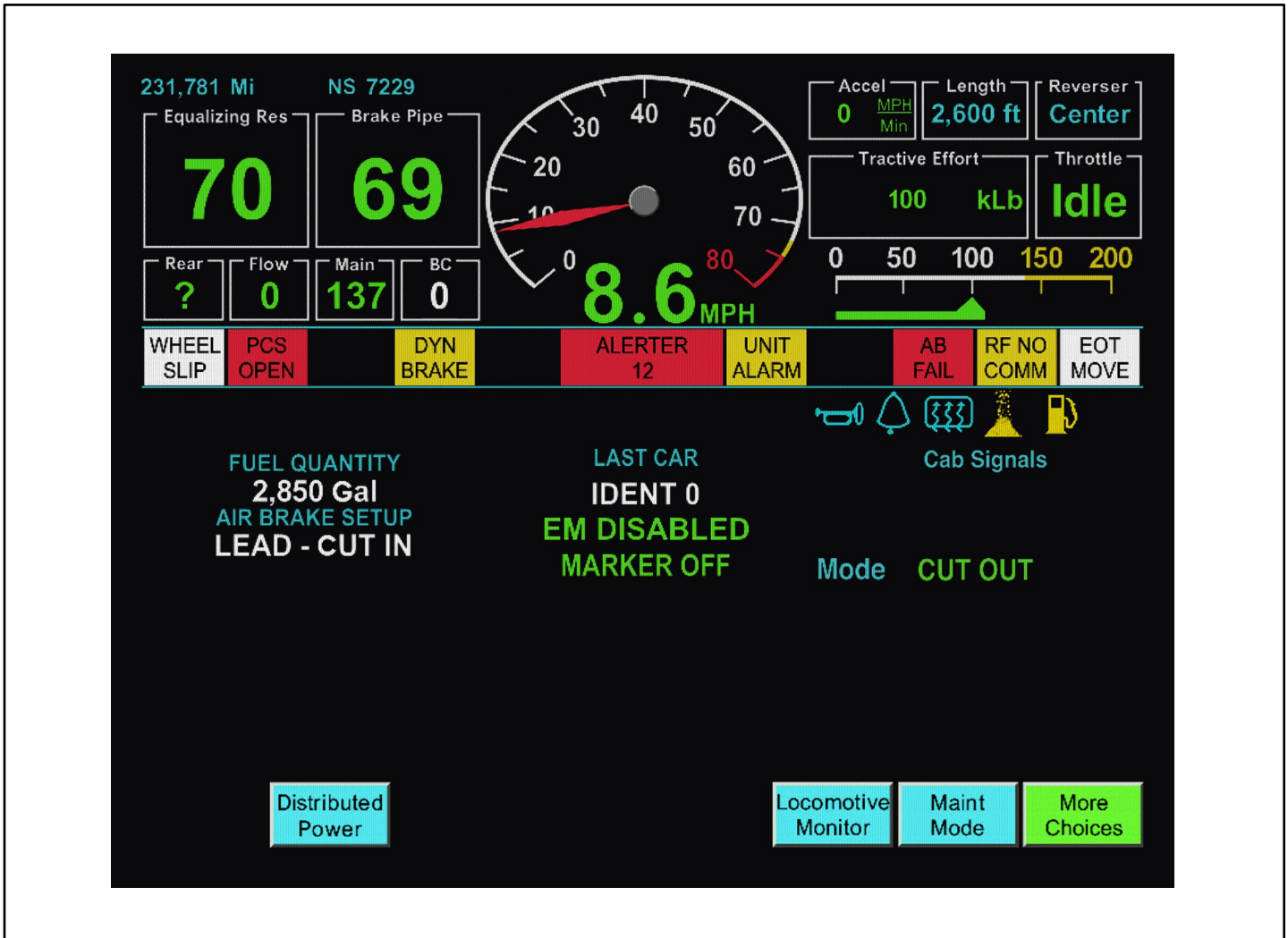
FIG. 3.

The FIRE system screens combine several control and indicator functions under one system. Using the FIRE system screens, the engineer can view important locomotive operating data and respond to various subsystems of the locomotive (including the EM2000 computer)** directly from the console.

Each FIRE display is equipped with a screen and eight buttons (keys) that allow the user to select or activate the menu items that appear on screen directly above the keys.

**EM2000 COMPUTER NOT SIMULATED ON THIS PRODUCT RENDITION.

FIRE DISPLAY
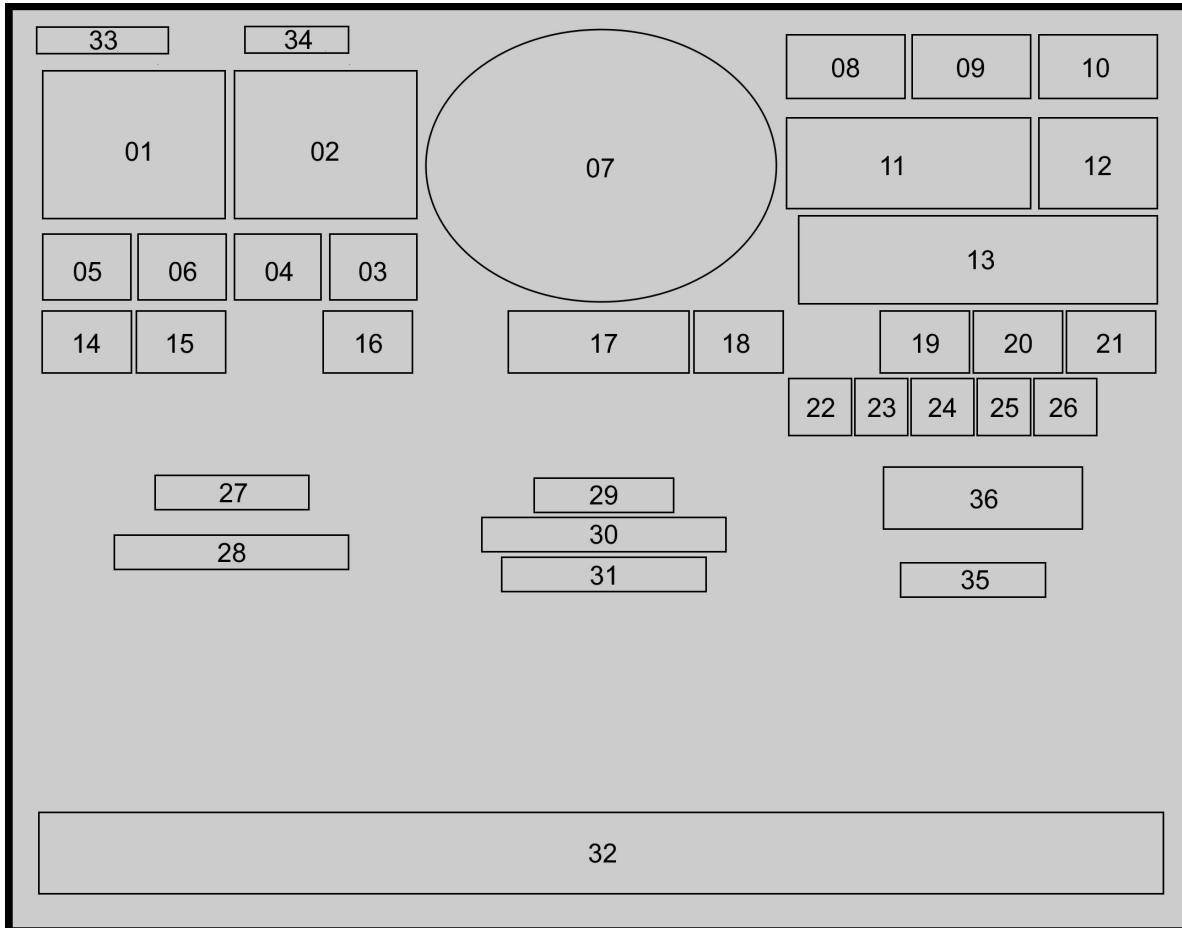
REF.	DESCRIPTION	REF.	DESCRIPTION
1.	EQUALIZING RESERVOIR PRESSURE (ER)	19.	PNEUMATIC BRAKING SYSTEM FAULT (AB FAIL)
2.	BRAKE PIPE PRESSURE (BP)	20.	EOT COMMUNICATION LOSS ALARM (RF NO COMM)
3.	BRAKE CYLINDER PRESSURE (BC)	21.	EOT MOTION MARKER (EOT MOVE)
4.	MAIN RESERVOIR PRESSURE (MAIN)	22.	HORN
5.	LAST CAR PRESSURE (REAR)	23.	BELL
6.	AIR FLOW GAGE (FLOW)	24.	WINDOW DEFOGGER (INOP)
7.	LOCOMOTIVE SPEEDOMETER (GRAPHIC AND DIGITAL)	25.	SAND
8.	ACCELERATION (MPH/MIN)	26.	LOW FUEL
9.	TRAIN LENGTH	27.	FUEL QUANTITY
10.	REVERSER HANDLE POSITION	28.	AB SETUP
11.	TRACTIVE EFFORT/LOAD METER (KLBS)	29.	EOT ID CODE
12.	THROTTLE HANDLE POSITION	30.	EOT EMERGENCY STATUS
13.	LOAD METER BAR GRAPH (BRAKE AND MOTOR)	31.	EOT LANTERN MARKER STATUS
14.	WHEELSLIP ALARM (WHEEL SLIP)	32.	MENU SOFT KEYS
15.	PCS OPEN ALARM (PCS OPEN)	33.	ODOMETER
16.	DYNAMIC BRAKE EXESSIVE CURRENT ALARM (DYN BRAKE)	34.	ROAD NUMBER
17.	ALERT INDICATOR (ALERTER)	35.	CAB SIGNAL MODE
18.	UNIT ALARM (UNIT ALARM)	36.	LSL TIME TO PENALTY

FIG. 4.

JEM RADIO

JEM RADIO CONTROL

Channel Selection

To enter a Narrow Band AAR frequency pair press the **CHAN** button. Next enter the first three digits of the transmitting TX channel by pressing the corrosponding digits on the numeric keypad. Repeat the same for the three digits of the receiving RX channel. After entering 6 digits, "***BSY"*** will momentarily appear in the lower right of the VF display and the radio will wait approximately 3 seconds before accepting the entry as a narrow band channel pair.

DTMF Tones

DTMF tones can be sent by hitting the number keys as well as the # and * key. The number keys will not send DTMF tones when in the channel or tone selection mode. Sequenced DTMF tones can be sent by first hitting the DTMF button and then hitting the number keys in succession to select a number sequence. The T/D field of the VF display will change to ***"D"*** and the first number selected. Each following number pressed will send the corresponding DTMF tone but the display will not change.

Invalid Channel Entries

Valid AAR channels are 001-099.

Volume Control

Pressing the right side of the **VOL** button will increase speaker volume while pressing the left side will decrease volume. As the volume is changed the display will indicate the volume level and a tone will be heard. Volume can be set to a value between 1 and 20. The volume level can be adjusted by pressing the **VOL** button for each increment, or by holding the **VOL** button down to automatically increment.

Operation Guideline

CHANNEL NUMBERS:

Road 1: AAR 051-051

ALARMS AND SAFEGUARDS

ALERTER

The Alerter promotes safe train operation by monitoring various operator movements to ensure the alertness of the operating crew. If a proper control movement is not detected within a predetermined reset time period, an alarm sequence including audible and visual alarms is started requesting an acknowledgement. Lack of response to the system during this time will result in a penalty brake application by de–energizing the Alerter Magnet Valve. This action will command a full service brake application bringing the locomotive to a stop.

The Alerter starts counting down from sixty seconds. After sixty seconds and with no acknowledgement it will begin to flash. With no response, an audible alarm will sound eight seconds later. The operator is then given another ten seconds to respond before a penalty brake application is automatically initiated.

NOTE: *The Alerter Function is disabled when Brake Cylinder pressure is greater than 25 psi or the Alerter Override is enabled.*

The following control movements will reset the Alerter:

- Operating the Alerter reset pushbutton

- Operating the Bell switch, Horn valve, or movement of the Reverse handle or Throttle handle

- Movement of the Automatic Brake handle, Independent Brake handle, or Bail–off

- Change in Dynamic Brake

EMERGENCY SANDING

Emergency sanding is automatically applied in FORWARD and REVERSE directions during all Emergency Brake applications for a sufficient time to stop the train.

CAB SIGNALING

This locomotive is equipped with in-cab signaling. Currently, RCAP and Open-NEC are the only supported signaling systems compatible with the in-cab signals on this locomotive.

Signaling systems can be manually cycled in-game through a simple key-command. Press **N** to cycle through the options. Any change in the setup will be displayed through a small alert message in the top right corner (Fig. 5)

FIG. 5.

There are a total of three cab signal modes available for operation depending on the territory, route signaling and requirement:

1. CS CUT OUT
2. CS ONLY (Usage: Former Conrail trackage found on the Norfolk Southern system such as Horseshoe Curve).
3. CS LSL (Usage: Along any portion of the Northeast Corridor).

Cab signal modes can be manually cycled in-game. Press **M** to change up and **Shift + M** to change down the CS mode. The FIRE display will display the currently active CS mode in the "Cab Signal Mode" window (Fig. 4) on the screen.

CS Mode: CS CUT OUT

NOTE: *In this mode, the in-cab signaling system is disabled.*

Cutting out the in-cab signaling during operation will not automatically reset any previous alarms and a penalty brake application may still occur.

CS Mode: CS ONLY

NOTE: *In this mode, the in-cab signaling system is enabled.*

An alarm sequence is started requesting an acknowledgment whenever the in-cab signal indication downgrades to a more restricting state. Lack of response to the system within a predetermined reset time period of seven seconds will result in a safety penalty brake application. This action will command a full service brake application bringing the locomotive to a stop.

To acknowledge a more restricting CS state change:

1. Press the CS Reset pushbutton.

CAB SIGNALING

CS Mode: CS LSL

NOTE: In this mode, the in-cab signaling system is enabled. Furthermore, the locomotive speed is monitored through the Locomotive Speed Limiter (LSL).

An alarm sequence is started requesting an acknowledgment whenever the in-cab signal indication downgrades to a more restricting state. Lack of response to the system within a predetermined reset time period of seven seconds will result in a safety penalty brake application. This action will command a full service brake application bringing the locomotive to a stop.

To acknowledge a more restricting CS state change:

1. Press the CS Reset pushbutton.

If acknowledged, the operator has 60 seconds to reduce max speed according to the in-cab signal indication (Fig. 6). The remaining time to penalty will be visually displayed in the "Time to penalty" window (Item 36, Fig. 4) on the screen and the time will continue to count down if the accelerometer (Item 8, Fig. 4) is showing a deceleration less than -4 MPH/Min. The count down timer will momentarily pause whenever the deceleration is greater than -4 MPH/Min.

An insufficient reduction in speed within the 60 second time period will result in a safety penalty brake application. This action will command a full service brake application bringing the locomotive to a stop.

*NOTE: To reset a safety penalty brake application, See **Alarms and Safeguards, PCS FUNCTION OPERATION** Section of this manual.*

SIGNAL INDICATION	STATE	MAX SPEED	TIME TO PENALTY
	CLEAR	> 60 MPH	- - -
	APPROACH MEDIUM	45 MPH	90 SECONDS
	APPROACH	30 MPH	60 SECONDS
	RESTRICTING	20 MPH	60 SECONDS

FIG. 6.

PCS FUNCTION OPERATION

An emergency brake application will cut power, reduce the engine speed to Idle and illuminate the PCS OPEN indicator light on the control stand.

To reset the PCS Function:

1. Move the Throttle to IDLE.

    NOTE: If the PCS Function has been activated while in dynamic braking, the Braking handle must be returned to OFF to reset the circuit. Dynamic braking will be retained when PCS is open.

2. For **Penalties**, proceed to **Step a**. For **Emergencies**, proceed to **Step b**.

    a. Move the Automatic Brake Handle to SUPPRESSION and wait at least eight seconds for Power Up, Over-speed, or other Penalty applications.

    b. Move the Automatic Brake Handle to EMERGENCY and wait at least 60 seconds for Trainline, Operator, EOT, or Brake Valve Emergencies.

3. Move the Automatic Brake Handle, when instructed and ready, to RELEASE.

NOTE: Penalty applications can be reset "on the fly" meaning the locomotive does not need to come to a full stop before the penalty can be reset.

WHEELSLIP

The locomotive computers continuously monitor axle speed. If a wheelslip or slide is detected by the Control System, the control decreases the torque command (motoring or dynamic brake) on the affected axle and orders sanding until the slip/slide is under control. Wheelslip is controlled per individual axle.

Sand can be applied either manually (using pushbuttons located on the control console) or automatically. Automatic sanding may take place as follows:

NOTE: Whenever possible, operation on grades should be at full throttle position. Throttle reduction during wheel slip is recommended only when:

1. Repeated wheel slip conditions cause severe lurching that may pull a train apart. (Such severe conditions may indicate the need for a helper or the need to take the train up the hill in two parts.)

2. In unusual conditions, simultaneous wheel slips may be incurred at low or stall speed. In this situation performance of the equipment is directly related to the skill and judgment of the operator. Therefore, the operator must determine to apply sand to the rail and/or reduce throttle.

AUTO ENGINE START/STOP (AESS) SYSTEM

The AESS System enhances fuel savings by automatically shutting down the diesel engine during periods of inactivity. The system monitors certain locomotive parameters and restarts the engine as needed. When this system is active, the diesel engine may start and stop without operator intervention.

> **WARNING: This locomotive is equipped with Auto Engine Start/Stop (AESS). The diesel engine may start without operator action.**

NOTE: Locomotives with AESS are identified by warning decals applied in the Operating Cab and at several locations on the exterior of the unit.

The diesel engine will only shut down automatically during inactivity (parked idle) periods. Any powered operation or movement of the locomotive will prevent the AESS system from shutting down the diesel engine.

Conditions for Automatic Shut Down

These conditions must exist for 10 minutes prior to initial automatic engine shutdown and for subsequent shutdowns.

1. All AESS permissions (certain locomotive system parameters) are within limits.
3. The Reverser is in the CENTER position.
4. The Throttle handle is in the IDLE position.
5. The Engine Isolation switch is in the "START/STOP/ISO" position.
6. The independent brakes are fully applied.
7. Locomotive speed is zero.
8. Engine Warming is not in progress.

Conditions for Automatic Start Up

Any AESS trigger (certain locomotive system parameters) outside of its limits will initiate Automatic Start–Up. These may include (but are not limited to):

1. Reverser momentarily placed into the FWD (Forward) or RVS (Reverse) position.
2. Engine Start push button momentarily pressed.

FASTER AIR PUMPING

To provide faster air pumping on locomotive, when reservoirs have been drained or after the locomotive has been coupled to a train, proceed as follows:

1. *Leave the Generator Field switch in the OFF position.*
2. *Place Reverser in CNTR position.*
3. *Advance Throttle above IDLE.*

BEFORE MOVING LOCOMOTIVE

Place Rear and Forward Headlight switch in the proper position for required operation.

Set Isolation switch into the RUN position.

Make an Independent air brake application.

Release the hand brake and remove any blocking from the wheels. The train is now ready for operation. Refer to the OPERATION section of this manual.

MOVING A TRAIN

1. *Set the Generator Field switch to ON.*

2. *Move the Reverser Handle to the desired direction of movement.*

3. *Release the brakes completely.*

4. *Advance the Throttle. The Throttle has notches, with each successive notch representing an increase in power, or locomotive tractive effort.*

STOPPING A TRAIN

Move the Throttle to IDLE, and apply the dynamic or air brakes according to Railroad Regulations. Also refer to Applying Dynamic Brakes paragraph located later in this section. If leaving the engineer's position after the train has stopped, center the Reverser.

STOPPING ENGINE

1. *Move the Throttle to IDLE.*

2. *Set the Generator Field switch to OFF.*

3. *Set the Isolation switch to START/STOP/ISO position.*

4. *Momentarily engage the Engine Fuel Cut Out (EFCO) / Engine Stop pushbutton on the Engine Control Panel.*

DYNAMIC BRAKE OPERATION

Applying Dynamic Brakes

Applying dynamic braking is done in the following manner:

1. *Move the Throttle to IDLE.*

2. *Advance the Dynamic Brake as desired.*

3. *After the slack is bunched, manipulate the Dynamic Brake until the desired braking effort is obtained. Observe and correct braking effort during the initial period of Dynamic Brake application.*

   The amount of braking effort obtainable varies with the position of the Dynamic Brake for various speeds. Maximum braking effort is obtained in the FULL BRAKING position at around 16 MPH.

Use Of Air Brakes during Dynamic Braking

NOTE: Use of independent air brake does not affect the braking effort from dynamic brake. Independent brake and dynamic brake can be applied at the same time with no reduction in either braking capability.

When necessary, the automatic air brake may be used in conjunction with the dynamic brake.

Use of Air Brakes during normal Operation

Applying or Reapplying Automatic Brakes

When applying or reapplying automatic brakes, make brake pipe reductions according to these guidelines:

1. *Make an initial brake pipe reduction as follows:*
   - For a fully charged system, reduce the brake pipe at least 6 psi, or
   - For an uncharged system, reduce the brake pipe 5 psi below the previous reduction.
2. *Use split reductions for planned slowdowns and stops. Make an initial (minimum) brake deduction of 6 to 8 psi followed by additional reductions in 2-3 psi increments spaced 30 seconds apart.*
3. *Limit brake pipe reduction to 15 psi or less to control speed.*
   Make a final reduction when operating conditions permit asd train is nearing a stop to prevent a run out of slack. A final reduction is a brake pipe reduction made in such a wayas to result in brake pipe pressure exhausting as the train comes to a stop.

Use of Automatic Brakes during cold weather conditions

During extreme cold temperatures (Below Zero Degrees Farenheit) when operating conditions and outstanding instructions permit, throttle manipulations and dynamic braking must be used in lieu of train air brakes whenever possible in controlling and stopping freight trains.

If automatic brakes are to be used, plan ahead and initiate a minimum brake reduction far in advance of a planned stop to warm up the brake shoes on the train so braking will be effective.

Cycle Braking

Avoid frequent application and release of the automatic brake to avoid complete loss of braking due to air supply in the railcars being exhausted.

Notch 2 DB Hold

The engine will run up to notch 2 engine speed during dynamic braking with the dynamic brake handle in SETUP or DB1-DB8.

> **NOTE**: *Engine returns to requested throttle notch speed with the dynamic brake handle in the OFF position.*

Oil Temperature

If the engine oil temperature exceeds 220 F (104 C), the engine will run up to notch 2 engine speed until the oil temperature has dropped back below 220 F (104 C). Engine load restrictions do not apply.

> **NOTE**: *Engine will return to low idle speed with the Engine Isolation switch placed in the "Start/Stop/ISO" position.*

Notch 8 Hold

In an effort to reduce carbon emissions during throttle changes, the engine will run up to notch 8 engine speed if the throttle is advanced to a position greater than notch 5.

> **NOTE**: *Engine returns to requested throttle notch speed after a 90 second timer or if the throttle is dropped to or below notch 5.*

BASE ENGINE PITCH SHIFT

BASE ENGINE PITCH SHIFT CONTROL

In-game you have the ability to manually turn the engine audio base pitch shift up and down. This feature was introduced to reduce the chance of the "swoosh" effect on audio that basically occurs whenever identical audio files are played in-game.

By the default, every locomotive placed in-game will automatically be assigned a random base pitch value on initialization. In some occasions however this still results in certain locomotive pairs sharing the same base pitch. To correct this, simply switch/cycle to the respective locomotive in your consist and manually adjust the base pitch shift until you've reached a more natural mix in overall engine audio.

Press **Shift + E** to increase and **Shift + Q** to decrease the base pitch shift. The pitch will change in .02 increments and will be displayed through a small alert message in the top right corner (Fig. 7).
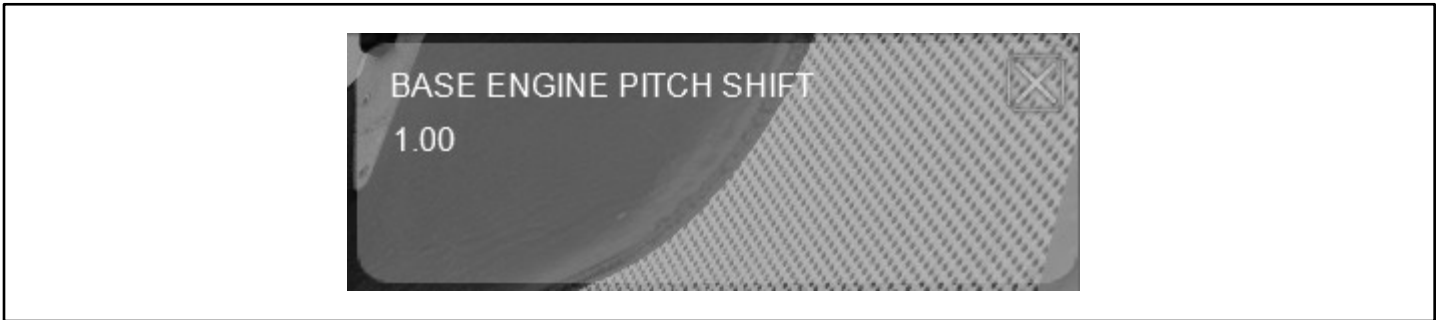
FIG. 7.

NOTE: *Valid base pitch values are within the **0.96 – 1.04** range.*

COOLING FANS

COOLING FANS

Cooling fans are picked up in order to maintain a steady engine coolant water temperature. When the engine water temperature exceeds the upper limit of 185 F (85 C), the Logic computer will begin to turn on fans. The fans will continue to turn on until the temperature has dropped back within the operating temperature range. Any fans that were on when the operating temperature range was entered will remain on as long as the engine water temperature stays within this range.

If the temperature continues to drop and goes below the lower limit of the operating temperature range, any fans that were on will begin to drop out. Fans will continue to be dropped out as long as the engine temperature stays below the operating temperature range.

If the temperature jumps back into the operating temperature range, fans that are still on will remain on as long as the temperature stays in this range.

Fans are picked up in sequence at slow speed first with a 10 second interval between fan pickups.

10 seconds after the last slow speed fan was picked up, fans are picked up at fast speed with 20 seconds between pickups, in the same order as slow speed.

The fans will be dropped out in the same order that they were picked up, starting with the fast speed fans in 15 second intervals, then the slow speed fans in 10 second intervals.

MISCELLANEOUS

ADVANCED BRAKES

The SD70s come equipped with an advanced braking simulation that takes in account a number of critical variables that affect air brake performance. The effective ability for braking is impacted by things such as ambient temperature, train length, brake valve type, and brake pipe leakage. The colder the ambient temperature, the higher the leakage your train will experience due to material shrinkage reducing the effective seals between rail cars. The longer the train you have, the longer it will take to charge the brake pipe and auxiliary reservoirs, and depending on the age of the cars, they may be equipped with more efficient brake valves that propagate changes in brake pipe pressure faster and are more resilient to leaks.

We have furthermore simulated tread brakes with dynamic brake forces that increase as the train speed is decreased.

> *NOTE: Be mindful of how many times you apply and release the train brakes during descents and braking phases as you can exhaust all of your available air within the system, resulting in a "runaway" situation.*

EXHAUST EFFECTS

The exhaust effects on our locomotives are fully configurable for each leading "[Lead]" unit individually and uniformly for all trailing units "[Trail]". You may further adjust base factors within the supplied configuration files to achieve different effects. (See **User Configuration** Section of this manual).

AMBIENT TEMPERATURE

The ambient air temperature will have an effect on engine behavior over all four seasons of the year. With a high ambient air temperature, the engine might overheat during periods of high tractive effort demand over extended time.

The ambient air temperature also has an effect on air break performance. You will experience longer recharge times of the air brakes especially on long trains in cold weather conditions due to material shrinkage reducing the effective seals between rail cars and thus resulting in higher leakage of the brake pipe pressure. This in turn for instance will trigger the air compressor to come on more often to sustain a constant Main Reservoir pressure level.

LUBRICATING OIL AND WATER TEMPERATURE

The lubricating oil and water temperature will have a direct effect on engine cooling. The radiator cooling fans will cycle on and off based on the water temperature and will run at different speeds depending on the engine speed.

Heat and cooling rates of both the lubricating oil and water are all dynamically changing based on season, engine load, engine operating time and other factors. This ensure that any input by the player will have an actual impact on engine performance.

TRAIN DATA REQUEST

TRAIN DATA REQUEST MESSAGE

Pressing Ctrl + I will request current train data to be displayed. This new feature is extremely helpful for improving your train handling skills. The output data will dynamically change with your train. Isolating locomotives for instance will result in lower available gross/net horsepower, thus resulting in a lower HP/T (horsepower per ton) rating and lower calculated max speed.
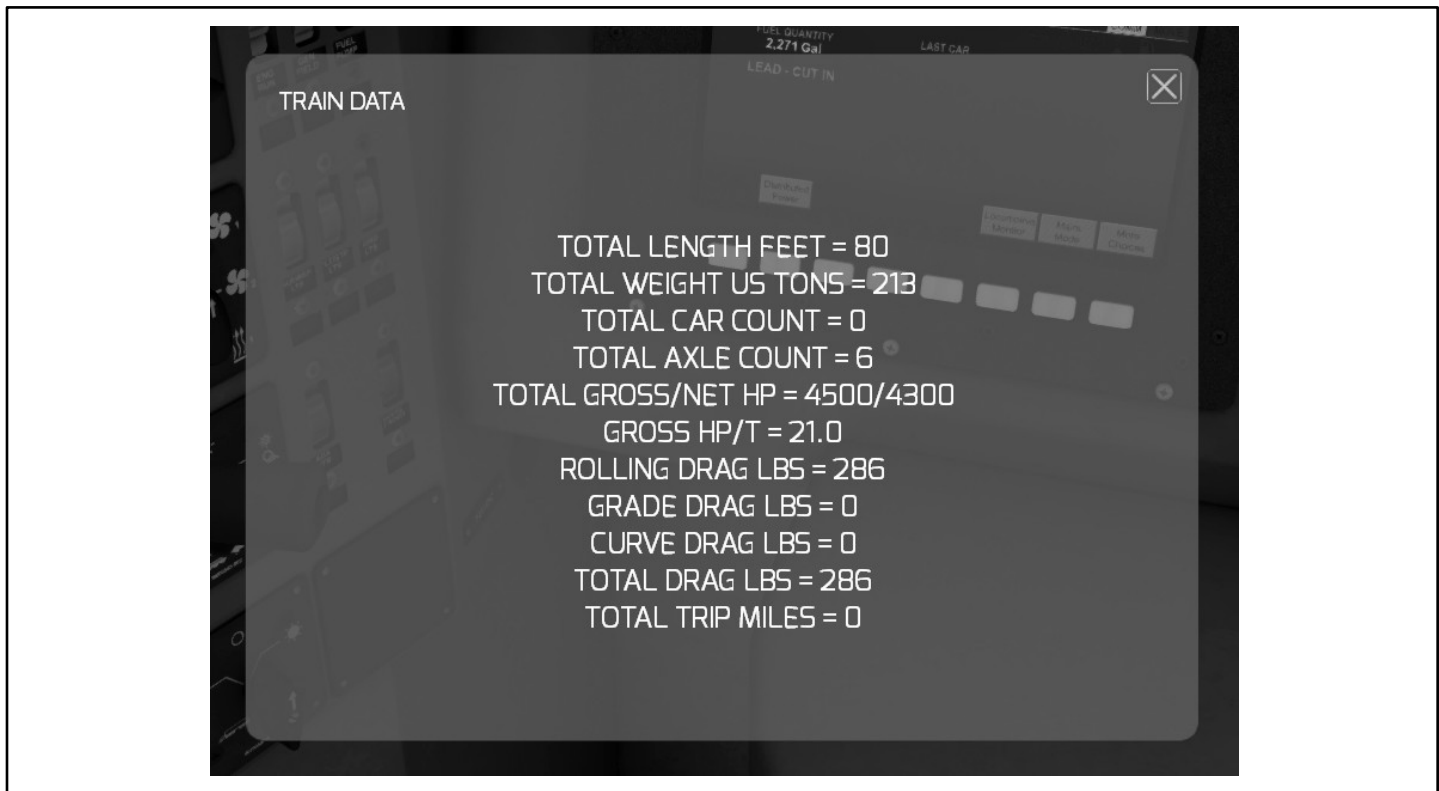

FIG. 8.

Train simulator uses the lead axle of your train as the only reference point to get the current grade, curvature and speed value from. This means that proper physics calculations for the entire length of your train are quite essentially impossible to run. The core game does not allow for proper calculations on a car-to-car or axle-to-axle basis. Hence the displayed drag values only properly account for constant grade and curvature track.

NOTE: *If you notice your train seemingly "dragging" down a grade as opposed to picking up speed, manually toggle the gradient override by pressing* **Enter** *on your numpad. A small alert message will briefly display in the top right corner, indicating which grade the train "should" realistically be on at the given time.*

NOTE: *Once displayed, the train data message window will pause your game. Close the window to return to your session.*

Only products marked with "Train Data Capability" are equipped with our train data request feature.

CONFIGURATION FILES

CONFIGURATION FILES

Configuration files are designed to to allow the user to fully customize their in-game experience when using our products. With the help of locomotive based configuration files, you get to change features, change settings or swap certain equipment on your lead and trailing locomotives (within limits).

> *NOTE: Configuration files can be found under each respective locomotive folder. Check the listed paths below for the respective locomotive you wish to configure. For player controlled [Lead] locomotive, modify the file "CONFIG_LEAD_INI" and "CONFIG_TRAIL_INI" for trailing locomotives in your consist.*

```
NAME:          PATH:
NS             Assets\SearchlightSimulations\EMD\JRSD70ACU\RailVehicles\Diesel\NS\Scripts\CONFIG_INI\NS
NS HL          Assets\SearchlightSimulations\EMD\JRSD70ACU\RailVehicles\Diesel\NS\Scripts\CONFIG_INI\NS_HL
```

> *NOTE: All trailing locomotives will run off of the "CONFIG_TRAIL_INI" configuration file.*

All configuration files are self explanatory and feature annotations for each configurable setting or variable within. To edit a configuration file, simply open it with any text editor such as **Notepad** or **Notepad++**.

CREDITS

Thank you to our entire team, all our beta testers, our scenario writer, our network engineer and JointedRail.

For proper support inquiries related to this product and or others, please use our support form on the our website or directly contact us at support@searchlight-simulations.com .

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