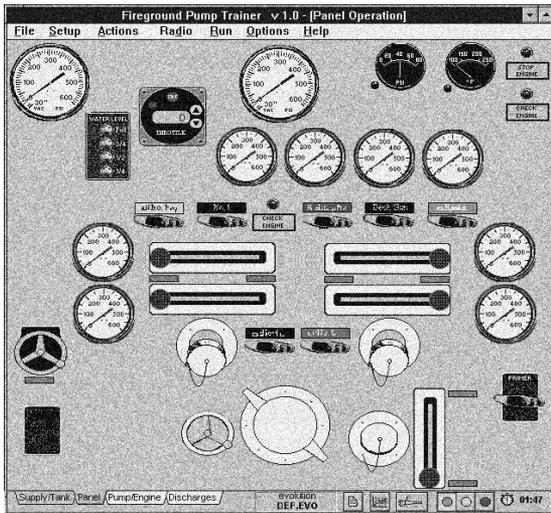


Fireground™ Pump Trainer

User's Guide

version 1.0 • revision 04 c



“the ultimate in software simulation”
for the fire service

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Chapter 1: Getting Started

1.1 System Requirements

The Pump Trainer runs under Microsoft Windows OS of: XP/ME/2000/NT/98. Forty-eight megabytes (MB) of RAM and fifteen MB of hard disk space, minimum, are recommended. These system requirements may change with new program updates (see www.simresearch.com)

1.2 Program Installation

Insert the CD-ROM into the CD drive. If the CD “autorun” capability is enabled (or “autoinsert notification” property is true) then the installation program should execute when the CD is inserted. Otherwise, you can execute “setup.exe”, located in the main directory of the CD. Then simply follow the instructions on the screen.

Pump Trainer Directory Structure:

...*Pump Trainer4* -- default main install directory (user-named)

- *evols* -- .EVO (evolution) and their .ITX (Incident & Command Text) files.
- *panels* -- .PNL (panel) files.
- *snd* -- .WAV (sound) and their .WTX (Wave Text) files.
- *recs* -- .DTA plot/graph data records
- *ini* -- .INI program initialization files

All files are installed into a directory tree with the main install directory at the top. No files are installed outside of the main install directory. If you need to uninstall the Fireground Pump Trainer, open the Windows “Control Panel | Add/Remove Programs” and select Fg Pump Trainer 4.

1.3 Running a Simulation

Double-click on the Fireground Pump Trainer icon in the Fireground group box in the Windows’ Programs menu. When the Pump Trainer first starts up, you will see the main pump panel. At this point, default settings and a default evolution have already been loaded. For a quick start, you can just click on the green light button in the bottom button panel. The panel lights then switch on and all the controls become operational. You can also load an existing evolution using File|Open, then click the green light button to start.

1.4 “Canned Evolutions”

Very basic evolutions are included with the Pump Trainer. Select *Files/Open* from the Pump Trainer menu to view the available *.EVO* (evolution) files or to load one of them. Use the “canned” evolutions to generate new, perhaps similar, evolutions without starting from scratch. As you create new evolutions, they will be saved in the default evolution directory, along with the original “canned” evolutions.

1.5 Program Audio

Whenever the Pump Trainer is executed, it checks for a Windows-installed sound card. If it finds one, it is used by default. (You can select *not* to use it.) If you install the Pump Trainer, execute the program, then hear air brakes and diesel engine when the truck moves across the introductory screen, then you have a sound card. You can also check the *Options/Sound* setup screen to see if you have a Windows sound card.

Sound cards installed through Windows will play sound files known as .WAV files.

The volume control of a sound card is typically found in software, and an icon representing sound is usually found on the Windows taskbar. If you open that program, you can adjust the volume for Pump Trainer sound by adjusting the WAV or Direct Sound slider control. When you record a sound file, i.e. radio call, to use in an evolution, you can plug a microphone into the sound card's "input" or "mic" jack (see the directions for your sound card), make sure the sound volume is at a reasonable level usually there is a separate *software* volume control for the "input" or "mic" level), and run a WAV recording program. Currently, "Sound Recorder" is still distributed with Windows and that can be used to record WAV sound files; it is easy to use and has its own on-line help. Sound cards usually have a "mic" input jack for microphone recording, and a "line" input jack, for recording directly from an audio player device, so use the appropriate one.

Note: It *is* possible to have a sound card installed in your

computer and it not be “recognized” or usable by Windows if it was not installed properly.

1.6 Video Display

Setting video resolution determines the size of the smallest dot of definition, or pixel size, on a computer monitor. The lowest resolution used is 640 (pixels across) by 480 (pixels vertical), or 640x480, “standard VGA” resolution. This resolution gives you the largest pictures and text, but that means that for a given window, you have fewer pictures and text than at a higher resolution. For the Pump Trainer, this means that if you have a side-mount panel with 15 discharges, as well as many other components, you will not be able to fit the entire panel on one screen (that is, without scrolling). If you increase your monitor resolution by a notch, to 800x600 (SVGA) or higher, your text and pictures become a little smaller, but you can fit many more components onto a panel.

It is recommended you use a Windows video driver of at least 800 x 600 resolution, using at least 256 colors. Most Windows OSs allow you to right-click your “Windows desktop” (*not* Pump Trainer) screen and select “Properties” from the pop-up menu, launching the “Display Properties” window. Select the tab which shows settings: colors and screen area/resolution; you can adjust the screen settings if necessary.

Chapter 2: The Pump Trainer Interface

The Pump Trainer interface is composed of various

screens, graphics, keystrokes and mouse-clicks which you, the user (or operator), require to setup and run the program.

When the *Pump Trainer* program is running, the main window is displayed. At the top it contains the title bar and menu bar. At the bottom, you find the notebook tabs for evolution setup, various control buttons, and the simulation timer, described below.

2.1 Menu Bar

The title bar shows the program name and version, along with the current page name in brackets. The menu bar is



Title Bar and Menu Bar

just below the Title Bar, and it contains the main menu items, which give access to all the program functions and options. (Some of these functions are duplicated by the convenient buttons or tabs on the bottom bar.)

File contains basic file operations. *Open...* allows you to open and load an existing evolution (.EVO) file from disk. *Save* will (re)save your currently-loaded evolution as its current name. If your evolution has not already been saved under a particular name, then *Save As...* is automatically invoked, which allows saving the current evolution under any name. All evolutions *must* be saved with the .EVO filename extension. *Print* prints the active screen, and *Print Setup* activates the installed printer's setup procedure.

Setup contains menu items *Supply/Tank*, *Pump/Engine*, *Discharges* and *Foam*, which invoke the setup page of their respective functions. *Friction Adjust* allows adjustment of friction losses for given diameters of hose (*Discharges Setup* for description). The *Panel Design* menu item appears when Panel Design Mode is entered (see Panel Setup). This submenu provides panel components and options for (re)designing your pump panel.

Actions are “physical” actions that an operator might perform in response to “incident” situations within the scenario of the evolution. Use *Check/Supply/Discharge Line* when you have reason to suspect there is a problem with lines, like a rupture or a kink. If there is a problem, it will tell you so, and then you can use *Replace* or *Reconnect*, depending on the problem. *Fill/Tank/DumpTank*, when selected, immediately refills the booster tank or portable dump tank (if drafting from dump tank). *Fill/Engine/Primer Oil* will alleviate a low oil pressure reading or a problem of obtaining prime if the primer reservoir is low or empty.

Radio allows configuration of radio calls that the operator will hear. You can check the configuration to see what calls have already been programmed for the current evolution, and when they will play. Radio calls can provide information or direction for the engineer, or inform him of incidents he must respond to. If you record WAV files to the *snd* directory, they will appear in the list of calls you can use (see *Radio Setup* for details). You can also create incident & command text files in this window, which can be programmed to play like WAV files.

Run contains options for controlling the simulation execution. *Start/Restart*, *Pause* and *Terminate* function the same as the green, yellow and red stoplight buttons on the button panel at the bottom of the screen. *Start/Restart* begins an evolution if it has not yet been started, or restarts it if it has been stopped using *Pause*. Use *Terminate* to stop the simulation and “lock” the simulation status as stopped. From this point, you can restart the same evolution with *Initialize*. You can also review any plotted data and further configure its display.

Options contains items allowing various configurations of the program. *Desktop* allows configuration of various panel attributes, selection of metric or english units, and department name. (See *Panel Setup* for more information.) *Sound* shows whether a sound card is installed or available, whether to use the *Engine* and/or *Primer* sounds, and whether to use *Random Radio Calls* or not in the program. All settings under *Options* are saved and used for *all* evolutions, not just the currently loaded evolution.

Data Records deals with the items pertaining to data that is recorded during an evolution. You can view record data being plotted online, or after the simulation is run. Here, you can also set up a class (or classes) of trainees, so that the data they log during an evolution goes into their own directory, and their performance plots are time- and date-stamped, and can be reviewed anytime.

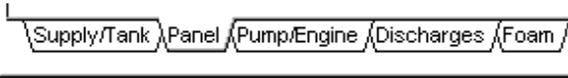
Help accesses the online help through item “Online Help”, alternatively accessed by the F1 key. *About*

displays a window of program information.

To the right of *Help* is *Operator:*, followed by the name of the operator currently logged on.

2.2 Notebook Tabs

Access the setup pages *Supply*, *Panel*, *Pump & Engine*, *Discharges* and *Foam* quickly by using the notebook tabs.

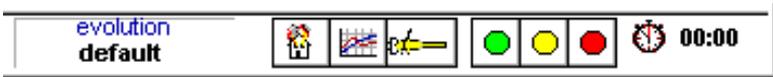


Notebook Tabs for Evolution Setup

These functions are also available through *Setup* on the main menu bar.

2.3 Command Buttons

Command buttons provide easy access to screens and program functions. At left is displayed the name of the current evolution loaded under *evolution*. If “default” is



Command Buttons

displayed, that means the program’s internal default values are being used.

To the right, at the clock, the simulation timer shows the *elapsed simulation time* in minutes and seconds.

The green, yellow and red *stoplight buttons* start, pause, and terminate a scenario (see the RUN description, in *Menu Bar*). If Pump Trainer uses WAV sound, a default sound (WAV file) signals a change in simulation status when a button is clicked.

When the button with the nozzle picture is clicked, the *nozzle window* appears. In this window you can open and close nozzle valves and read nozzle pressure for the selected nozzle. Click the nozzle button again and the window disappears.

The *graph button* makes the current plot appear or disappear, and gives access to plot setup.

The *burnhouse model button* brings brings up a screen for a simulated “house burn.” When clicked before the simulation begins, it allows *burnhouse* design. If clicked after the simulation begins, it shows the status of the simulated burnhouse.

Chapter 3: Evolution Setup

Typically, you will want to (1) setup an evolution, (2) save it, and then (3) run it (or run it at a later time). *If you setup an evolution and do not save it to disk, your changes will be lost.*

3.1 Supply Setup

The notebook tab labeled *Supply/Tank* will show the page

that sets up an external supply and the tank.

The dropdown box in the upper left of the supply setup page gives you the option of *Hydrant*, *Draft*, or *Relay*. Positive supplies of hydrant and relay are practically identical, but you can select either to specify your evolution. Selecting *Hydrant* will show the *Source* box in the lower right corner, allowing adjustment of available water from the hydrant. Within the source box, click on the

rating	gpm
<input checked="" type="radio"/> AA	1500 +
<input type="radio"/> A	1000 - 1499
<input type="radio"/> B	500 - 999
<input type="radio"/> C	< 500

▲ ▼ 3000 gpm
Adjust "rated" flow

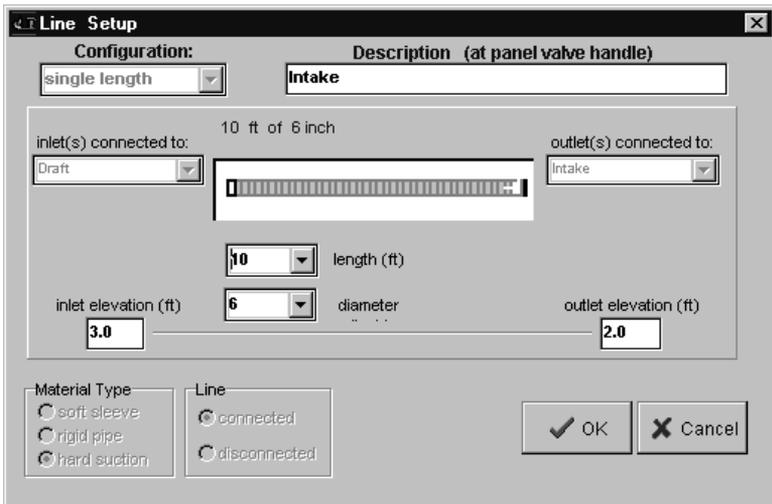
Hydrant Adjustment

up/down arrows to adjust flow.

The hydrant *rating* dot will reflect your adjusted flow. This rating reflects the rule of thumb that when hydrant pressure is down 10%, 1/3 of the available water is being used, and if pressure is down 25%, half the available water is used, etc. Selecting *Draft* will show the *Source* box options of *Lake/River*, *Swimming Pool* and *Dump Tank* which are: unlimited, limited non-refillable, and limited refillable drafting sources, respectively.

Selecting *swimming pool* or *dump tank* will display a box below showing the reservoir capacity (which you can edit), whether it will start full or start empty at the beginning of an evolution, and gallons remaining (you can refer to this while the evolution is in progress).

Set *Static psi/kPa* to the desired “no-flow” pressure of the source. When *Draft* is selected, the static psi is set to 0.0. If the external supply is switched from draft to hydrant or relay, static psi is set to a default positive value. *Elevation* of the supply will add to or subtract from the “no flow” pressure as measured at the apparatus intake. *Altitude* of the fireground above sea level has an effect only on drafting “lift”, where there is roughly one ft loss of lift per 1000 ft of altitude.



(Intake) Line Setup

The *Supply Hose* box at the upper right shows the basic configuration of the straight supply line. To change it, click on the green triangle, which displays the *Line Setup* screen. To change the intake valve label as it appears on the pump panel, edit *Description*. Dropdown boxes for hose *length* and *diameter* allow you to either select a value or enter you own. Note: you are *not* limited to hose

lengths in the dropdown box. *Inlet elevation* duplicates *elevation* on the supply setup page, and *outlet elevation* is the height at which the supply line meets the apparatus. ***Zero elevation is ground level***, that is, the ground on which the apparatus sits. All elevations in the Pump Trainer are with respect to this zero elevation. The *Material Type* box gives you the option of selecting soft sleeve, rigid pipe, or hard suction. Each of these materials has different friction-loss coefficients. Making this selection is currently only for reference, as material type is not “connected” to friction loss. Selecting *OK* will accept changes made, and *Cancel* will disregard them, and either selection causes the *Line Setup* screen to disappear.

The *Tank* box at the center of the supply setup screen allows you to set the initial volume of water in the apparatus’ tank (used only at the start of a simulation), and the tank capacity. The tank’s dimensions are modeled as a rectangular solid surface. *Tank height*, the height of that rectangular block, is used to calculate the tank’s contribution to supply pressure as seen by the pump, dependent on the current tank water level or height.

Supply/Relay Incidents

Selecting *Hydrant* (or *Relay*) will also display the *Incidents* box below it, which shows a list of selectable incidents to alter the supply during the course of an evolution. In order to use any incident, the box to the immediate left must be checked (or X’d) and a *start* time must be entered for that incident (when applicable). Neglecting either of these will

cause the incident not to occur. Also, only one incident may be active at a time. That is, do not allow incidents to overlap. Currently, there are no internal checks, so you have to keep track of it yourself.

Supply Fluctuates: To set the incident time, click on its green triangle, to bring up its setup box. Enter the simulation time at which fluctuation will start. Enter a stop time only if you want fluctuation to stop, otherwise it will continue throughout the simulation. *Fluctuation %* is the maximum amount the supply will fluctuate, as a percent of the original static supply pressure. The *Fluctuation Type* box allows a continuous sin wave fluctuation where you set the *period* or peak-to-peak time, or a *sporadic* fluctuation where the supply variations are random step changes within the set percent fluctuation and they occur somewhat randomly about a programmable *mean time*.

“Shifting” Supply: The shifting supply starts at the original set pressure, then shifts to a new pressure, presumably the result of poor flow to the hydrant and heavy usage nearby. To set any of three incident shift events, click on its green triangle, to bring up its setup box. Enter the simulation time at which shifting will start. Then enter the new static pressure to which the supply will shift, and finally enter the time at which the supply recovers (if it does recover) and reverts to the original static psi/kPa. Supply pressure can shift up to three times. If you use more than one shift event, fill in the events from the top, and do not overlap the start/stop times of each event.

Line Rupture: The line rupture results in a total loss of intake pressure. A line rupture has only a rupture start time, and is repaired when the operator selects *Actions/Check/Supply Line* and then *Actions/Replace/Supply Line*. To set the incident start time, click on the green triangle for line rupture, to bring up its setup box, and enter the simulation time at which the break occurs.

Kink in Line on Startup: A line kink has a start time of 00:00 (min:sec) and is repaired when the operator realizes there is a problem, selects *Actions/Check/Supply Line* , at which time he is prompted to fix the line.

Drafting Incidents

Selecting *Draft* will also display the *Draft Incidents* box below it, which shows a list of selectable incidents to alter the supply during the course of an evolution. As with hydrant incidents, in order to use them, the box to the incident's immediate left must be checked. Again, only one incident may be active at a time.

Loss of Prime: The incident start time must be set. Click on its green triangle and its setup box is displayed below. There are three opportunities to lose prime. If you plan for it to happen only once, enter the simulation time only in the top box. If you plan on two losses, use the top two boxes, and so on. Times must be entered with the earliest time at the top, and the latest time at the bottom. There are currently no program checks to make sure you do this

correctly. Naturally, whenever prime is lost, the operator must reestablish it himself.

Hard Suction Collapsing is specified as a “trigger” pressure, below which the suction line will collapse. When the operator notices a sudden drop-off in pressure at the intake or sudden cavitation, he should check the supply line using *Actions/Check/Supply Line* and then replace the hard suction using *Actions/Replace/Supply Line*.

When *Draft* and *Dump Tank* (in *Source* box) are selected, *Use Tender as Resupply* is available as an incident. Click on its green triangle to display its setup box. *First call response time* will be the time at which the tender first shows up (starting from the current simulation time) and discharges its load into the dump tank. Tender dumps are currently instantaneous. *Round trip interval* is the time between tender dumps.

3.2 Panel Setup & Panel Design Mode

Before a simulation is run, the panel is in setup mode and the panel controls are not accessible. The appearance of the panel can be changed in a number of ways, in both Panel Design Mode and the panel *Desktop Options*.

Panel Design

Choose *Setup/Panel* to display the menu of options available for panel manipulation. *Enable Design*, when selected, initiates “Panel Design Mode” and allows design of the panel. It also creates a new menu item, *Panel Design* just to the right of *Setup* on the main menu bar. *Open...*, *Save*, *Save As...*, and *Delete...* all refer to panel files to be read from or saved to disk.

Select *Enable Design* to enter Panel Design Mode and change the appearance of the current panel. When selected, it creates a new menu item, *Panel Design*, just to the right of *Setup* on the main menu bar. It contains numerous design options, which boil down to: adding or removing panel components, *dragging* panel components to new locations, and changing component colors and text. *Enable Design* is reset or deselected whenever a simulation is begun or new evolution loaded. The panel is designable only while *Enable Design* is set.

Panel components and other options are available through the four pop-up Panel Menus, one of which will appear whenever the right mouse button is clicked over the *Panel* screen. The menu displayed depends upon where on the panel you click. You get a different pop-up menu with a

right-click over a pressure gauge, over a valve handle, or over the temperature or oil gauge. A right-click anywhere else displays the main panel component pop-up menu, same as *Panel Design* on the main menu bar.

The *Panel Design* menu or main component pop-up allows you to choose from a number of components. See 4.2 *Panel Controls and Indicators* to view what's available. To add or remove a component, simply click on the desired component name on the menu. Discharges and Intake items have separate add and remove menus. For all other components, if that component has a check next to it, then it is already on the panel. Select a checked item to remove it, or an unchecked item to add it.

Up to 15 discharges are allowed. The number of discharges on the panel determines the number of configurable lines on the *Discharges* setup page. If you have an evolution loaded where the apparatus has 11 discharges, then you load a panel with 8, you will have just lost 3 discharges. When you add a discharge, a new gauge and valve handle will appear in the top left corner of the panel. As you drag the gauge to the new position, note that its title box moves with it. Similarly, when you drag the valve handle, its title box moves with it. The valve title box can also be moved by itself. The captions in the title boxes are changed with a right-click on the component, and selecting *rename* from its popup menu. Gauge color (white or black) is changed with a right-click on the gauge, and selecting the desired color. Valve type is changed with a right-click to the valve, and selecting a type. The quarter-turn valves can be selected as horizontal, vertical, opening

at the left, right top or bottom, and short or long. Also available is an electronic valve, (modeled after a Class 1 component), T-Handle, ball-pull, and rotary valve. Rotary valves can be selected as opening clockwise or counter-clockwise. When a discharge is removed through the menu, the one removed is the one that was last added, and all gauge and valve parts are removed.

Along with the discharges, and intake, are the hose-panel connectors under menu item *Hose Connections*. When using one of these menu items, the connector will be capped or not, depending upon whether that discharge line was setup as connected or disconnected.

Throttle selection is currently limited to two rotary vernier throttles (modeled after those on Pierce and Hale pump panels) and an electronic model (after FRC).

Relief valves and governors are used mutually exclusively-either one or the other. Relief valves used are those at the pump discharge side only, both manual and rotary valves. With the Waterous-style component is included a separate switch plate, from which you switch the pressure control system on and off. When you drag the main element, the switch moves with it. (The switch can be moved separately as well.) The Class 1-style governor has a preset pressure, configurable only in Panel Design Mode. Click the “pre” button (left) and enter a value in the pop-up window.

Foam components can be added only after a foam system is selected on the *Foam* setup page. When one is selected, then the *Foam Components* menu item is enabled. If a

foam system is selected and you do not add foam/CAFS components to the panel, those elements will be considered switched off. When foam is used, all of the foam menu items should be checked by the time you have completed the panel design.

You can add or remove an engine cooler, digital LED flowmeter (after FRC), engine temperature gauge, and oil pressure gauge--all “functional” components. The engine temperature and oil pressure components have a right-click option to *show indicator light* (or not) or to not make the gauge *visible* (i.e., remove the gauge).

Three indicator lights are selectable: check transmission, check engine and stop engine, which are currently not reactive in the simulator, but are useful to match the looks of your panel and orient other components. The department ID box (under menu item *other*), which normally contains your department name, can be selected as visible or not. This is the place where the word “cavitation” flashes during pump cavitation, if the ID box is visible and *Indicate Cavitation* is selected in the *Options* window. Also under *other* are two horizontal bars (wide and narrow) used strictly for looks, about which you can locate components.

The size and location of the panel itself can be changed. Just grab the corner of the panel window and drag the edge with the mouse to resize it, or grab the window’s title bar and drag it to move it. You will want to resize the panel if you are adding many components to, say, a default top-mount-sized panel. If you are running in the low monitor

resolution (see 1.6 Video Display), resizing is not a useful option.

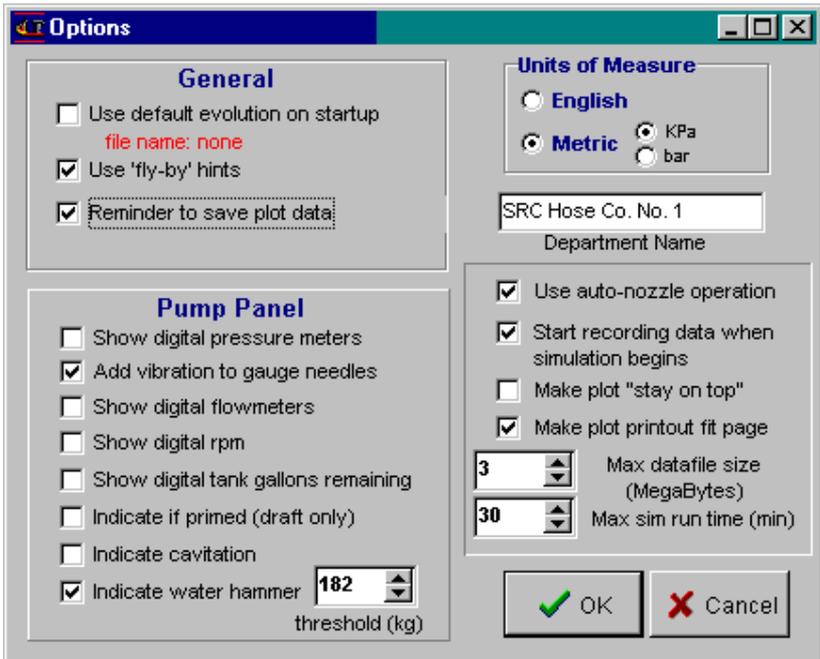
Once you have placed your components, select the *Setup/Panel/Save As...* menu item, and save your designed panel as a PNL file. If you want this panel associated with a given evolution, you need to have that panel loaded, then save your evolution under *File/Save* or *File/Save As..* . Once saved with an evolution, this panel will appear whenever that evolution is loaded. Also, different evolutions can use the same panel. If you modify a panel used by multiple evolutions, the panel will be changed in all of those evolutions.

Note: If you don't save your panel after making changes to it, your changes will be lost. If you save the evolution but not the panel, your changes will be lost.

Panel Desktop Options

Choose *Options/Desktop* to display the Options screen and a number of panel parameters, which are located in the *Pump Panel* box.

Select the *Units of Measure* as *English* or *Metric*, which all panel components will then display. If you select metric, also select the units for pressure, *kPa* or *Bar*. Also, type



Options Screen

your *Department Name*, which will appear in the Department ID Box, if it is visible on the panel (visibility is set in *Panel Design* menu).

When *Use auto nozzle operation* is selected, the Pump Trainer operator does not need to open nozzle valves in order to get water to start flowing. If there is water in the pump, it then flows when discharge valves are opened. All valves will start in open position at the beginning of each

evolution, but if you close them, they'll stay closed.

Start recording data when simulation begins, if enabled, will start logging data at the beginning of an evolution. All logging stops when the simulation is ended.

Make plot "stay on top" will cause the graph to be the topmost window whenever the graph window is open.

Max Datafile size and *Max sim run time* are automatic checks to keep the Pump Trainer from dominating your hard drive. *Max Datafile size* will cause the running evolution to terminate when the plot datafile reaches that size. *Max sim run time* will terminate the evolution after it has been running for that amount of time.

Use default evolution on startup will invoke an evolution and it's attached panel whenever the simulator is begun. Check the box to enable this option, and a file dialog box appears, from which you can choose your startup .EVO file.

"Fly-by" hints (or tool tips) causes little help information boxes to appear over selected images and text, when selected.

Reminder to save plot data, when checked, will display a dialog box before beginning a new evolution, asking the user if previous evolution plot data should be saved (or discarded).

Some might consider it "cheating" to see the flow of each

discharge line during operation, especially if your real-life panel has no such flowmeters. You can elect to see or not to see those flows, or any digital gauges on the pump panel by (de)selecting the “digital” items in the *Pump Panel* box. Pressure gauges can be given an irritating sense of realism by adding *vibration* to their needles.

When drafting, you can add an indicator that tells when you have achieved prime (located on the primer T-handle) by selecting *Indicate if Primed* (not really necessary if you watch the gauges). *Indicate cavitation*, if selected, will display a red and yellow message when cavitating, located inside the Department Name ID Box on the pump panel.

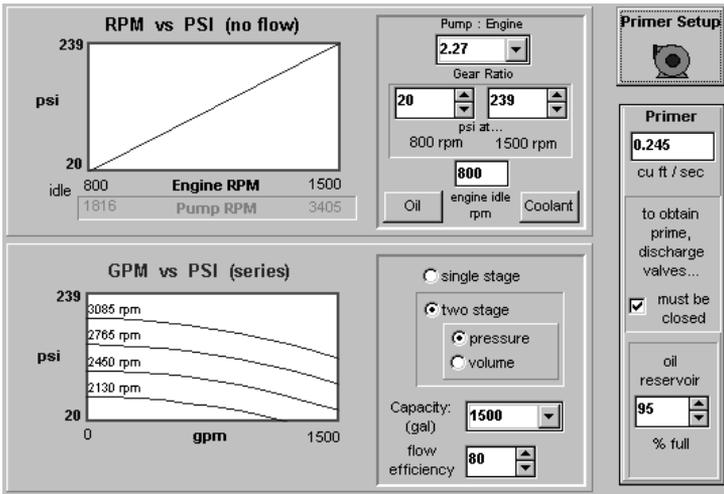
Indicate water hammer will activate the hammer sound (or show a text box if no sound is used) whenever a water hammer, of a magnitude of the set threshold or greater, occurs.

Selecting *OK* in the *Options* window will save these settings, and all of the settings on the *Options* screen will be used for the current evolution and every subsequent evolution, until the user changes *Options* values again..

3.3 Pump & Engine Setup

Pump characteristics can be modified by selecting a single-stage or two-stage pump, and modifying the pump *capacity* and its *flow efficiency*. Flow efficiency, as used here, is a relative measure of how much discharge pressure the pump loses as its net flow increases. When the efficiency value is set at 100, that represents an ideal pump, where no discharge pressure is lost as the flow increases.

The Pump Trainer pump can be configured as a single-stage or two-stage pump by selecting either the *single stage* or *two-stage* option. Choosing *two-stage* brings up a box below with the two-stage pump operation mode options of *pressure* (series) or *volume* (parallel). Volume mode is typically used when the pump is to deliver more than 50% of its rated capacity. Selecting *volume* or *pressure* will not



Pump Setup Page

change the pump to that mode--it only allows you to see the other curve. To switch between pressure and volume after an evolution is underway, the transfer valve must be used. Pressure is the default position. To start in volume mode, you can save an evolution switched to volume operation, and then reload it.

The RPM vs. PSI (RPM vs. KPA) curve always shows the linear (straight-line) relationship between RPM and net

pump pressure when there is no discharge flow. What this linear relationship means is that whatever factor by which the rpm is increased is the same factor by which the pressure increases, i.e., doubling the rpm doubles the pressure.

The GPM vs. PSI (LPM vs. KPA) graph shows how discharge pump pressure decreases as flow increases. It shows curves for selected pump rpms and how, for a given pump rpm, pressure is greatest when there is no flow and decreases with increasing flow. It also demonstrates that as rpm changes, the “current” pump curve (dictated by the current pump rpm) is just translated up or down.

The pump capacity determines the flow at which and past which the pump begins to very rapidly decrease in pressure. The GPM vs PSI (LPM vs KPA) plot currently does not reflect this sudden drop-off in pressure at the pump capacity, but it is accurate up to the pump capacity.

Engine rpm and pump rpm are related through the *pump:engine ratio*, usually found on a plate on the pump panel of a pumper. Increasing this value will increase pump pressure for a given rpm. The RPM vs. PSI curve shows both engine rpm and pump rpm along the same axis. Note that pump rpm values are engine rpm values multiplied by the pump:engine ratio.

Engine idle rpm is the engine rpm at idle when the pump is filled with water. Before the pump is charged, engine rpm will be more than twice the charged pump rpm.

Setting the “psi at...” values will adjust the pump operating pressure. The left box will be the net pump pressure at engine idle, the right box is pressure at some arbitrarily higher (1500) rpm. These values shape your pump curves, specifying pump characteristics. Both values appear as the minimum and maximum pressure of the two pump curve graphs.

The *primer setup* button allows adjustment of the rate at which the primer pump pumps, in cubic ft per second. The higher this value is, the faster it will evacuate a given length of hard suction. *Discharge valves must be closed* gives you the option between a pump, which requires all valves closed to draft, and one which does not. The *primer oil reservoir* can be set below 5% full to disallow priming, in which case the operator would have to use *Actions/Fill/Primer Oil Reservoir* and then see if prime can be established.

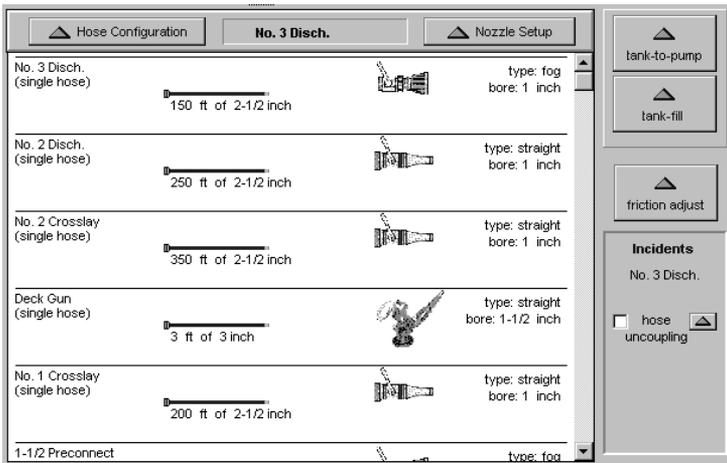
The *Oil* button will bring up the engine oil box (underneath the *Primer Setup* button) when clicked. There you can set the engine oil pressure value, at which it will stay throughout a simulation, unless the bottom *lose pressure at...* box time is set. If set, the oil pressure drops to 0.0 at the set time. Also, the *warning light* (if visible) will switch on at any pressure below the pressure set in its box.

The *Coolant* button will bring up the engine coolant box (also underneath the *Primer Setup* button) when clicked. There you can set the initial engine temperature value. Beneath it is the warning light trigger temperature box. The temperature warning light switches on (if visible) when

the coolant goes above that value. See *Engine Temperature and Engine Cooler* for modeling of engine heating.

3.4 Discharges Setup

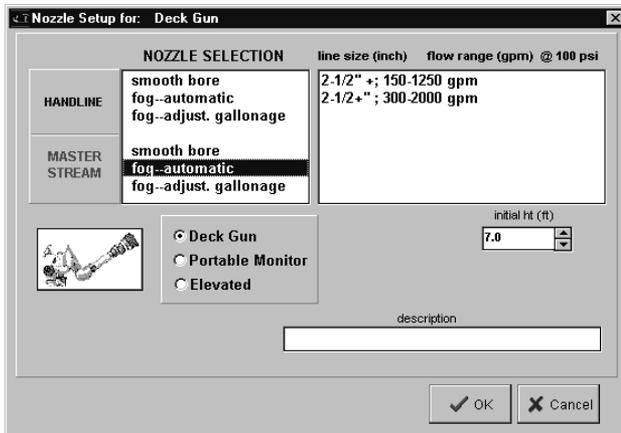
On the *Discharges* page, configure a discharge hose by clicking on the hose of a given line (left side of the page), and then selecting the “hose configuration” button. (Alternatively, double-click on the hose.) This will bring up the *Line Setup* window, where you can adjust hose



Discharges Setup Page

parameters as needed. If a siamese connection is used, the *inlets connected* to list boxes must show the siamese inlets connected to different discharge valves. The dropdown list box will only show discharge valves that are available, that is, disconnected. If a wye configuration is used, it is assumed that there are identical nozzles connected to the hose outlets, both nozzles opening and closing simultaneously.

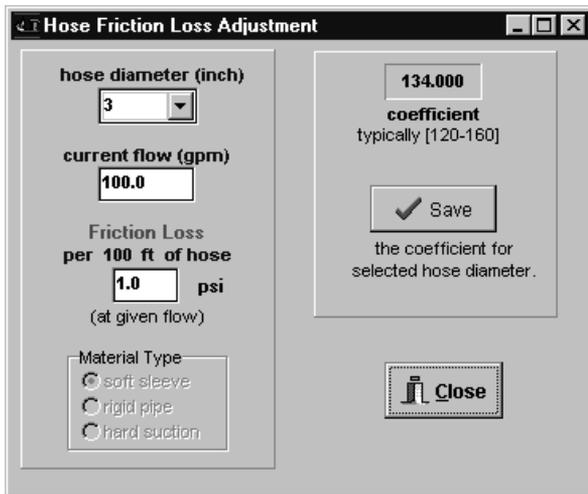
To configure a nozzle, click on the nozzle of the desired line and click on the “Nozzle Setup” button (or just double-click on the nozzle). This activates the *nozzle setup* window. Here you can select a smooth bore or fog nozzle



Nozzle Setup Window

for *handline* or *master stream*, then choose bore size or other nozzle specifications.

Friction loss can be adjusted for hoses. Click on the *Friction Adjust* button. The default friction losses were taken from an IFSTA reference, but these values vary greatly from the theoretical, mathematical model and there



Friction Adjust

are great discrepancies between various references. Therefore, Pump Trainer friction losses have been made adjustable. There is a separate coefficient for each hose diameter, each adjusted individually. You can change the coefficient for only one diameter, if that is the diameter, which disagrees with your data. To make an adjustment, select a diameter and the flow for which you know the friction loss. Enter that friction loss in the lower box, then click the *Save* button.

Hose uncoupling incident will occur when the hose-uncoupling box (under the friction adjust button) is checked, and a time is set for uncoupling a specific hose.

The active hose is named in the box. To change the active hose, just click on a discharge hose or nozzle on the discharge setup screen, and that line then becomes active. Then click the green setup triangle, and type in the desired uncoupling time into the incident box that appears, and click OK. You may want to trigger a radio call at the same time to the effect of “loose hose flying around”. Only one hose per evolution can uncouple. The result of uncoupling is very heavy flow and discharge pressure loss. To correct the situation, the operator should “look” at the line using *Actions/Check/Discharge Line*, then shut down that line, and use *Actions/Reconnect/Discharge Line*. When a hose-uncoupling incident is used, the word hose uncoupling is red; you don’t have to check every line to see if that incident has been used.

3.5 Foam Setup

Click the *Foam* notebook tab to show the *Foam Setup* page. The foam system selection buttons will display a setup

No Foam

Balanced Pressure

Direct Injection

In-Line

Changes on this page are changes made to the current panel. Changes are retained when the panel is saved. Enter "Panel Design Mode" to add foam components to panel.

Direct Injection

number of foam tanks

 1
 2

tank switch type

 manual
 electronic /toggle

Compressed Air Foam (CAFS)

CAFS installed

 Yes
 No

foam percent range

 0.1% to 1.0%
 0.1% to 6.0%
 1.0% to 6.0%

proportioner style

 manual / rotary
 electronic

select discharge lines that use foam:

No. 3 Disch.
 No. 2 Disch.
 No. 2 Crosslay
 Deck Gun
 No. 1 Crosslay

1-1/2 Preconnect
 No. 1 Disch.
 Ladder

capacity of single foam tank (gal)

Foam Setup Page

page for each system. “No Foam” is default. The Direct Injection systems allow you to select which lines are connected to foam. It also allows compressed air foam system (CAFS) components. After this page is setup, you must enter Panel Design Mode to install the components onto the panel, or else they will be considered switched off.

Also, changing from one foam system to another, using the foam system select buttons causes the previously installed system to be removed.

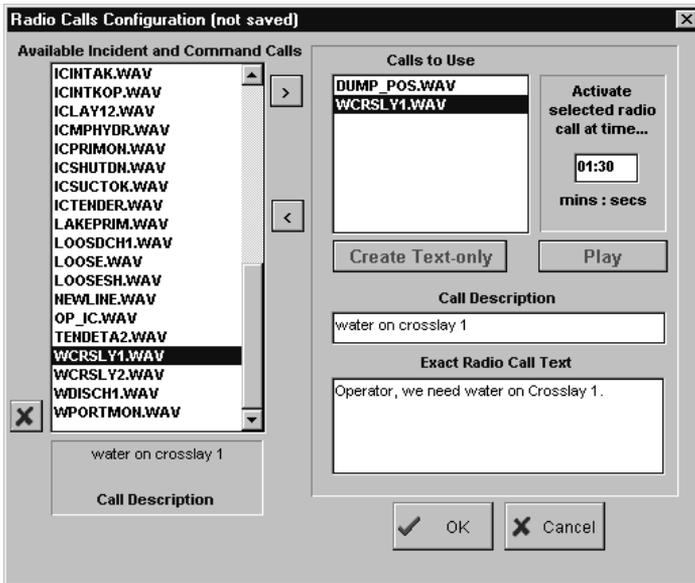
3.6 Radio Setup

Radio calls take two forms in the Pump Trainer: random calls (basically radio noise) and incident and command (I&C) calls.

Random radio calls are switched on and off in Options|Sound, and usable only with a sound card. All .WAV files with the name of callXX.wav (XX= any two digits 00 to 63) and located in the sound directory are played at random to simulate radio traffic. You can record your own random calls to be used in the Pump Trainer using Windows’ *Sound Recorder* and a microphone in your sound card, or any digital audio recording system that produces a .WAV file. It is recommended you do NOT record in stereo, as the sound files created are twice the size of those in mono. Also, keep each recording short but use multiple calls in succession to decrease sound file loading time, and to minimize interruptions of the simulation.

Even if you have a sound card, you can also use text files. These files are saved as Wave Text (.WTX) files in the sound directory. Creating a WTX file is a little simpler and

faster than adding WAV sound to the evolution. You can create a WTX file by clicking the *Create Text-Only* button.



Radio Calls Configuration Screen

This saves an empty file. Next, type a short description or caption in the Call Description box, and the incident or command in the *Exact Radio Call Text* box. If you want to include this file in the current evolution, type in a time for the call, otherwise remove the file from the current play list with the “<” button.

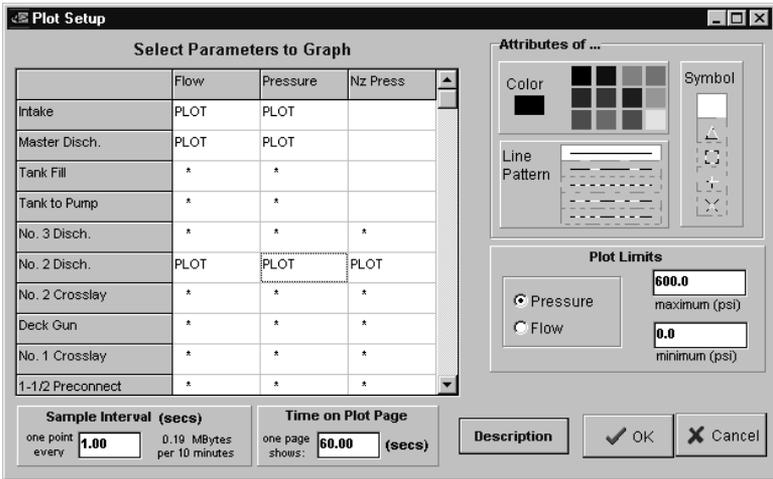
Incident calls are those that inform the engineer that something has occurred to which he must respond, like a tender dump or a portable monitor flying loose, etc. Command calls are directives or descriptors, instructing the engineer to open lines or feather a valve to give a certain pressure at a nozzle, or just describing a scenario or environment. If a random call is playing when an I&C call is scheduled to play, the I&C call will interrupt the random call; I&C calls have higher priority. Open the *Radio Calls Configuration* screen using *Radio/Configure*. On the left, you see all the sound files available to the current evolution and currently available for I&C calls. To use one of those files, click it to select it, then click the “>” button to send it to the *Calls to Use* box. You can use the same call multiple times by clicking the “>” button more than once, and assigning a play time to each file. Select it in the *Calls to Use* box, then enter a time in *Activate selected radio call at time* box to determine when that file will play. Calls in this box are sorted according to time. Note: it is up to you to program the playtimes so they don't overlap; Pump Trainer does not do such checking. If you do not have a sound card or you have switched the sound off within Pump Trainer (*Options/Sound*), then the text you see in *Call Description* and *Exact Radio Call Text* will appear in a small center-screen window at the radio call time. That text should be basically a caption *and* a transcription of the WAV file speech. The collection of sound and text call filenames that you use in an evolution are saved in an incident & command text (.ITX) file in the evolution directory. This file is saved by Pump Trainer with the same root name as the evolution. For that reason, you must have a saved evolution first before you can save the accompanying ITX

file.

Like the random radio calls, you can create your own I&C files by recording them and placing them in the sound directory using any valid name of the form *.wav, as long as the name does not include “call” (to distinguish it from random calls) and does not begin with the letter “z” (reserved for program “system” sounds). Earlier releases required that the I&C wave file name start with “ic”, but this is no longer the case. When you do create new calls, bring up the Radio Calls Configuration screen and assign text to the files. Even if you do not save the I&C’s evolution file with *OK*, any text you entered, associated with each WAV file, is saved as you assign that text.

3.7 Graph Setup

Graphs or plots allow inspection of operator and pump activity. The plot can be an online “strip chart” to follow activity at the time it occurs, or the plot can be evaluated at a later time after saving the data to disk. The format of the data, i.e., which data are plotted, the interval between sample points, plot colors, etc. can be determined before, during, or after the simulation in which the data is collected. This graph setup is accessed under menu item *Setup/Graph* or by clicking the graph button on the bottom control bar (which displays the graph window) and then clicking the *Setup* button, which causes the *Plot Setup Window* to appear. Data is regularly collected if *data recording* is enabled. Data recording is enabled “automatically” at the beginning of a simulation and switched off at the end if *the Start recording data when simulation begins* box is checked in the *Options/Desktop*



Plot Setup Window

window. If you do not want to start recording at the beginning, leave that box unchecked and when you reach the point in the simulation where you do want to record, check *Options/Data Records/Start*. You can shut down data recording at any time using *Options/Data Records/Stop*. The regular time interval at which each data point is collected is called the sample interval (in the *Sample Interval* box), which may be as short as once every 0.5 sec. The volume of data collected is determined by the sample interval value, and the rate of data collection on disk is displayed on the right in the sample interval box, as the number of megabytes per 10 minutes. “Data point” as used here means all data collected at a specific simulation time.

All data collected is shown in the scrollable *Select Parameters to Graph* grid on the Plot Setup window. Each item of data collected can be plotted, and all such items that can be plotted, has its own cell (or box) with either an asterisk (*) or the word “PLOT” inside it. Double-clicking a cell toggles between “*” and “PLOT”. PLOT” means

that that item will show up on the graph. Whether “PLOT” is selected or not for a given plot parameter, that data is still collected throughout the simulation, so you can still review the data later, offline.

The length of time shown on one graph page is determined by *Time on Plot Page* box. When data is being collected and when simulation time reaches the time at the end of a page, that page of data collected is then saved to disk. If the simulation is terminated, or *Options/Data Records/Stop* is selected, any unsaved data on a page is saved to disk.

For an individual plot parameter, you can select a color, a line pattern and a symbol for each. To do this, click on the cell of the plotted parameter to highlight it. The color of that plotted line appears under the word “Color” in the box at the top and to the right. Line pattern and symbol for that parameter are highlighted in the adjacent *Line Pattern* and *Symbol* boxes. Line pattern may not be discernable until the scale of the plot is enlarged, by reducing “Time on Plot Page”.

Units of plotted parameters are either pressure or flow. When a cell in the *Flow* column of *Select Parameters to Plot* is selected the Plot Limits box selects Flow, and the current maximum and minimum limits of flow are displayed. Similarly, when a cell in the Pressure column is clicked, Pressure is selected in the Plot Limits box. Any parameter which exceeds a plot limit is displayed as the limit value, and appears as “bottoming-” or “topping out”. Use plot limits to expand a plot area of interest.

After the simulation is completed, different parameters can be chosen for plotting, as well as different plot attributes and the time on the plot page. (Sample interval is not accessible.) This allows you to customize your charts to complement your plot data.

3.8 Burn-House Setup

The burn-house model within Pump Trainer allows you to simulate simple structure fires of various dimensions, where the structure model has a single [equivalent] vent. Adjust structure *length*, *width* and *height*, vent *area* and effective *height* from ground level. % *Efficiency of applied water* is determined by a number of factors. If you

Structure	
structure description	old warehouse
Stay On Top	<input checked="" type="checkbox"/>
length (ft)	100.0
width (ft)	40.0
height (ft)	30.0
area (sq. ft)	56.3
height (ft)	15.0
% efficiency of water application	10.0
fire load (lb/sq. ft)	<input checked="" type="radio"/> 5.0
total enclosure fire load (lb)	<input type="radio"/> 20000
approx. burn time, fire severity (hrs)	5.7

Burnhouse Setup Window

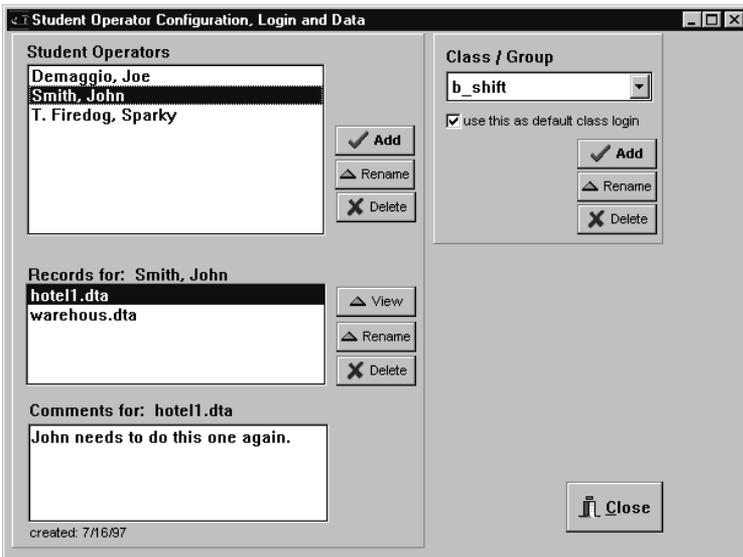
use foam, increase the water efficiency. Equivalent *fire load* is a measure of combustibles in the structure, which can be set as either lb/sq. ft or total lbs within. Enter a *structure description* for your own reference. *Stay on top* will make the burnhouse window the topmost window as long as it's displayed. Approximate burn time, or fire severity is calculated from all the factors set in this window.

This burn time is the time at which the combustibles are 100% burned. The *save* button will apply these settings to

the current run of the current evolution, however, they will not be saved to disk until the evolution is again saved.

3.9 Student Operator Setup

Select *Data Records/Students/Configure* to open up the *Operator Configuration, Login, and Data* window. Here you can configure a group, class or classes of operator trainees. Names you add become legitimate login names, which Pump Trainer will ask for on each startup, once a class (of 1 or more) is created. On program startup, only



Operator Configuration, Login and Data Screen

one class is searched for the login name, and that class is either the class which uses *use this as default class login* (checked), or its the first class listed alphabetically. The only reason for logging in is to collect performance data under an operator's name. You can still generate graphs without logging in (just press ENTER when the login

window appears). Also, the login screen will appear automatically only if a class has been created. When Pump Trainer starts up, the student logs in and his performance data is saved under his name, which you access through this screen. When a simulation is running and data recording is switched on, data is stored in the student's directory into a data file "tmp.dta". When starting a new simulation or exiting the program, you will be prompted to change the temporary data file name. If no one was logged in, the default directory is "recs", and at the end of the evolution, you can change the name of that data file by using menu item *Data Records/Save As*.

Chapter 4: Operations

4.1 Overview

After the evolution is set up, the simulation is ready to start, the evolution and panel saved. Click the green stoplight button and begin. The panel controls become activated.

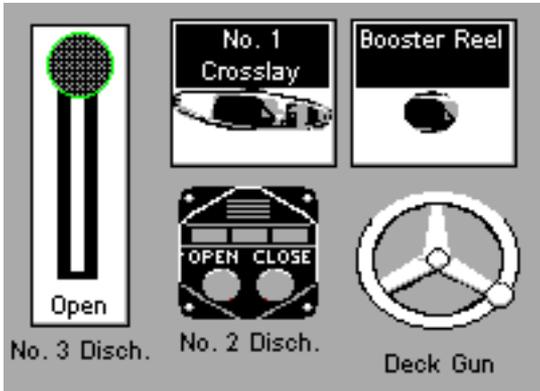
The simulation starts with all discharge valves closed. All pressure gauges read “zero.” If a positive-pressure supply is connected, the intake gauge will show that pressure when the intake valve is opened, plus any elevation gain. The master discharge gauge will show that pressure plus the net pump pressure. Adjusting the throttle will change the net pump pressure and the discharge pressure. To get flow, you need to open a discharge valve and the corresponding nozzle valve. (Master stream valves are always open.)

To monitor nozzles or to open and close nozzles, click on the nozzle button at the bottom the main window, which brings up the nozzle window. The elevation, nozzle pressure and % open are shown at the top for the selected nozzle. To select a different nozzle, click that nozzle. To adjust the nozzle valve, drag the nozzle valve handle to the right or left. If a line was setup as not connected, that nozzle will not appear.

To view the graphed statistics generated during the simulation, click on the graph button at the bottom of the main window. Then select the graph *setup* button to change plotted parameters. After the simulation (i.e., stop button pressed), a scrollbar appears at the bottom middle of the graph window, which is used to scroll the graph from start time to finish time.

4.2 Panel Controls & Indicators

Discharge Valves: To open a vertical ball-end (quarter turn) discharge valve, *click* on the ball of the valve handle and *drag* the handle downward. For valve T-handle or ball-pull handle, drag the valve handle downward or to the right, or both.



Discharge Valve Handles

Primer Pump: To operate the primer pump, click on the primer t-handle, and it will brighten, denoting it is switched on. If a sound card is installed, you will hear a high-pitched whine. If “indicate when primed” (*Options/Desktop*) is selected, the primer has a text label at its base denoting its primed state (displayed only if drafting).



Transfer Valve: To use the transfer valve to change from pressure to volume, *click* on the toggle button and *drag* downward and hold for about 4 seconds. When the “VOL” light is lit, the transfer is complete. To change back to pressure, drag upward and hold. When a single-stage pump is installed (*Pump/Engine* setup page), the transfer valve panel component disappears.



Tank level: The Tank level indicator shows green lights up to current tank level. It starts off at initial tank level, set on the *Supply/Tank* page.



Throttle: To operate the Pierce- or Hale-style vernier throttle, place the mouse cursor anywhere inside the throttle assembly. To increase throttle, *drag* in a counter-clockwise



Pierce



Hale



FRC

Throttles

direction. The current rpms appear on the tachometer. To decrease rpms, drag clockwise. To operate the throttle, you do *not* need to stay in the throttle box, but you must start

the drag there. The FRC-style throttle increases or decreases RPM by clicking or click-and-holding on the up or down arrow buttons. Click on the *Idle* button to bring the engine to idle speed.



Waterous

Relief Valve: To switch on the Waterous relief valve, *drag* the relief valve on/off switch to “ON”. *Drag* it to “OFF” to switch it off. Once it is switched on, either the red or green relief valve indicator lights will be lit, depending on the discharge pressure and the relief valve set pressure. To



Waterous Indicator

adjust the set pressure, rotate the relief valve knob by dragging clockwise (increase pressure) or counter-clockwise (decrease pressure).

The Hale-style relief valve mechanism is switched off until it is rotated to any positive pressure position.



Hale

Governor: The Class 1-style governor is switched on at the start of the simulation. Its display shows either “R=“ or “P=“, denoting RPM or



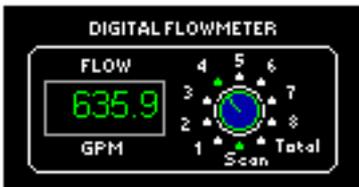
Class I

Pressure mode of governing. Mode is selected by clicking the *Mode* button. Click the *Idle* button to bring the engine to idle. *Decr* and *Incr* decreases or increases RPM or pressure, depending on the current mode selected. The left side button, labeled “pre”, is clicked to change to a preset pressure or RPM (set in Panel Design Mode).

The other selectable governor functions similarly, but has toggles instead of pushbuttons. Its *Warning* light is currently not functional.



Flowmeter: The flowmeter is switched on at the start of the simulation. To monitor a particular discharge/channel up to 8 discharges, click on that number on the flowmeter face. For the default top-mount panel, “1” corresponds to “No. 3 Discharge” (the default leftmost valve), “2” represents the next valve to the right, and so on to the



8th discharge valve. If you design a panel which does not have a strict left-to-right orientation, you will want to place the valves in a logical manner on the panel, or simply remember which valve is assigned to which flowmeter number. You can see these numbers in design mode when you right-click on the corresponding gauge, and in the pop-

up menu which appears is the number of the discharge line in the *rename* menu item, in parentheses, i.e., “rename: Deck Gun (#4)”. Click on flowmeter *total* for total discharge flow, or *scan* to advance to the next discharge every few seconds.

Oil Pressure: Oil pressure is basically a “set” value (*Pump/Engine* setup) unless a *loss of oil pressure incident* has been programmed. When the pressure goes below the indicator light trigger pressure (*Pump/Engine* setup) the low-pressure indicator light will switch on (if it has been selected as visible).



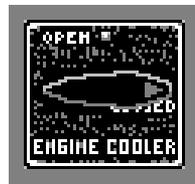
Engine Temperature and Engine Cooler: Engine Temperature will increase to a stable idle temperature within a couple minutes of operation. Engine operating temperature increases with increasing rpm. When the indicator light trigger temperature (*Pump/Engine* setup) is reached, the light is switched on.



Engine Temperature Gauge

The style of engine cooler modeled is a heat exchanger between the pump water and engine coolant. When the engine cooler is switched on, the engine temperature will start to approach the pump temperature. If there is

The style of engine cooler modeled is a heat exchanger



Engine Cooler Switch

no water in the pump or the engine cooler valve is closed, then the engine will not be cooled at all. If the pump is not recirculating “new” water, the pump temperature rises and the engine cooler can cool the engine only as low as the pump temperature.

The engine can also be cooled by recirculating using tank-fill and tank-to-pump valves.