

KLASS User Guide

LiveCD Release Version 1.1

KLASS Release Version 2.2.0

TEACHER WORKSTATION OPERATION 2

Starting the Simulation Model Control (SMC) Interface..... 2

SMC Interface Operation – Running the Simulation 4

Overriding Launch Holds 8

Troubleshooting Tips 10

WORKING WITHOUT THE KLASS LIVECD 12

Starting the SMC Interface 12

Terminating the Simulation Model Interface (Modelserver)..... 12

STUDENT WORKSTATION OPERATION 13

KLASS Display Startup 13

Subsystem Display Interface..... 14

KLASS Display Shutdown 14

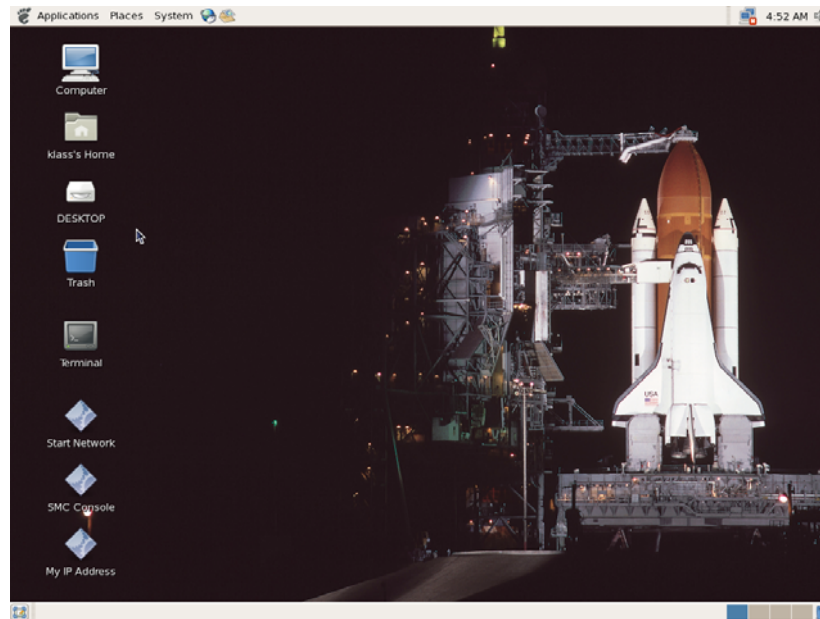
Troubleshooting Tips 15

Teacher Workstation Operation

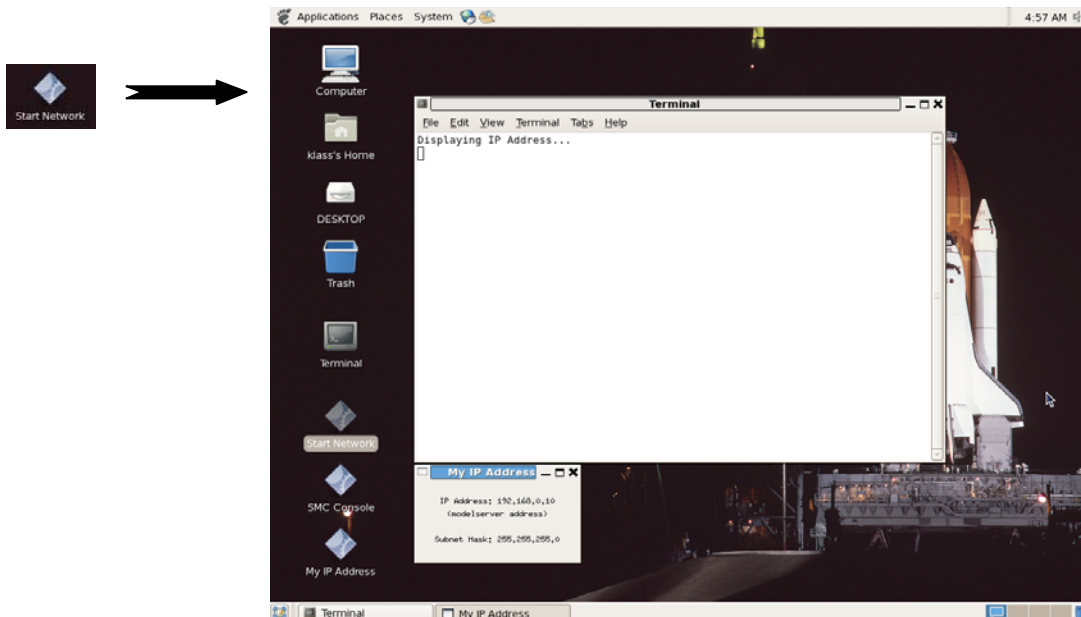
Starting the Simulation Model Control (SMC) Interface

1. **Boot your computer from the KLASS LiveCD.** If you're not sure how to boot your computer from a CD, see the Troubleshooting section for some ideas or contact your network administrator.

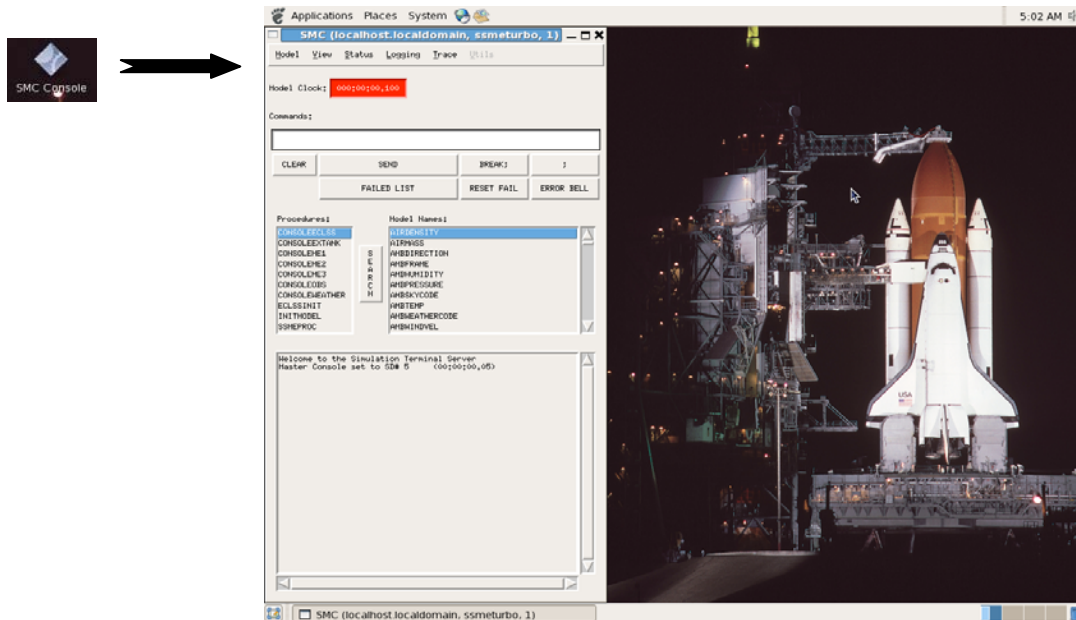
When your computer finishes its boot-up process, you will see the KLASS Desktop.



2. **Double-click on the Start Network icon.** "Start Network" sets up networking for the Teacher Workstation and assigns it an IP address of 192.168.0.10, which you will use as the "modelserver" address when setting up the Video and Student Workstations. An IP Address window should appear if the network started successfully. You can close this window and proceed to Step 3.



3. **Start the SMC.** If Start Network was successful, you can start the Teacher Console by double-clicking the SMC Console icon on the Desktop. A Terminal window will open, execute some commands, and then close. A new window, the SMC interface (or Teacher Console) will appear after a brief pause. This entire process may take from 10 seconds to 2 minutes.



SMC Interface Operation – Running the Simulation

The following steps take you through the process of running a launch simulation from beginning to end. These steps are the same whether you use the LiveCD or a full installation of the Teacher Workstation software.

- STEP 1 Enable those systems that will participate in the launch.
- STEP 2 Initiate the launch simulation from the SMC Interface.
- STEP 3 Start the Video Player on the Video Workstation (optional). If you're not using the Video Player, enter the command `A 50 SLPTIM ;` in the SMC Commands window.
- STEP 4 Start the Student Consoles.
- STEP 5 Students correct main engine anomalies or any other anomalies that come up.
- STEP 6 Launch resumes (unless another anomaly causes a hold condition).

The remainder of this section elaborates on the above steps to give you a better understanding of what is happening during the launch simulation. It is important to read through each of the following steps and understand them well before attempting to run a full launch simulation in the classroom.

1. On the SMC window, enable those systems that will be participating in the Launch Countdown. These are the MCP's (Model Control Procedures) labeled:

Procedures:	CONSOLEECLSS (Environmental Control and Life Support System)
CONSOLEECLSS	CONSOLEEXTANK (External Tank)
CONSOLEEXTANK	CONSOLEME1 (Main Engine One)
CONSOLEME1	CONSOLEME2 (Main Engine Two)
CONSOLEME2	CONSOLEME3 (Main Engine Three)
CONSOLEME3	CONSOLEOBS (Operational Biomedical System)
CONSOLEOBS	CONSOLEWEATHER (Weather console)
CONSOLEWEATHER	
ECLSSINIT	
INITMODEL	
SSMEPROC	

These systems are all defaulted to OFF so the Launch can be performed in "Spectator Mode" if desired. Spectator Mode allows the countdown to continue through launch without any need for intervention.

To enable/disable a system for student control and participation, right-click on one or all of the selections above (in the left window of the SMC). A pop up will appear to which you respond by clicking the top "SEND" button. This "toggles" the particular system participation state to ON. If you want to shut the system back OFF, click on the SEND button again.



Systems that do not participate *must* be left in the OFF (or default) state. If they are turned ON, then that particular console must be brought up on a Student Workstation and "manned" because the system will cause a launch HOLD scenario which must then be corrected by the student in order to continue the launch countdown. The CONSOLEME1 MCP should always be enabled.

Once the above systems have been enabled/disabled, you are ready to bring up the corresponding student machines for all systems that are in the ON (enabled) state. Student machines can also be brought up for disabled systems if the students prefer to just monitor a system.

2. On the SMC interface, under "Procedures:" right-click on the "initmodel" procedure. When the pop-up appears, click "SEND".
3. If you have the KLASS Video Player installed on one of your PCs, start it by double-clicking its shortcut icon. Once the Video Player appears, the launch video should immediately load in a halted state indicating "Launch Status: Hold".

NOTE: If the model (on the Teacher Workstation) is restarted or if you need to restart the Video Player, you *must* terminate all the Video Player processes that may still be running. Once the Video Player is completely shut down, you can run the Video Player again to re-establish communication to the model. The Video Player runs as three separate processes: KLASSVideoPlayer.exe, SimDev.exe, and SimCMDR.exe. All three processes should be terminated. You can terminate them with the Task Manager by depressing CTRL-ALT-DEL keys, choosing Task Manager, selecting the Processes tab, right clicking on each process listed above, and choosing "End Task". An alternative method would be to reboot the Video Player machine.

The above steps 1 through 3 do the following:

- Connects all Main Engines to the Marshall Space Flight Center (MSFC) engine test stands. In this mode, the Main Engines can be started and tested without using propellants from the External Tank. The Engines are "remote". The purpose of this is to allow students to troubleshoot anomalies in the engine and calculate the correct parameters needed for proper engine performance before applying these parameters to the Shuttle they are about to launch.
- Starts the overhead projector video (if present) which will display "Launch Status: HOLD"
- When the proper parameters have been entered, the engine thrust will be around 425,000 Pounds Force. The engine will continue to run for 30 seconds after which it will automatically shut down and the engine parameters will then be applied to the engines of the KLASS Shuttle on the KSC launch pad.

If you are not using the Main Video Player as a part of KLASS, then at the SMC "Commands:" window enter the following:

```
A 50 SLPTIM ;
```

Then click on the "SEND" button. If your simulation runs too fast, increase the value to 60. If your simulation runs too slow, decrease the value to 40. You should experiment with different values to find the optimum value that makes the simulation run "real-time" on your particular computer.

4. Start the Student Workstation displays as outlined in the "Student Workstation Operation" section. On each individual PC, open one of the enabled subsystem displays from the KLASS main display.

5. At this point, students should make adjustment to Main Engine #1 to obtain proper engine thrust on the MSFC test stand. When proper parameters have been entered, the "initmodel" procedure will terminate after auto-starting SSMEPROC.

The engine controller (SSMEPROC) will autostart the engines at T-6 seconds. The ssmeproc MCP MUST be active for autosequence to occur. Engine HOLDS will be disabled since the correct parameters have already been entered.

While Engine testing has been underway, other systems will also cause HOLDS in the countdown. Holds are caused by Launch Commit Criteria (LCC) violations and they can be caused by out of limit values (anomalies) in the model and must be fixed by the students. LCC holds can be caused by any number of system problems. The overall LCC summary list, by system is as follows:

- **Main Engine problem** (1, 2, and 3) (corrected by students during remote testing and diagnosis)
- **External Tank problem**
 - ET GOX (gaseous oxygen) Vent Arm (beenie cap) retract command not given at the correct time.
 - ET GOX pressure is too high, or too low. (this must be monitored and periodic action taken by the student)
 - Fuel or Oxidizer tank sensor failure or incorrect state (must be corrected by the student)
- **Environmental Control and Life Support System failure**
 - Cabin temperature is too high, or too low.
 - Circulating Fan inoperative ("Fuse Blown")
 - Equipment overheating
 - Fluid leaks (flow problems)
 - Heat Exchanger Problem
 - Temp/Time predictions

SPECIAL RELEASE NOTE for KCLASS Version 2.2.0:

Upon initial startup of ECLSS or any time the fuse is replaced, the teacher must use the SMC console to set the FANRESTART model variable to the ON state. This is accomplished by scrolling down the "Model Names" window, until this model variable is found. Left-click the model variable name to select it then right-click it to produce the commanding pop-up. Left-click on "SET", then "ON". This workaround will be implemented as a button command on the ECLSS display in a future release

- **Operational Biomedical System**
 - Manual "HOLD LAUNCH" button if the student detects a problem with Astronaut vital signs.
- **Weather System**
 - Manual "HOLD LAUNCH" button if student detects possible problems with weather conditions.

The KCLASS system will support launch hold anomalies as described in this Guides as well as any number of other anomalies introduced by teachers as they become increasingly familiar with KCLASS.

6. Upon correcting all problems in all enabled systems, the countdown clock will automatically restart at the point where the hold occurred. If no other hold conditions arise, the launch will pass through the T-31 second point at which time, the KLASS internal autosequencer will inhibit any further holds and the class will experience a successful launch and ascent to orbit. Launch narration on the video projection system will also enable the class to compute velocity, acceleration, and trajectory of the vehicle over time from launch to orbit.

When the simulation is complete, the overhead video will "freeze" shortly after ET separation in orbit. The model will also slow to a crawl and fall out of realtime.

If you wish to run the model again, refer back to the steps under "Teacher Workstation SMC Interface Operation."

Overriding Launch Holds

Since KCLASS models are models of real world systems and devices, it is possible that incorrect student inputs over time can result in a "non-recoverable" model situation where the model is HOLDing launch and the amount of effort to get the model back into a correct state would either take too long, or restarting the entire simulation inconvenient. In this case, if desired, the particular model can be "disconnected" from the simulation.

On the SMC screen, scroll down to one, or more, of the following model names (in the Model Names list box) and right click on the name. Choose FAIL on the pop-up menu, and set the name to OFF.

Model Names:

HEATXCHGREFFICIENCYW2F
HOLDCLOCK
HOLDCOUNT
HOLDCOUNTBIO
HOLDCOUNTECLSS
HOLDCOUNTET
HOLDCOUNTME1
HOLDCOUNTME2
HOLDCOUNTME3
HOLDINHIBIT

System	Model Name
SSME1	HOLDCOUNTME1
SSME2	HOLDCOUNTME2
SSME3	HOLDCOUNTME3
ET	HOLDCOUNTET
ECLSS	HOLDCOUNTECLSS

Procedures:

CONSOLEECLSS
CONSOLEEXTANK
CONSOLEME1
CONSOLEME2
CONSOLEME3
CONSOLEOBS
CONSOLEWEATHER
ECLSSINIT
INITMODEL
SSMEPROC

SEARCH

Model Names:

GOXPRESSRELIEFCMD
HEATXCHGREFFICIENCYW2A
HEATXCHGREFFICIENCYW2F
HOLDCLOCK
HOLDCOUNT
HOLDCOUNTBIO
HOLDCOUNTECLSS
HOLDCOUNTET
HOLDCOUNTME1
HOLDCOUNTME2

DISPLAY
SET
FAIL
RESET FAIL
TRACE
RESET TRACE
Model Name Info

ON
OFF

Welcome to the Simulation Terminal Se
Master Console set to SD# 5 (00:0

This will allow the countdown to continue if the particular system is responsible for the launch HOLD condition. Keep in mind, however, that since the particular system is not doing its job correctly, other systems could be affected in which case the remaining countdown and launch may not proceed correctly. For example, if SSME3 is not running correctly, the ET fuel consumption profiles will be affected and M.E.C.O (Main Engine Cut-Off) will not match what is displayed on the overhead projected video, and would also not occur at T+8:32 on the countdown clock.

Troubleshooting Tips

While the LiveCD has been tested on several different types of computers, there is always the chance it may not work on your particular hardware. There could be incompatibilities with certain video cards, displays, network interfaces, or pointing devices. Sometimes there are simple workarounds but there will inevitably be some computer configurations that just cannot run the LiveCD. If this is the position you find yourself in, you may need to install the full version of the Teacher Workstation on a dedicated computer. See the Installation Guide for further information on installing the KLASS Teacher Workstation.

Below are some issues and questions that may arise when using the LiveCD.

I don't know how to boot from a CD.

For many computers, booting from anything other than the internal hard drive requires you having to hold down a key while the computer starts. For example, on many Dell computers, holding down the F12 key as the computer starts brings you to a boot menu where you can choose "CD/DVD" as your boot drive. For Apple computers, you hold down the option key as the computer starts until you see your boot options. Sometimes, computers will have a "boot order" set so that if you start with a CD in the CD drive, it will automatically boot from the CD. Since not all computers work the same, you may have to ask your network administrator or search on the Internet for "Boot [your computer's manufacturer] from a CD".

When my computer starts with the LiveCD, all I see is a login prompt.

Login as `klass`. At the command prompt, enter the command `startx`. If the KLASS Desktop does not start up, you may have a video card that is incompatible with the LiveCD.

When I double-click on the Start Network icon, nothing happens.

Open a Terminal window, and then execute the commands

```
cd /home/klass
./network-start
```

You should see the IP Address window pop up. If nothing happens, you may have to assign an IP address manually.

When I double-click on the SMC Console icon, nothing happens.

Open a Terminal window, and then execute the commands

```
cd /home/klass
./smc-start
```

The `smc-start` command will restart the SMC Console. You may see some error messages beginning with "Connection refused..." This is expected since `smc-start` attempts to shut down all running KLASS processes whether they are currently running or not.

I need to change the IP address for the Teacher Workstation.

By default, the LiveCD sets the Teacher Workstation IP address to 192.168.0.10 and the Netmask to 255.255.255.0. If you need to assign a different IP Address and Netmask, follow the steps below.

- ***Open the Terminal.*** Double-click on the Terminal desktop icon.
- ***Determine what “network interface” you’ll be using.*** At the Terminal’s command prompt, type `ifconfig` and then press Enter. You should see output formatted similar to what’s below.

```
localhost.localdomain<class>DEV[1]% ifconfig
eth0      Link encap:Ethernet  HWaddr 00:1C:23:A1:11:37
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 b)  TX bytes:258 (258.0 b)
          Interrupt:10 Base address:0xc100

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:1618 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1618 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)
```

This tells us there are two interfaces: `eth0` (Ethernet) and `lo` (Loopback). Generally, you would use the first one listed, which in this case is `eth0`. You may see `eth1` or `en0` instead of `eth1`. This will depend on the network hardware in your computer. Note the name of the interface you’ll be using.

- ***Stop NetworkManager.*** Enter the following command on the Terminal’s command line and press Enter.

```
su -c 'service NetworkManager stop'
```

- ***Set the IP Address and Netmask.*** Issue the following command making three substitutions: INTERFACE is the interface you identified when you executed `ifconfig`, IPADDR is the IP address you’ll be using, and NETMASK is the netmask for that address.

```
su -c 'ifconfig INTERFACE IPADDR netmask NETMASK'
```

Test the new settings. At the Terminal’s command prompt, type `ifconfig` again. This time you should see an additional line after the first line listing your network interface. This second line should now start with “`inet addr:`” and contain the address and netmask you assigned.

Working without the KLASS LiveCD

Starting the SMC Interface

If you are not using the LiveCD to run the Teacher Workstation, the procedure for starting the SMC interface (Teacher Console) is a little different. Assuming you have a working installation of Linux and the Teacher Workstation software on a dedicated computer (see the Installation Guide for more information), you do the following:

1. If any terminal windows (C shell windows) are open, close them.
2. Open a new C shell terminal window by selecting "Applications → Accessories → Terminal" from the desktop menu. You should see your current directory (`/home/klclass/ssmeturbo`) displayed at the top of the window followed by a command prompt ending in `%`. If you didn't see this directory listed, then enter the following command at the command prompt

```
cd /home/klclass/ssmeturbo
```

3. Type the following to start the simulation environment:

```
simenv up dev
```

4. After the "`== simenv actions complete ==`" message, type:

```
sim
```

5. At the `sim>` prompt, enter

```
load ssmeturbo
```

After a few seconds, you should see the "SMC" (SGOS Model Control) screen pop-up. You will use this screen (the Teacher Console) to set up, initiate, and control the launch process.

Terminating the Simulation Model Interface (Modelserver)

If you are running a full installation of the KLASS Teacher Workstation, type the following at the command prompt (in the shell window used to start the SMC interface):

1. Enter at the `sim>` prompt:

```
sim> kill all
```

2. Acknowledge the "Lost connection to Model!" dialog pop-up by clicking on the "O.K" button.
3. On the "Save Session" dialog pop-up, choose to either save or not save the session log by clicking on "Yes" or "No", respectively.

The SMC interface has now been terminated. At this point, you can close the shell window or restart the SMC interface again by entering in the shell window at the `sim>` prompt:

```
sim> load ssmeturbo
```

Student Workstation Operation

When selecting computers to use as Student Workstations, keep in mind that some subsystem displays work best at certain resolutions. Although you can display any subsystem on a Student Workstation, consider the following recommendations.

Subsystem	1280 x 1024	1024 x 768	800 x 600
SSME	⚙	⚙	⦿
ET	⚙		
Weather	⚙		
OBS	⚙		
ECLSS	⚙	⚙	⦿
Integration	⚙	⚙	⦿

⚙ Resolution is fully supported.

⦿ Some text labels may be obscured or may overlap.

KLASS Display Startup

The most important prerequisite for running KLASS on a student workstation is having a running Teacher Workstation Modelserver on the same network as the Student Workstation. See the section in this document entitled “Starting the Simulation Model Interface” for instructions on running the Modelserver.

To run a KLASS display on a Student Workstation:

1. **Run KLASS.** Select the Start menu, then All Programs, and then KLASS_2.2.0. As KLASS starts, you will see a **System Status Console** window at the bottom of the desktop displaying messages about startup progress. Within a few seconds, the KLASS main display will appear on the left side of the desktop. Wait until you see the message

```
SIMCMDR  STARTUP  COMPLETE...  SELECT A MODEL CONNECT BUTTON
```

before clicking on any buttons in the KLASS main display. The main display consists of a video player interface located in the center of the display, a column of buttons labeled "Model Connect:" and another column of buttons labeled "Launch:".

2. **Choose a subsystem to display.** Select one of the Model Connect buttons to enable a subsystem for display on the Student Workstation.
3. **Launch the display.** After selecting a subsystem, click on its corresponding Launch Display button. A window for that subsystem will launch. This “Student Console” is what students will use to monitor and interact with the KLASS simulation.

Subsystem Display Interface

All of the subsystem displays, with the exception of the weather display, follow a standard layout including an Elapsed Time/Countdown dialog, a "Model Names" dialog, a "Model Output" dialog, and a subsystem model graphics display window. Although KLASS can run all subsystem displays on one computer, it is recommended that you dedicate one PC for each subsystem displayed.

At the top of each subsystem display, a limited feature main selection menu is provided. Although incomplete as of the KLASS 2.2.0 release, the following main menu capabilities are provided:

- **CTrace:** Allows you to turn On/Off the scrolling of modelvariable output in the "Model Output" window.
- **Window:** Where applicable, toggles the graphical OGL model mode from 2D to 3D and back. With the graphical model in 3D mode, press and hold down the left-mouse button to rotate the model in 3D space or press and hold the right-mouse button to zoom in and out. Note that modelvariable data output is only available in 2D mode.

To view information about an output variable on a subsystem display, right-click on the variable value itself. An information pop-up box will appear with information about the variable and actions you can perform on that variable. The information pop-up provides the following capabilities:

- **Model Variable Name.** Non-selectable. Information only.
- **Apply.** If applicable to this modelvariable, produces an Analog value commanding dialog. This interface allows the user to send a floating point commandable value to the Modelserver. Note that not all model variables are commandable.
- **Set.** If applicable to this modelvariable, produces a Discrete type (e.g., ON/OFF) commanding dialog interface that allows the user to send a floating point commandable value to the Modelserver. Note that not all model variables are commandable.
- **Trace.** On every model clock elapsed time update, a snapshot of this model variable's value is shown in the "Model Output" window.
- **Reset Trace.** Removes the trace set in the "Model Output" window above.
- **Model Name Info.** The following information is presented in this pop-up window:
 - The Model variable's name,
 - Type: Analog (floating point) or Discrete (e.g., ON/OFF),
 - Mode: Input (Commandable) or output (Read-only),
 - DVS index: The ModelVariablesDataBase.dat file database ID number for this variable.

KLASS Display Shutdown

When terminating the Student Workstation portion of KLASS, close all displays first then close the main KLASS window. Doing this will insure an orderly shutdown of KLASS and all of its supporting processes.

Troubleshooting Tips

The System Status Console displays the message WAITING FOR SIMDEV STARTUP COMPLETION... and then disappears.

It is likely that KLASS cannot find a Modelserver. Make sure the IP address in the modelserveraddress file is correct and that the Teacher Workstation Modelserver is running. If both of these conditions are satisfied, there may be a network configuration problem. To test for network connectivity, select Start, then Run..., and enter the following command in the Run dialog box's Open field:

```
command /K ping 192.168.0.10
```

This is assuming 192.168.0.10 is the IP address of your Modelserver. On the Command window, make sure there are as many packets received as sent. If not, then the Student and Teacher Workstations are not able to communicate over the network. In this case, check the PC's network settings, make sure all network cables are plugged in, and check that your network switch or router is functioning properly.

A Windows Security Alert pops up and asks if I want to keep blocking program with the name Simdev?

Since KLASS initiates network communication with the Modelserver, Windows is asking for confirmation that you want to allow this network connection. Click Unblock. Simdev is a program that runs as part of the Student KLASS application and needs to communicate with the Teacher Workstation.

A subsystem display is partially blank or doesn't seem to update properly.

Make sure the video driver for the computer is current. In some cases you may need to download a video driver update from the video card or computer manufacturer. Generally, the manufacturer's latest video driver offers better graphics performance than what ships with Windows.

Alternatively, you may need to turn off DirectX acceleration. To do this. Open Properties after right-clicking on the desktop, select the Settings tab, click the Advanced button, choose the Troubleshoot tab and move the Hardware Acceleration slider to the third position from the left. You may also need to turn off "Enable write combining" by unchecking it.