3B Scientific

AURORA USER MANUAL

RESPISIM® 4.5 FOR AURORA MANIKIN

1025194, 1025195

AURORA USER MANUAL

CONTENT

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1. ABOUT THE USER'S MANUAL

This User's Manual is for IngMar Medical's RespiSim® Software. This software, designed by educators for educators is intended to provide a superior user experience with a simplified, streamlined user interface. It is recommended that you read through this instruction manual carefully before using RespiSim® Software. This manual is divided into several main sections to help you easily access the information and instructions you need.

1.1 Conventions the User's Manual

WARNING! Indicates a potentially harmful condition that can lead to personal injury.

CAUTION! Indicates a condition that may lead to equipment damage or malfunction.

NOTE: Indicates points of particular interest or emphasis for more efficient or convenient operation.

1.2 Instructor Computers Running RespiSim® Software

RespiSim® Software is designed for touch and non-touch computers. All screens and buttons can be controlled via touch interaction. For example, on the Scenario Map: to zoom in or out from the map view, use a pinch-style gesture; to move / pan the map around the screen, use two (2) fingers; to slide the Scenario Builder bar up and down, use one (1) finger.

2. ABOUT RESPISIM®

2.1 What is RespiSim®?

The Aurora manikin is a new addition to the RespiSim® environment bringing a more affordable solution that incorporates the same ALS 5000® architecture to a manikin simulator with an internal lung system. The Aurora manikin also provides the spontaneous breathing with the ability to hold PEEP at most clinically relevant levels. This system is designed as an adult manikin with an anatomical range of airway resistance and lung compliance. The Aurora manikin is also designed to be a teatherless system allowing home-to-hospital simulation capabilities

2.2 Intended Audience

The intended learners include anyone in need of ventilator management training such as Respiratory Therapists, Pulmonologists, Anesthesiologists, Neonatologists, Intensivists, Critical Care Physicians, Emergency Medicine Physicians, Nurses (ICU, ER), Physiotherapists, Nurse Anesthetists, Nurse Practitioners, EMT/ Paramedics, Physician Assistants, and Perfusionists. Train first-year students all the way through becoming credentialed practitioners and beyond. Intended learners can also include re-training staff and on-boarding new ventilators or other respiratory-based equipment. The user-friendly design allows for all levels of training from basic ventilation management through complex scenarios.

3. AN INTRODUCTION TO RESPISIM® SOFTWARE

3.1 RespiSim® Software Basics

3.1.1 Loading the Software

Start RespiSim® Software by double-clicking on the RespiSim® icon on the desktop of the Instructor Display computer. When RespiSim® Software starts, the Startup Screen opens with options to setup connection to the ASL 5000® (or to run in ASL Emulation Mode), start a new or existing Scenario, as well as view a Debrief from previously completed Scenarios.

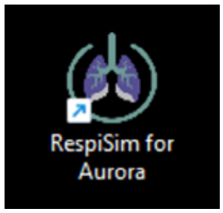


Figure 3.1: Desktop Icons (4.5 Right)

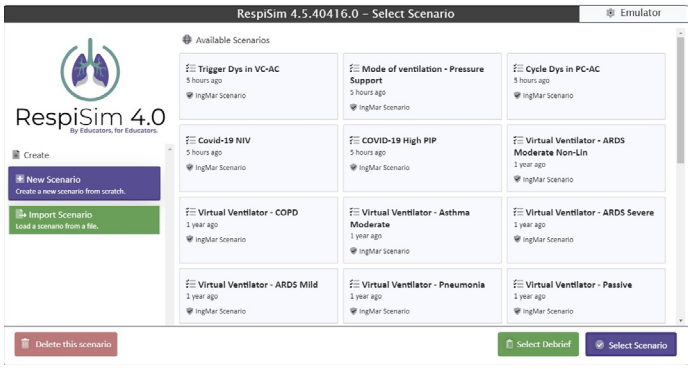


Figure 3.2: Startup Screen (RespiSim® 4.5)

3.1.2 Emulator Setup

RespiSim® 4.5 with the Aurora manikin is designed to automatically connect between the manikin and the instructor's pc running the software. With the 4.5 software, the "Device Setup" button on the Startup Screen is replaced with an "Emulator" button. This allows the user to work in a software-only mode to build scenarios and test various lung models.

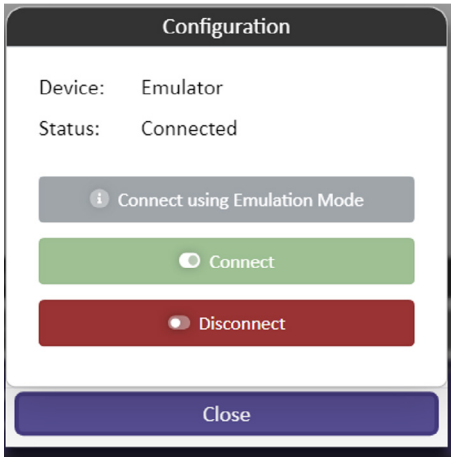


Figure 3.3: Emulator Configuration Screen (RespiSim® 4.5)

3.1.3 Lung Model Library

From the Startup Screen, open an existing Scenario or load a new Scenario from scratch. To create a new Scenario, select New Scenario and click Select Scenario to open the New Scenario screen. This screen is where the Scenario can be named (optional) and the patient's initial condition Lung Model is selected.

NOTE: If the Scenario Name is left blank, the name defaults to New Scenario1. Any new Scenario without a name created thereafter, increments the Scenario number, e.g. New Scenario2, New Scenario3, etc.

The Lung Model Library includes a wide range of pre-configured Lung Models covering patient populations from neonatal through adult.

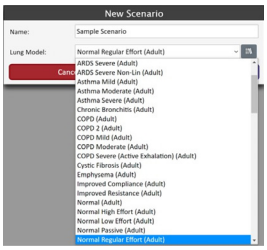


Figure 3.4: Lung Model Library – Basic View

Select a Lung Model from the dropdown list or click the icon next to the Lung Model name to open an expanded view of the Lung Model Library.

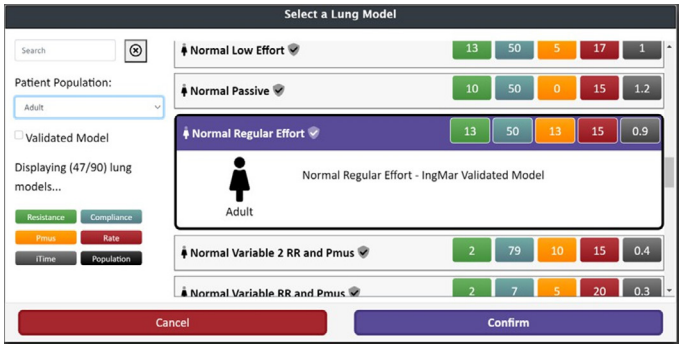


Figure 3.5: Lung Model Library – Advanced View

Search for the name of the Lung Model or filter by patient population. The shield icon indicates models that have been validated by IngMar Medical clinicians.

Once a Lung Model is selected, click confirm to open the RespiSim® Software Home Screen.

NOTE: All Lung Models can be customized to suit the interactions needed to provide the expected response from a ventilator or other externally connected device (e.g. CPAP or Bi-PAP).

3.2 Main Software Environment

When an existing Scenario is selected or a new Scenario is created, the software will open with three (3) main tabs that are accessible by clicking their name at the top of the screen: Home Screen (with the Scenario name), Scenario Map, and Worksheet. This manual introduces each of these tabs in greater detail as the instructions progress from basic to more complex Scenarios.

3.2.1 Home Screen

The Home Screen works like a dashboard, providing detailed information about the patient and how the patient interacts with ventilators and other external devices.

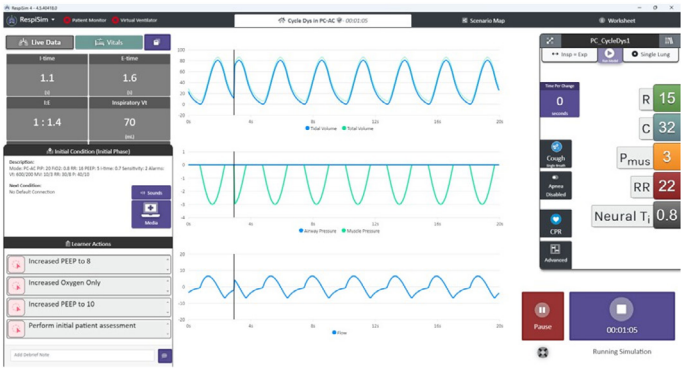


Figure 3.6: Home Screen

3.2.2 Scenario Map

The Scenario Map is the main environment where Scenarios are developed. This is where Patient Conditions are defined and linked together to interact with the Patient Monitor Application (typically via an external Learner Display) to create simple to complex Scenarios.

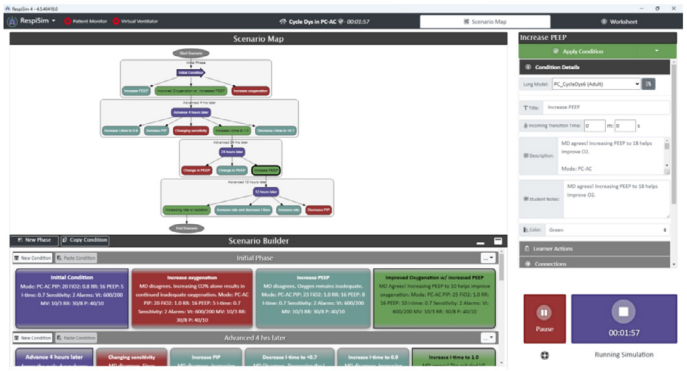


Figure 3 9: Scenario Map

3.2.3 Worksheet

The Worksheet provides the instructor and learner(s) with medically relevant information about the patient and Scenario environment as well as general expectations resulting from the Scenario. The Worksheet is broken into selectable sections that can be exported/ printed as part of the Scenario. For instance, the Patient Information section can be printed and given to the learner before starting the Scenario. Click any of the named sections on the left pane to focus the view to the selected section.

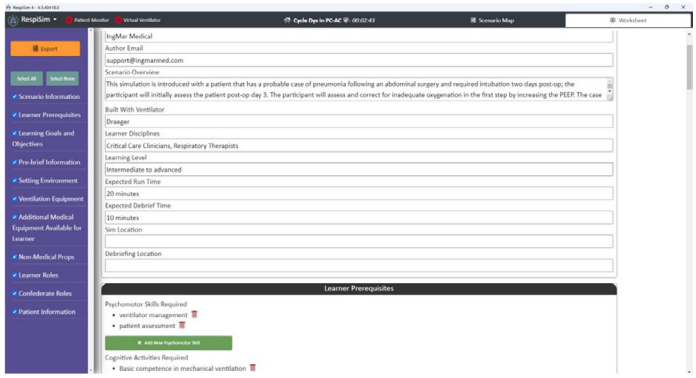


Figure 3 10: Worksheet

3.3 Building and Running a Basic Scenario

3.3.1 Getting Started

From the Startup Screen, create a new Scenario by selecting New Scenario and clicking Select Scenario. At the prompt, provide a name for the Scenario (optional) and select the patient's initial condition Lung Model.

NOTE: If the Scenario Name is left blank, the name defaults to New Scenario1. Any new Scenario without a name created thereafter, increments the Scenario number, e.g. New Scenario2, New Scenario3, etc.

After selecting the patient's initial condition Lung Model, click confirm. The Home Screen opens.

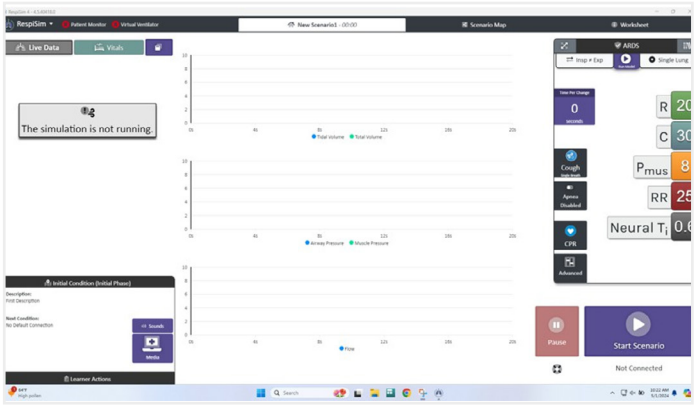


Figure 3 11: Home Screen

3.3.2 Scenario Map

Access the Scenario Map by clicking the Scenario Map tab at the top of the RespiSim® Software Home Screen. This is the environment where a Scenario is created and edited. The Scenario Map consists of three (3) sections: Scenario Map, Scenario Builder, and Condition Panel. A Scenario consists of Phases and Patient Conditions (within each Phase) that interact to create a structured, seamless simulation environment.

To the right of the Scenario Map is the Condition Panel. This panel is where the Lung Model appears (under the Condition Details) and patient information is added, including the patient assessments, vital signs, media (images and sounds), as well as labs/ ABG's. The figure below shows some of the components of the Condition Panel.

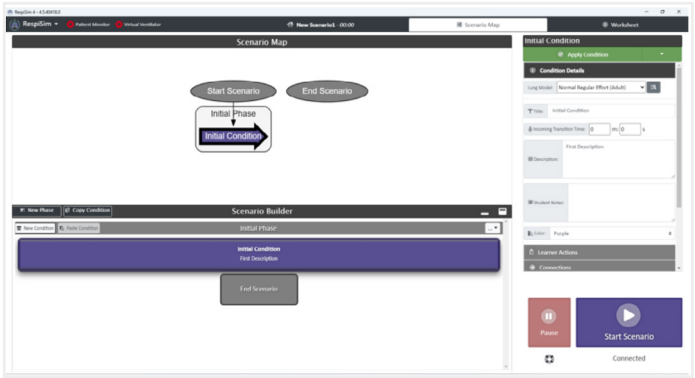


Figure 3 12: Scenario Map

To the right of the Scenario Map is the Condition Panel. This panel is where the Lung Model appears (under the Condition Details) and patient information is added, including the patient assessments, vital signs, media (images and sounds), as well as labs/ ABG's. The figure below shows some of the components of the Condition Panel.

Anywhere the icon is present, a preview of the waveform or media can be seen by clicking the icon. Click anywhere on the screen and the media / waveform preview closes. This preview shows the instructor what the learner sees on the Patient Monitor when performing a deeper investigation into the patient physiology.

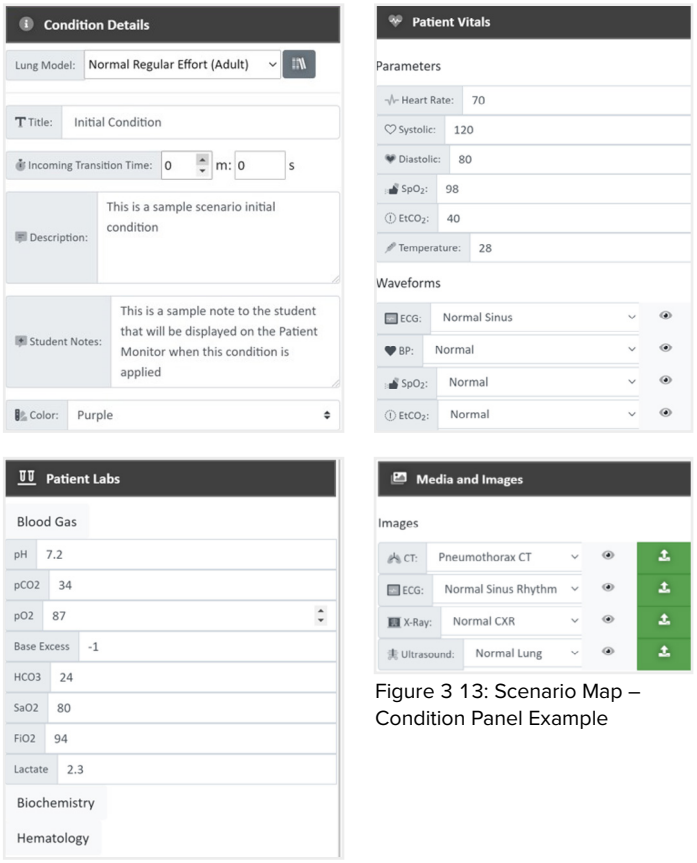


Figure 3 13: Scenario Map – Condition Panel Example

Below the Scenario Map is the Scenario Builder. The Scenario Builder provides a view of each Patient Condition, including the Description from the Condition Details. Within the Scenario Builder, there are buttons to create a new Phase or new Patient Condition. Existing Patient Conditions can be also copied / pasted where only specific physiologic changes are necessary, reducing Scenario development time.

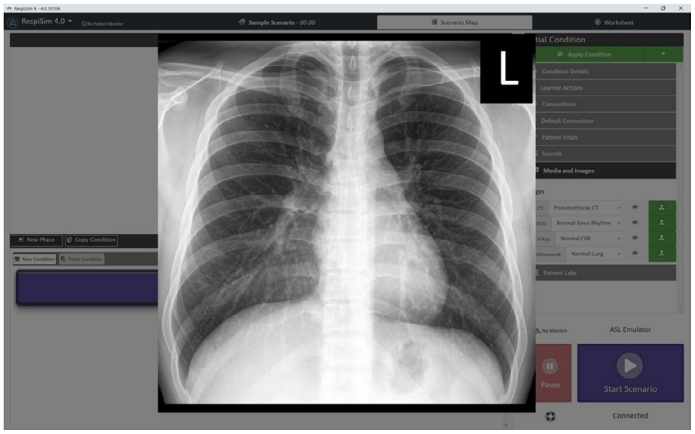


Figure 3 14: Scenario Map – Image Preview of X-Ray

Add a new Patient Condition by clicking the New Condition button on the Initial Phase bar. This will open a window with a prompt for the new Patient Condition name (required) and Lung Model associated with that Condition.

As with the Initial Condition, the assessment and physiological information can be added to this new Condition. After the Condition is added, the Scenario Map and Scenario Builder will update accordingly.

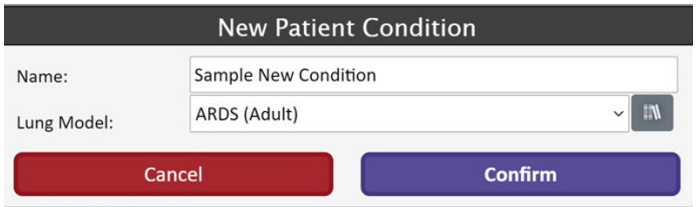


Figure 3 15: Scenario Map – New Patient Condition Prompt

Click on any Condition on the Scenario Map or in the Scenario Builder to create a bold border around the Condition signifying the selected Condition. When a Condition is in the shape of an arrow, this signifies an applied Condition during a running or idle simulation.

NOTE: The information displayed in the Condition Panel is always based on the selected (not necessarily applied) Condition.

The Scenario can be started from the Home Screen or from the Scenario Map by clicking the Start Scenario button. When connected to the Patient Monitor Application, the information in the applied Condition will be visible to the learner on the Learner Display.

NOTE: The Patient Monitor Application runs on a separate device (called the Learner Display) and is part of the RespiSim® System. The Patient Monitor is explained in detail below.

Starting the simulation applies the Initial Condition by default. Clicking on any other Condition and selecting “Apply Condition” (or from the drop down, “Apply Now”) at the top right of the Scenario Map, results in that Condition’s Lung Model and physiologic properties being applied to the currently running simulation.

This is visible on the Scenario Map by the Condition changing to an arrow outline.

NOTE: An applied Condition changes to an arrow. A selected Condition has a bold border. The information in the Condition Panel is always based on the selected Condition.

The figure shows an example of the Home Screen view when a Condition has changed from the Initial Condition to the Sample New Condition.

At any time during the process of building a Scenario, the Scenario can be saved. Using the RespiSim® dropdown menu at the top left, select Save or Save a Copy in the Scenario section.

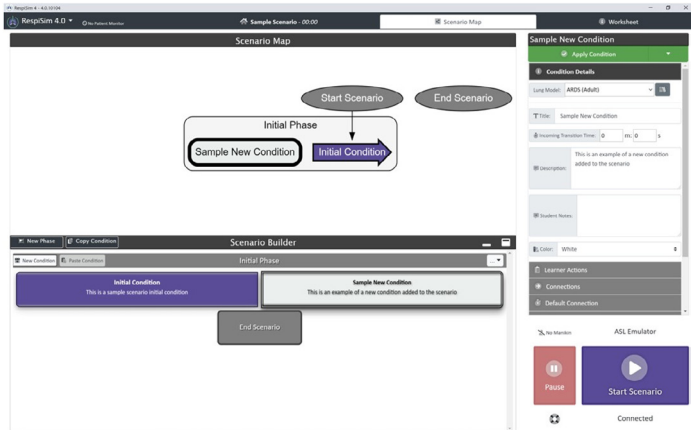


Figure 3 16: Scenario Map – Adding a Condition

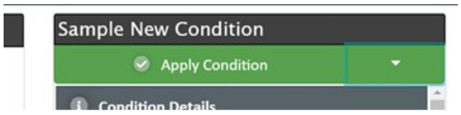


Figure 3 17: Scenario Map – Apply Condition

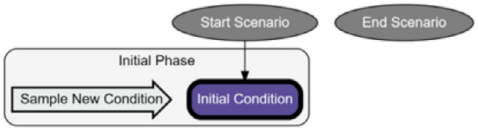


Figure 3 18: Scenario Map – Sample New Condition Applied

Figure 3 19: Home Screen after Sample New Condition Applied

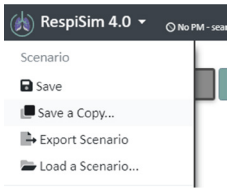


Figure 3 20: Saving a Scenario

Once saved, the Scenario will be available on the Startup Screen. In this example, the saved Scenario is called Sample Scenario.

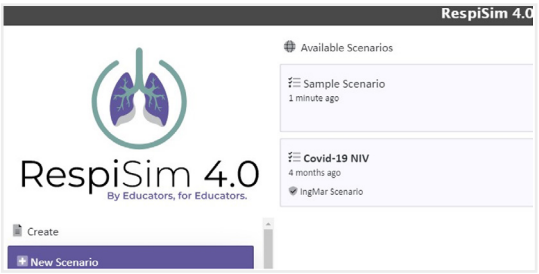


Figure 3 21: Saved Scenario

3.4 Building an Advanced Scenario

Using the example created in the Basic Scenario section above, you can design a more advanced Scenario to utilize many of the features of the RespiSim® Software. Examples include setting Learner Actions, connecting Conditions, transitioning from one (1) Condition to another over a set time, and more. Use the Worksheet to include important patient and simulation environment information for the Scenario.

When looking at the Condition Panel on the Scenario Map, each tab appears in an intentional order to create a more sequential approach to building a Scenario Condition.

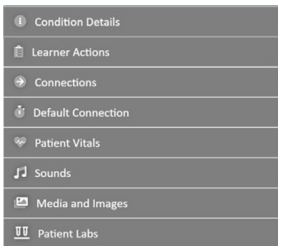


Figure 3 22: Condition Panel

3.4.1 Condition Details

Condition Details include information about the patient state when this Condition is applied. This includes the Lung Model used, the title of the Condition, Incoming Transition Time, a Description for the instructor, Student Notes, and the color the Condition will appear in the Scenario Map / Scenario Builder.

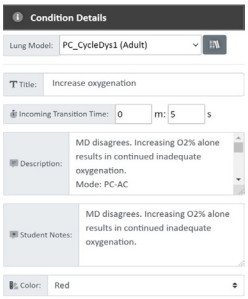


Figure 3 23: Condition Details

3.4.2 Learner Actions

Learner Actions are a list of prepared actions that are a result of the learner completing or not completing some expected maneuver or change to the ventilator. Learner Actions can also be the trigger to move to the appropriate next Condition. Learner Actions are specific to each Condition.

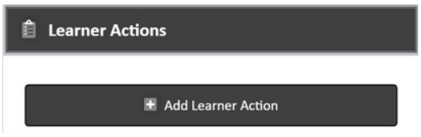


Figure 3 24: Condition Panel – Add Learner Action

Clicking the Add Learner Action button opens a prompt to provide a name for the Learner Action and an optional Note about the action. Learner Action names should be associated with what you expect the learner to be doing when this Condition is applied in the Scenario. To assist in some of the more common actions, the Name field auto fills 20+ name recommendations for the Learner Action. Typing the word “vent,” for example, will recommend seven (7) options for Learner Actions associated with that word.

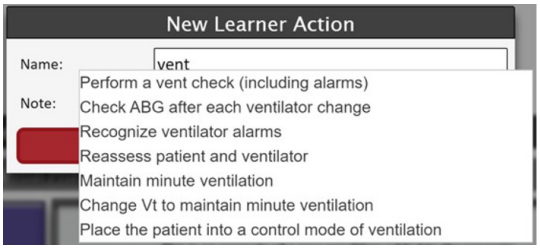


Figure 3 25: Learner Action Auto-fill Text Example

Learner Actions can also be used to trigger an automatic change from one (1) Condition to another. In the figure below, the Initial Condition now has a “Perform a vent check...” Learner Action as well as a Learner Action that includes a trigger to move to a different specified Condition.

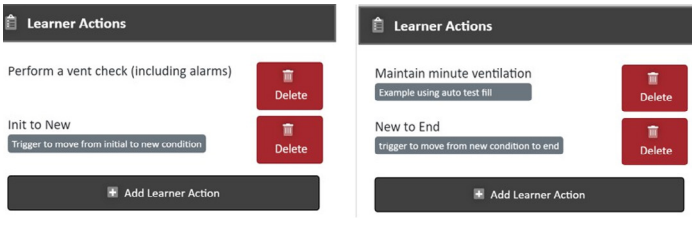


Figure 3 26: Initial and New Condition Learner Actions

3.4.3 Connections

Conditions are linked together using Connections. When a Connection is created, information about the Connection is displayed as an Outgoing or Incoming Connection to the selected Condition.

Figure 3 27: Conditions Panel – Add Connection

To create a Connection, select a Condition in the Scenario Map or Scenario Builder. In the example above, this would be the Initial Condition. Next, click the Add Connection button which opens the Choose a Target window on top of the Condition Panel. Select the Connection target by clicking any Condition in either the Scenario Map or Scenario Builder.

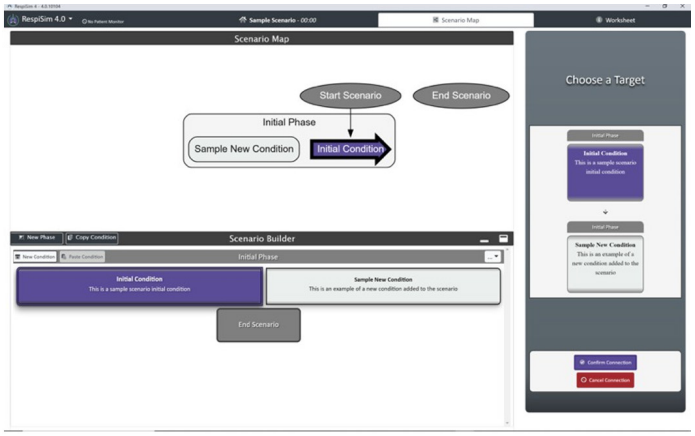


Figure 3 28: Scenario Map – Connecting Conditions

Once the target Condition is selected, click Confirm Connection, which results in an additional prompt allowing Notes or Learner Actions (both optional) to be associated with the Connection. In this example, the Init to New Learner Action will be associated with this Connection as a Learner Action trigger.

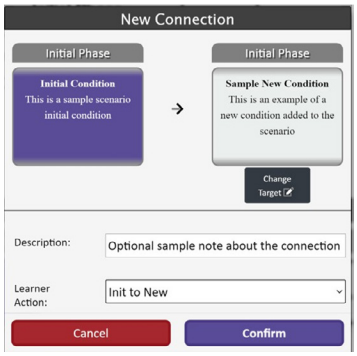


Figure 3 29: Scenario Map – Confirm Connection

Adding this Connection as well as a Connection from the Sample New Condition to the End Scenario gives the updated Scenario Map shown in the figure below.

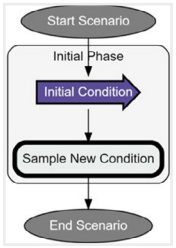


Figure 3 30: Scenario Map with Connections

Learner Actions are NOT required to add as triggers when creating a Connection between Conditions (in which case the connections are simply a visual guide for the scenario). In the example above, the Connection from the Initial Condition to the Sample New Condition includes a Learner Action trigger, whereas the Connection from the Sample New Condition to End Scenario does not include a Learner Action trigger. In the figure below, the Initial Condition's Connection to the Sample New Condition includes a Learner Action trigger. The icon designates a Connection with an available Learner Action trigger.

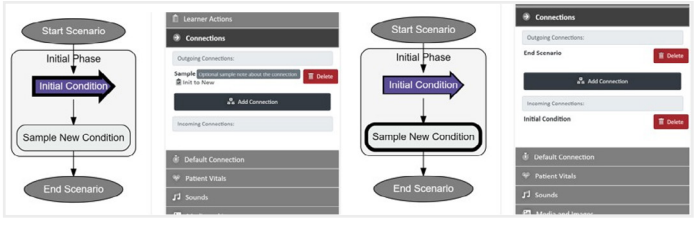


Figure 3 31: Connection with and without Learner Action Trigger

3.4.4 Transition and Default Connection Timing Options

RespiSim® Software Scenarios can move from Condition to Condition manually by selecting a Condition and using the Apply Condition (or Apply Now) button at the top of the Condition Panel. Triggers can also be created using Learner Actions coupled with Connections to automatically transition to new Conditions from the Home Screen once the Learner Action is clicked.

There are two (2) types of timing options to move from one Condition to another in a Scenario:
1. Incoming Transition Time
2. Default Connection and Hold Time

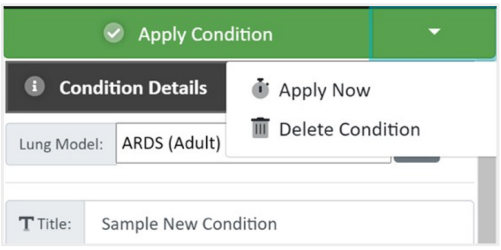


Figure 3 32: Scenario Map – Apply Condition Option

3.4.4.1 Incoming Transition Time

Incoming Transition Time reflects the time it will take to transition from the currently applied Condition to the selected Condition once that Condition is applied. All Lung Model parameters will transition over this set amount of time. The incoming Transition Time is set in the Condition Detail tab of the Condition Panel. The value is in minutes and seconds. When the selected Condition is applied, all parameters (lung parameters) change linearly to the new Condition values. Using the example Scenario above, the Incoming Transition Time from the Initial Condition to the Sample New Condition is 30 seconds. This means it will take 30 seconds to transition from the previous Condition Lung Model (Normal Regular Effort) to the Sample New Condition Lung Model (ARDS). .

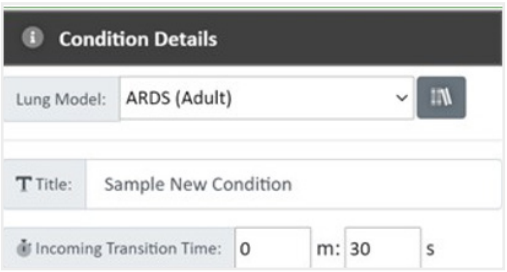


Figure 3 33: Condition Details – Incoming Transition Time

NOTE: The Initial Condition does not allow for an Incoming Transition Time as it is the first Condition in Scenario.

3.4.4.2 Default Connection and Hold Time

After Connections are created between Conditions, the instructor may want to define a default path through the Scenario where the simulation remains in a Condition for a specified time, and then transitions to a default next Condition. This may continue from the Initial Condition to the end of the Scenario. Referencing the above figure, this default path may flow as follows:

Initial Condition ➔ Condition 1 ➔ Condition 2 ➔ Condition 3 ➔ End Scenario.

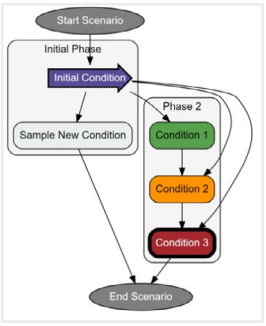


Figure 3 34: Scenario Map with a Default Simulation Path

The default path would be developed, for example, to make a Patient Condition worsen to help / coerce the Learner to recognize what is expected in the Scenario.

NOTE: At any time during the simulation, the instructor can select and apply any Condition regardless of the timing settings.

To set the Default Connection from the Initial Condition, select the Initial Condition and click the Default Connection tab on the Condition Panel. Select the Default Connection (Condition 1) and set the Hold Time (5 minutes). Hold Time defines how long to remain in the currently applied Condition before transitioning to the default next Condition. In the Figure above, when defining the path from the Initial Condition, the Default Connection can be any of the connected Conditions from the Scenario Map.

This process can be repeated from the default path as shown in Figure above from Initial Condition all the way to End Scenario.

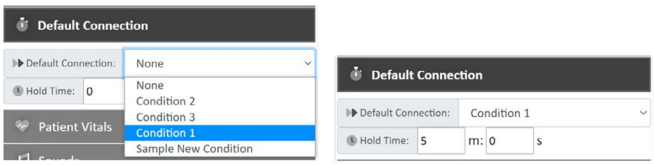


Figure 3 35: Condition Panel – Default Connection

NOTE: The three (3) remaining tabs on the Condition Panel represent the patient's physiology. This includes the Learner Display running a Patient Monitor and the RespiScope®, which works with the RespiPro® and Aurora (option) Manikins for auscultation feedback. Each of these devices are explained in greater detail below.

3.4.5 Patient Vitals

The Patient Vitals tab is where the instructor can set the physiology parameters and waveforms that will be displayed on the Patient Monitor (running on an external Learner Display). The waveforms include an array of ECG and $ETCO_2$ signals, as well as modified BP and SPO_2 signals.

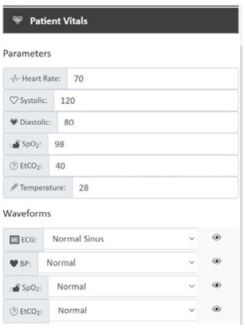


Figure 3 36: Condition Panel – Patient Vitals

Click the  to see a preview of any waveform that will be displayed on the Patient Monitor Application. Figure 3-33 shows waveform samples of Atrial Flutter ECG and Emphysema $ETCO_2$.

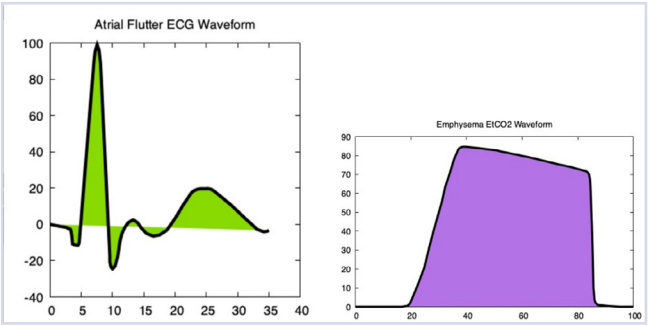


Figure 3 37: Condition Panel – Patient Monitor Waveforms

3.4.6 Sounds

RespiSim® Software includes two (2) options for simulating sounds/ auscultation feedback from the Scenario environment. The Learner can perform auscultation using the RespiScope® with the RespiPro® and Aurora (optional for Aurora) Manikins or the instructor can play the local sounds that are uploaded from outside sources (.mp3 and .wav formats only) on the Instructor Display computer.

Click the RespiScope® and Local Sounds button to open the sounds interface. Here, local sounds can be uploaded and set for any selected Condition. See RespiSim® Auscultation section below for detailed instructions on using the RespiScope® and local sounds.

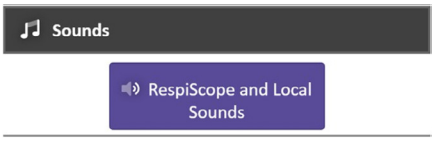


Figure 3 38: Condition Panel – Sounds

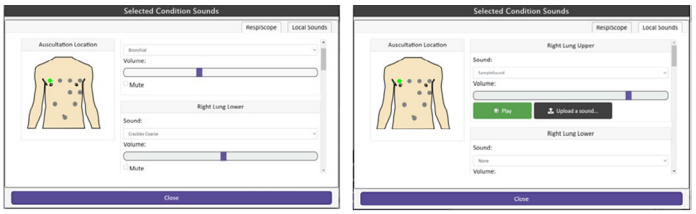


Figure 3 39: Condition Panel – RespiScope® vs Local Sounds Interface

3.4.7 Media and Images

View and apply a library of CT scans, ECG rhythms, X-rays and Ultrasound onto the Patient Monitor Application

Click the  icon to preview any of the images, including live .gif images for Ultrasound files. Click the  icon to upload custom media for displayed on the Patient Monitor.

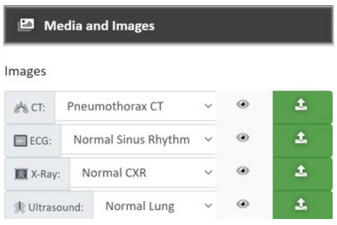


Figure 3 40: Condition Panel – Media and Images

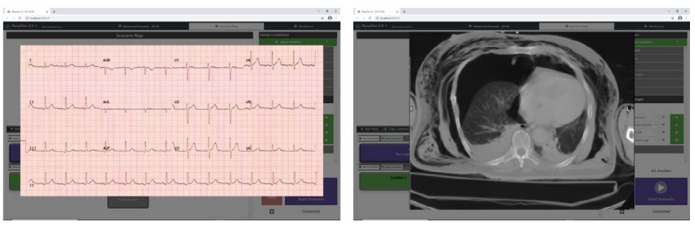


Figure 3 41: ECG Rhythm and CT Scan Preview

3.4.8 Patient Labs

The Patient Labs tab allows the instructor to set investigations made available to the learner on the Patient Monitor Application. There are three (3) levels of labs that can be defined for each Condition including Blood Gas, Biochemistry, and Hematology.

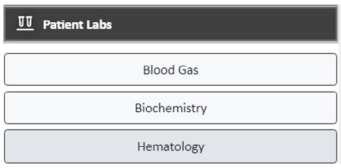


Figure 3 42: Condition Panel - Patient Labs

Clicking any of the buttons expands each option for the instructor to populate values as applicable to the Condition or Scenario.

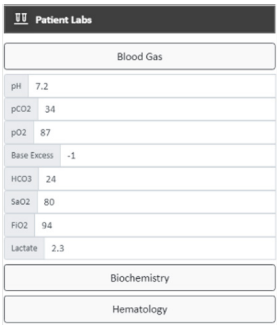


Figure 3 43: Blood Gas Parameters

3.5 Running an Advanced Scenario

To demonstrate running an advanced Scenario, open the IngMar Scenario “Cycle Dys in PC-AC” from the Startup Screen. This Scenario does not use every available feature defined above, but it provides a great example to follow.

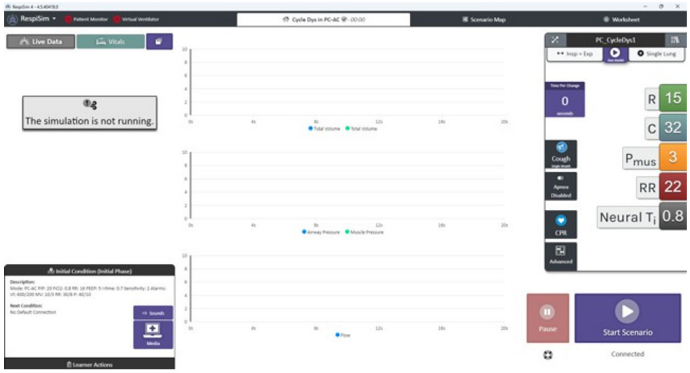


Figure 3 44: Cycle – Dys In PC-AC Scenario

From the Home Screen, note the Condition and Learner Actions at the bottom left of the screen. Recall that clicking the Learner Actions tab expands and collapses the available Learner Actions, as well as the Debrief Notes prompt.

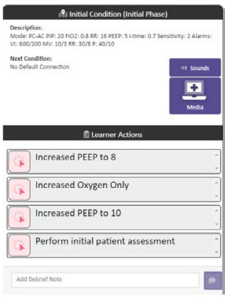


Figure 3 45: Cycle – Dys - Home Screen Condition Details

Looking at the above figure, the Description field for the current Condition contains the settings that should be applied on the ventilator during that point in the Scenario. No default Connection has been identified. Therefore, changing to a new Condition requires a Learner Action trigger from the Home Screen or selecting / applying the next Condition manually from the Scenario Map.

Click the Media button to show what will be displayed on the Patient Monitor. For the Initial Condition, there is one (1) media image available to the learner in the form of a lung X-ray and three (3) waveforms (Normal Sinus ECG, Normal BP, and Normal SpO2). Click the Close button to return to the Home Screen view.

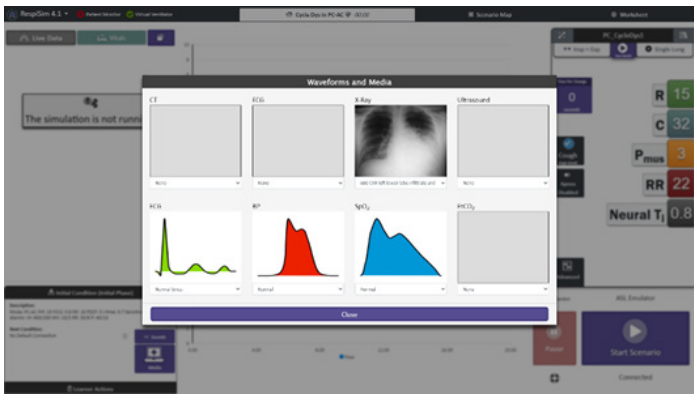


Figure 3 46: Cycle Dys – Home Screen Initial Condition Media View

Finally, note the Lung Model selected for the Initial Condition at the top right of the screen is called PC_CycleDys1 with its Lung Model characteristics.

Clicking from the Home Screen to the Worksheet provides the instructor and learner with valuable information about the simulation. Looking at the Scenario Information section, the introduction to this Scenario, including an example Scenario Overview:

“This simulation is introduced with a patient that has a probable case of pneumonia following an abdominal surgery and required intubation two days post-op; the participant will initially assess the patient post-op day 3. The participant will assess and correct for inadequate oxygenation in the first step by increasing the PEEP. The case is advanced to four hours later. The participant is next required to assess and correct for a severe cycle dysynchrony by increasing the set inspiratory times. The case continues to advance the following day when the participant will again assess for and correct inadequate oxygenation by increasing the PEEP. However, after the increase in PEEP, the total inspiratory pressure will violate 30 cm-H2O (indicative of volutrauma). This, in addition to a decrease P/F ratio and CXR changes, indicate probable ARDS. The participant is required to decrease the Vt to 6 ml/kg IBW and increase the RR (according to the ARDSnet protocol). However, in addition to these changes, the participant must also request an increase in sedation to prevent cycle dysynchrony and unintended volutrauma.”

The figure below shows the Patient Information section of the Worksheet. This section, along with any other section within the Worksheet view, can be exported and distributed to the learner as the “Patient Chart” prior to starting the Scenario. Exports are in .pdf format and will export only those sections that are checked.

Examine the full Scenario by clicking on the Scenario Map. By default, the Initial Condition will be selected and applied (bold border and arrow shape). The Scenario Builder bar can be raised/ lowered to view the Scenario Map or Scenario Builder area of the page. Use pinch-touch or a mouse / trackpad to zoom in / out of the Scenario Map view. For this example, the focus will be on the Initial Condition and the Initial Phase. The figure below shows a zoomed-in view of this part of the Scenario.

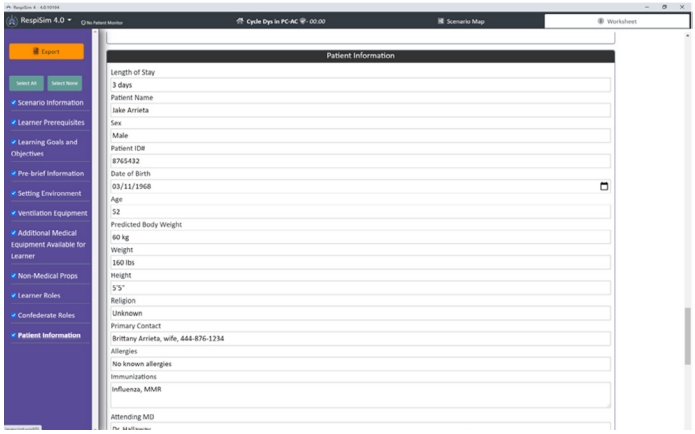


Figure 3 47: Cycle – Dys - Scenario Worksheet

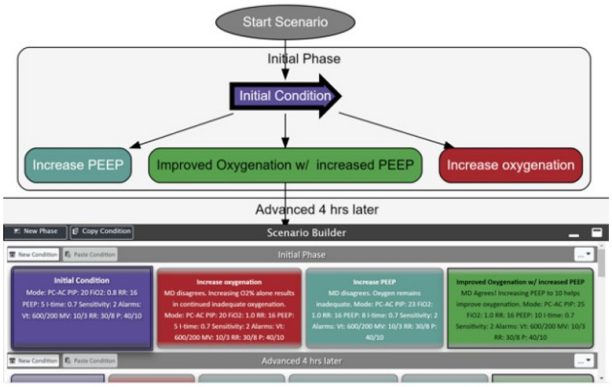


Figure 3 48: Cycle – Dys Initial Phase with Selected/Applied Initial Condition

The figure below shows the Condition Details, Connections, and Patient Vitals tabs. The Description that was seen on the Home Screen was defined in the Condition Details tab. In the Connections tab, notice that all Learner Actions are triggers (based on the icon). The Patient Vitals tab includes the numeric values and set waveforms that will be displayed on the Patient Monitor Application.

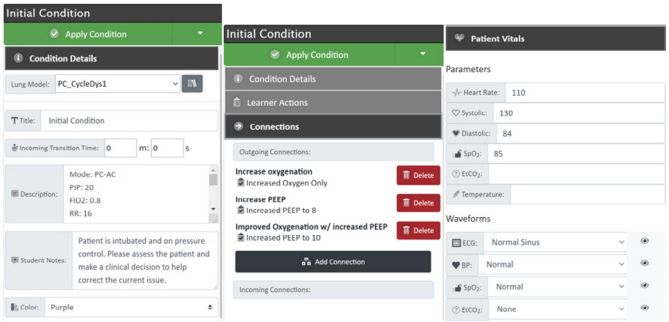


Figure 3 49: Cycle – Dys Initial Phase Condition Panel

The general flow of this simulation's Initial Phase is the expectation that the learner will do one (1) of three (3) maneuvers on the ventilator: increase PEEP only, increase oxygenation only, or increase oxygenation with increased PEEP (ideal path). The ideal progression is evidenced by the arrows in the path as well as the Description note in the Improved Oxygenation w/ increased PEEP Condition.

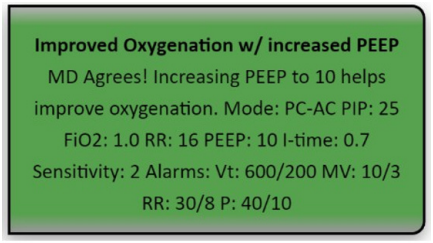


Figure 3 50: Cycle – Dys Ideal Next Condition in Initial Phase

The Scenario can be started from the Scenario Map or the Home Screen. The RespiSim® Software is connected to the ASL Emulator with "No Manikin" selected. Therefore, when the Scenario was started, the RespiSim® Software connected to the "virtual" simulator, running the Initial Condition.

Figure 3 51: Cycle – Dys Running Initial Condition

While running the Initial Condition, the instructor observes that the learner performs a patient assessment. When this happens, the instructor can click the 'Perform initial patient assessment' Learner Action, which changes the state of the Learner Action from Red (incomplete) to Green (complete).

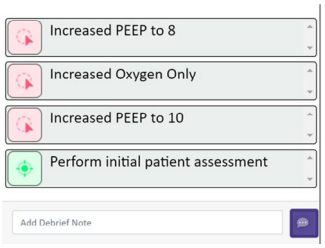


Figure 3 52: Cycl – Dys - Learner Action Complete

Next, the learner decides, in this example, to only increase PEEP. Recall the Increased PEEP to 8 Learner Action is a trigger automatically move to the Increase PEEP Condition. The instructor can add a Debrief Note. Clicking the icon will submit the note, which will be visible on the timeline during debrief.

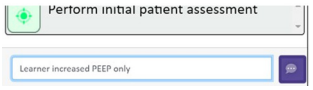


Figure 3 53: Cycl – Dys - Debrief Note

Clicking the Increased PEEP to 8 Learner Action automatically triggers a Condition change to the Increase PEEP Condition as evidenced by the applied arrow on that Condition.

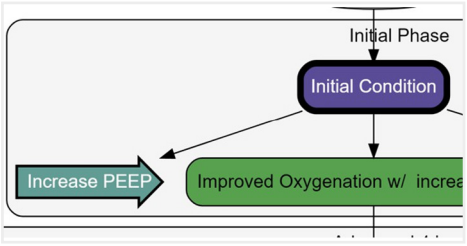


Figure 3 54: Cycl– Dys - Increase PEEP Condition Applied

This new Condition includes Learner Actions such as vent check, increase PEEP, and increase oxygenation. The Description explains why the Scenario (or MD) disagrees with this action. Additional notes can be added to the Debrief Notes to highlight a teaching moment.

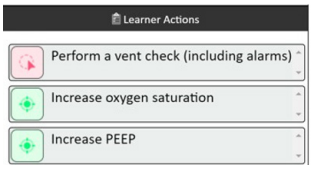


Figure 3 55: Cycl – Dys - Learner Actions for Increase PEEP Condition

Let's assume the learner now increases PEEP and oxygen saturation, which leads the instructor to manually apply the ideal Condition by navigating to the Scenario Map, selecting the Improved Oxygenation w/ increased PEEP Condition and clicking the green Apply Condition button. With this action, the learner returns to the ideal path and the Scenario can continue to the next Phase and, eventually, to the end of the simulation. The Scenario can be stopped at any time, ending the simulation.

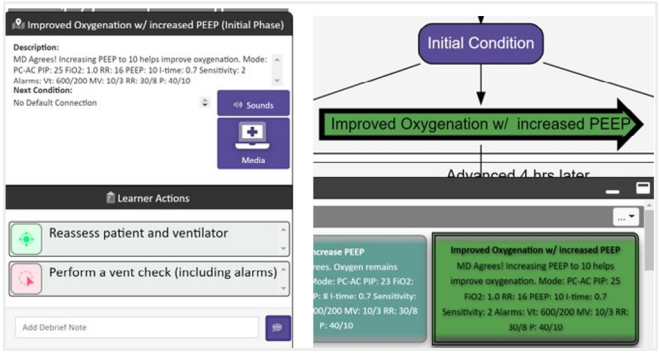


Figure 3 56: Cycl – Dys - Ideal Condition Reached in the Initial Phase

This will prompt the instructor to save or discard the Debrief recording of the simulation that was just completed.

Reviewing the recorded Debrief for this example can be found in the next section. Reviewing the IngMar Scenarios that are included with the RespiSim® Software are a great way to understand the flow of RespiSim® Scenario design.

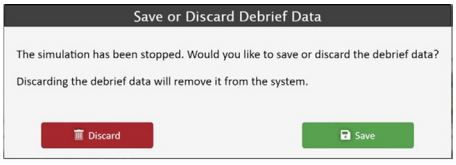


Figure 3 57: Stopping a Scenario Dialog to Save Debrief Data

3.6 Debrief

RespiSim® Software includes a Debrief component that is accessible from the Startup Screen or from the RespiSim® dropdown menu.

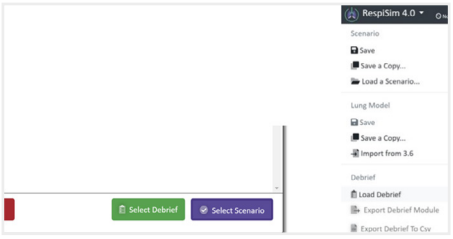


Figure 3 58: Loading a Debrief

The Debrief screen includes the ability to load a Scenario Debrief on the Instructor Display computer, as well as import a Debrief from colleagues' systems. As the library of recorded simulations increase, the instructor can search via keyword of can sort by Title, Simulation Date, or Patient Type.

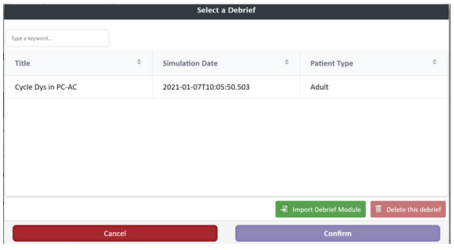


Figure 3 59: Select a Debrief Screen

Clicking the Scenario name, then clicking Confirm will open the Respi-Sim® Software in a nearly identical view as opening the software to run a Scenario (except for the Debrief remote control window).

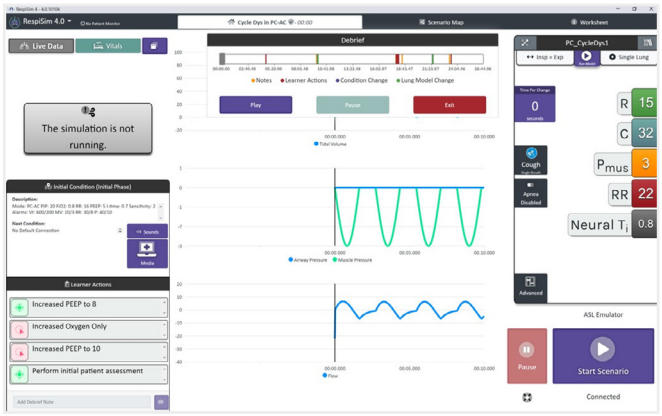


Figure 3 60: Debrief View

The Debrief remote control window will always remain in front of all screens. Any of the three (3) main tabs can be accessed while in Debrief. The remote control can be dragged anywhere on the screens to be out of the way.

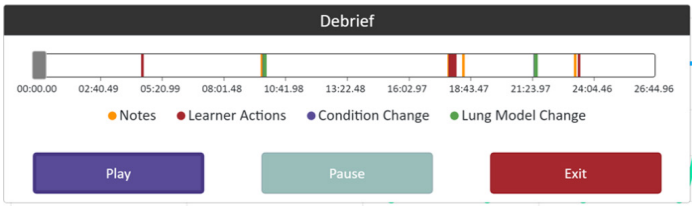


Figure 3 61: Debrief Remote Control

The progression of the Scenario is fully captured and controlled by the Debrief remote control window. Note the markers and legend defining changes during the simulation. Clicking the Play button runs the simulation in real-time, showing the waveforms and Live Data changes. Manually grab the slider on the timeline and move to any time in the Scenario, and all information from the Scenario will be updated, as well.

The Condition and Learner Action section of the Home Screen show which Learner Actions were completed while the Scenario was running with that Condition applied. Any notes that were submitted using the Add Debrief Note prompt will load when they were added on the timeline. As the Scenario playback progresses, all notes will continue to add to the list so that they can be referenced at the end of the Debrief, during any ensuing discussions.

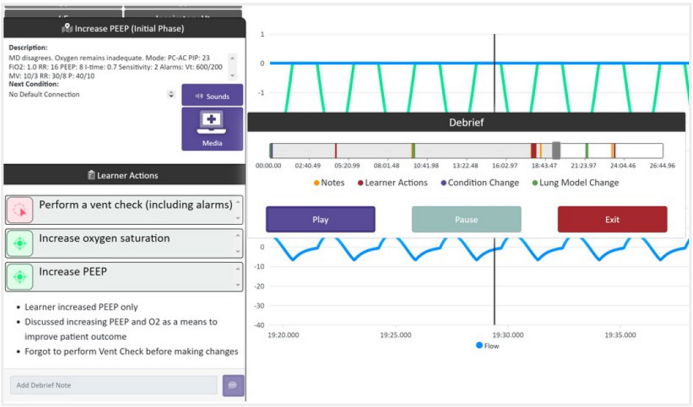


Figure 3 62: Debrief Learner Actions and Notes

The Scenario Map is also interactive during Debrief. As the simulation timeline shows a Condition change, it will also be visible on the Scenario Map as the applied Condition. Any Condition can still be selected to view the associated Condition Panel, but the applied Condition stays under the control of the Debrief timeline.

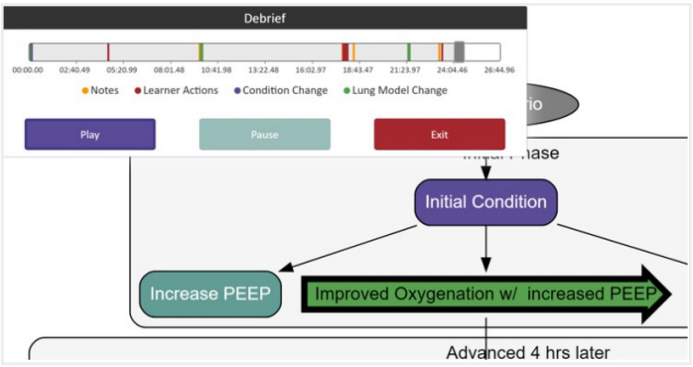


Figure 3 63: Debrief and Scenario Map

4. SYSTEM SETUP

4.1 Connecting to the Aurora Manikin

Respiratory devices such as ventilators or CPAP machines can connect via a patient circuit directly to the manikin either through an ET Tube or via non-invasive means. The ventilation device will respond with realistic pressures, flows, and volumes.

Figure 4 1: Aurora Manikin

NOTE: The Aurora manikin has an internal network router allowing the instructor to connect the RespiSim® software directly to the manikin with no need for extra wires.

4.2 Connecting the Patient Monitor

NOTE: The Patient Monitor Application works on any PC / Surface computer running Windows operating system (ver 10 and 11). The patient monitor computer must be on the same network as the computer running the RespiSim® software (Instructor PC).the manikin with no need for extra wires.

The Patient Monitor Application is controlled by the RespiSim® Software and is accessible via the Landing Application. This works like a webpage for access to the Patient Monitor (included with RespiSim®) and the Virtual Ventilator (Optional for RespiSim® e-Learning courses).

Figure 4 2: RespiSim® Landing Page for Patient Monitor and Virtual Ventilator

The Patient Monitor is an instructor-driven, interactive application that gives the learner information about the patient medical state during a Condition within a Scenario. This includes vitals, waveforms (HR, SpO2, BP, ETCO2), labs/ ABGs, as well as relevant images / media (x-rays, CT scans, ECGs, Ultrasounds) and notes about the patient's condition in the Scenario. This application displays all Patient Vital elements explained in the previous sections.

NOTE: When installing the Landing Application on a separate device, the recommended screen resolution is 1920x1080.

Follow the steps below to install the application on a separate Windows 10/11 device (Surface / Laptop):

Installing the Landing Application on a Windows computer:

17. Install "31 00 768 RespiSim_LandingPage.exe" onto a Windows 10/11 device
18. Completing the installation will place a shortcut to the Landing Application on the desktop of the device

Figure 4 3: Landing Application Icon for Windows 10/11

Start RespiSim® on the instructor computer. Once RespiSim® is running (and the Landing Application is installed on a device on the same network), start the application to connect to the Patient Monitor.

NOTE: When the Landing Application first opens, the Device Address field will have "Localhost" as the default address. This can be used to connect to the Patient Monitor if the Landing Application is loaded on the same computer running RespiSim®

Select the Patient Monitor icon, then enter the IP address of the device running RespiSim®. This opens the Patient Population window.

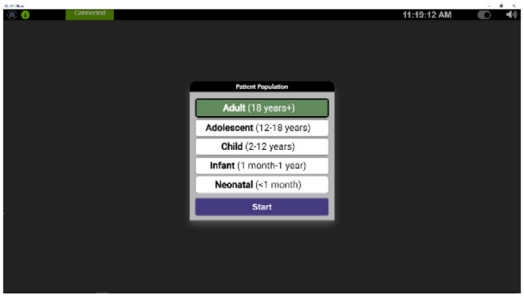


Figure 4 4: Patient Monitor - Start Screen

Select the patient type and click the Start button. The Patient Monitor opens displaying connection status in the top left of the window. The window stays in this view until the RespiSim® Software starts.

Figure 4 5: Patient Monitor Before Starting a Simulation

4.3 Putting It All Together

With RespiSim® running and the Patient Monitor Application open and connected, select a simulation or start a virtual simulation.

NOTE: IngMar Medical uses the Quick License Manager system (QLM) to manage licensing of the RespiSim® Software and features like the Virtual Ventilator. The system prompts you for a license key on your first attempt to connect to the Aurora manikin, or the Virtual Ventilator. Please contact our customer support team with any questions at support@ingmarmed.com..

1. From the RespiSim® Start Screen, select a scenario or start with a new scenario

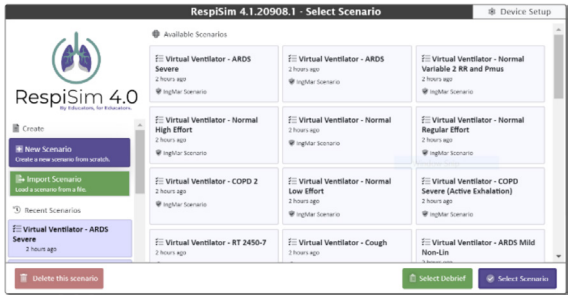


Figure 4 7: RespiSim® Software Startup Screen

2. If running a scenario with the Aurora manikin, the system should be ready once a scenario is selected if the computer is connected to the manikin's internal network router.

3. If using the Virtual Ventilator, the ASL configuration will be set to Connect using ASL Emulation Mode. For detailed instructions on activating your license for the Virtual Ventilator software, please refer to the Virtual Ventilator User Guide (80 31 770) found on the RespiSim® Downloads page (http://www.ingmarmed.com/RespiSimdownloads).

The following steps are included as a guide to activating the license:

NOTE: The Virtual Ventilator is a feature that requires a separate license. The process below is similar for the Virtual Vent feature upgrade. For detailed instructions on activating your license for the Virtual Ventilator software, please refer to the Virtual Ventilator User Guide (80 31 770) found on the RespiSim® Downloads page (http://www.ingmarmed.com/RespiSimdownloads).

You are now connected and ready to run simulations. The remaining sections of this manual provide details about each of the main areas of the software. Instructions are also included for connecting to additional devices, including the RespiScope®.

5. STARTUP SCREEN

5.1 Startup Screen General Layout

The Startup Screen is the launch pad for working in the RespiSim® Software environment. From this screen, all Scenarios (custom or created / validated by IngMar Medical) are accessible. The screen includes a view of the available Scenarios. A new Scenario can also be created from scratch.

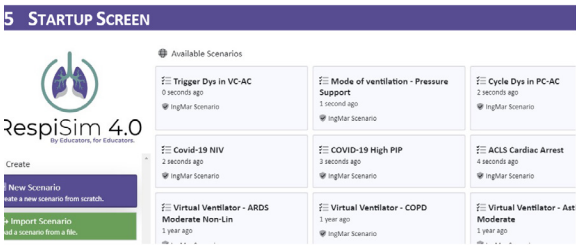


Figure 5 1: RespiSim® Software Startup Screen

For RespiSim® 4.4 and below, the top of the screen is the Device Setup button which is where you configure the ASL 5000® connection. For RespiSim® 4.5, the Device Setup button is replaced with the Emulator button. This is because the Aurora manikin automatically connects to the RespiSim® software when the computer is connected to the internal Aurora network router. The bottom of the screen includes the selection and deletion of Scenario and selection of a Debrief recording

5.1.1 Connect using ASL Emulation Mode

This mode is available when developing or running Scenarios in a virtual environment (without an ASL 5000®). This is also the primary mode for running e-Learning simulations with the Virtual Ventilator feature). The ASL Emulator connection simulates the realistic volume and flow feedback as a result of the patient's resistance, compliance, and effort (or muscle pressure). In ASL Emulator Mode, the airway pressure feedback, due to external pressures and flows from an external device (e.g. ventilator), is not available. However, using the Virtual Ventilator feature will provide the realistic airway and pressure feedback. When clicking the Connect using ASL Emulation Mode button, the Device name updates to ASL Emulator. The Status name remains Not Connected until the you click the Connect button. Then, the Status name updates to Connected. Click the Disconnect button and the Status returns to Not Connected.

5.2 Loading/ Deleting New or Existing Scenarios

5.2.1 Loading Scenarios

To load a new Scenario, from the Startup Screen, click the New Scenario button under the RespiSim® logo, then click the Select Scenario button at the bottom right. This will open a prompt to name the Scenario (optional) and select an initial patient condition Lung Model (required).

Figure 5 6: Loading a New Scenario

Load a Lung Model using the dropdown menu or by clicking the library icon which opens the Lung Model Library (detailed explanation in the Home Screen section below). Click Confirm and the Home Screen opens with the selected Lung Model. When loading an existing Scenario, there is no prompt, and the Scenario opens to the Home Screen.

NOTE: If the Scenario Name is left blank, the name defaults to New Scenario1. Any new Scenario without a name created thereafter, increments the Scenario number, e.g. New Scenario2, New Scenario3, etc.

5.2.2 Deleting Scenarios

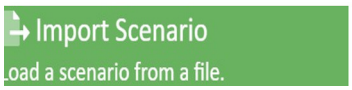
Scenarios can only be deleted from the Startup Screen. Select the Scenario you wish to delete, then click the Delete Scenario button. This opens a prompt requiring you to click Confirm before the Scenario is deleted.

NOTE: IngMar Scenarios are protected and cannot be deleted.

Figure 5 7: Deleting a Scenario

5.3 Importing Scenarios

Scenarios created in the RespiSim® Software 4.0 or newer environment can be imported. Click the Import Scenario button from the Startup Screen. Click the Choose File button and navigate to the Scenario to be imported. The file format for Scenarios will be .zip.



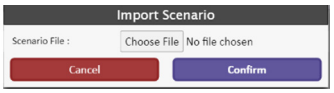


Figure 5 8 - Import Scenario

NOTE: The feature to export a Scenario occurs from the RespiSim® dropdown menu after a Scenario is opened. This is explained further below.

5.4 Selecting a Recorded Debrief

When a Scenario is complete, the instructor has the option of saving or discarding the recorded data for use in a Debrief session. A Debrief can be loaded directly from the Startup Screen or from the RespiSim® Software dropdown menu. Click the Select Debrief button from the Startup Screen and the Select a Debrief screen opens. For details on the Debrief screen, see the Debrief section below.

6. USER SETTINGS

The RespiSim® Software user settings are mostly contained within the RespiSim® dropdown menu. The dropdown is divided into four (4) sections: Scenario, Lung Model, Debrief, and System. These are further defined below.

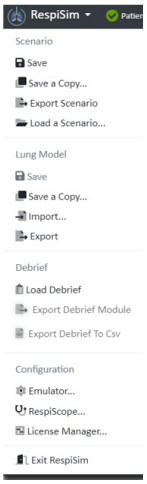


Figure 6 1: RespiSim® Dropdown Menus

6.1 RespiSim® Dropdown – Scenario

6.1.1 Save

This option saves an open Scenario. All IngMar Scenario's, which are labeled with the icon on the Startup Screen, are protected to prevent modifications.

6.1.2 Save a Copy...

The instructor can save a copy of any open Scenario, including Ingmar Scenarios

6.1.3 Export Scenario

Export any Scenario by opening it and selecting this option from the dropdown menu. The export will be saved as [scenario name] _export.zip.

6.1.4 Load a Scenario...

Click Load a Scenario to return to the Startup Screen and the Load Scenario options. If the currently opened Scenario has not yet been saved, the system asks you to Save or Discard the Scenario.

6.2 RespiSim® Dropdown – Lung Model

6.2.1 Save

This option saves an open Lung Model. All IngMar Lung Models, which are labeled with the icon in the Lung Model Library, are protected to prevent modifications.

6.2.2 Save a Copy...

The instructor can save any Lung Model, including IngMar validated Lung Models.

6.2.3 Import from 3.6

RespiSim® Software was previously developed as an optional feature of the ASL 5000® Software 3.6. Many users created their own custom Lung Models that can be useful in Scenario development in this new version of RespiSim® Software. To import a 3.6 Lung Model, select this option from the dropdown menu. Define the Patient Population (Neonatal, Infant, Child, Adolescent, Adult), then navigate to the Lung Model (.vr3 file) by clicking the Choose File button. Clicking the Confirm button adds the Lung Model to the Lung Model Library.

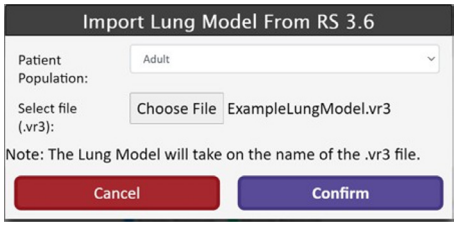


Figure 6 2: Import Lung Model from 3.6

6.2.4 Import from 4.0

Import Lung Models between RespiSim® Software 4.0 users by selecting this option from the dropdown menu. Define the Patient Population (Neonatal, Infant, Child, Adolescent, Adult), then navigate to the Lung Model (.lm file) by clicking the Choose File Button. Clicking the Confirm button adds the Lung Model to the Lung Model Library.

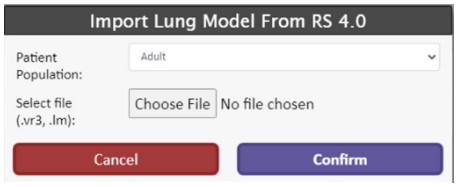


Figure 6 3: Import Lung Model from 4.0

6.3 RespiSim® Dropdown – Debrief

6.3.1 Load Debrief
Selecting this option opens the Select Debrief screen to Load and review a recorded Debrief.

6.3.2 Export Debrief Module
When a Debrief is loaded, the instructor can select this option to export the currently open debrief. Selecting this option opens the Export Debrief Module screen. Replace the name in the box with a name that is recognizable for the intended user. By default, the file exports to the Downloads directory.

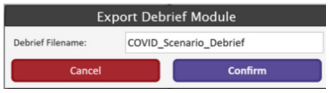


Figure 6 4: Exporting a Debrief Module

6.3.3 Export Debrief to CSV
The instructor may wish to offload the waveform and Live Data for research purposes. Like exporting a module described above, the data can be exported to a .csv file format. To capture this file, the Debrief must be loaded. Selecting the option opens the Export Debrief to CSV screen. Enter a filename and check the Waveform and Live Data boxes as applicable. Click confirm and a .zip file containing the waveform and live data will export to the Downloads directory.

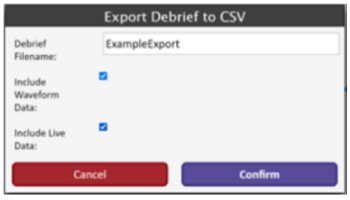


Figure 6 5: Exporting Debrief Data

6.4 RespiSim® Dropdown – Configuration

6.4.1 Emulator
This option opens the Emulator configuration window if the user wants to run a virtual simulation

6.4.2 RespiScope®...
This option allows you to configure and connect the RespiScope®. This is explained in detail in the RespiSim® Auscultation section below.

6.4.3 License Manager...
This option opens the QLM license manager to activate or deactivate a license.

6.5 RespiSim® Dropdown – Exit RespiSim®
This option allows you to exit the software and automatically disconnect from Aurora.

7. HOME SCREEN

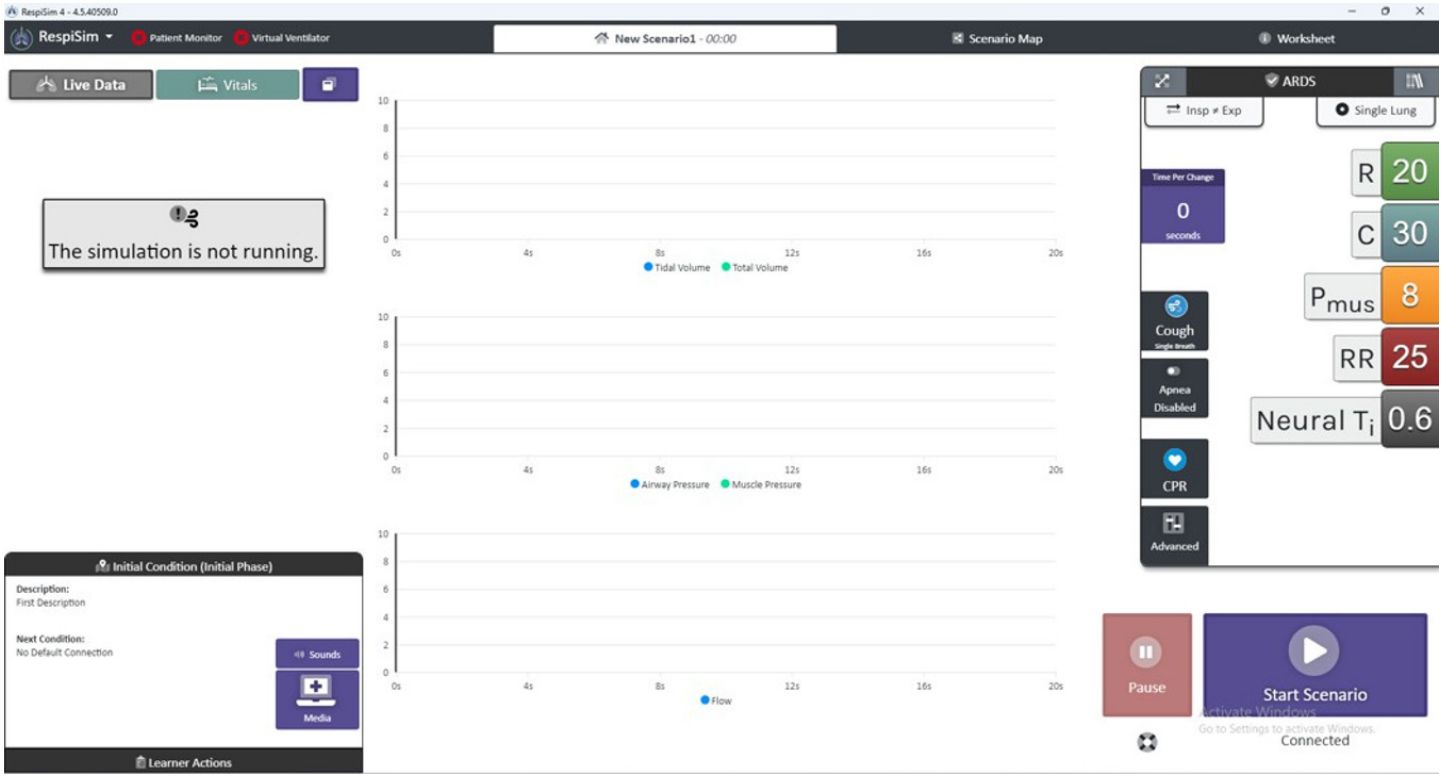


Figure 7 1: Home Screen Prior to Starting a Simulation

7.1 Lung Waveforms

The Lung Waveforms are the pressure, flow and volume waveforms that are provided by the physical lungs (or emulator). The volume measurement is displayed as Tidal Volume which is intended to closely match the results seen on a ventilator. The two (2) pressure waveforms are Airway Pressure, measured by the lungs, and Muscle Pressure, used to create the spontaneous breathing efforts by the patient. The flow accounts for total flow in the system. The waveforms depicted in RespiSim® Software are from the patient's point of view and, therefore, small differences between these waveforms and those of a ventilator can be expected.

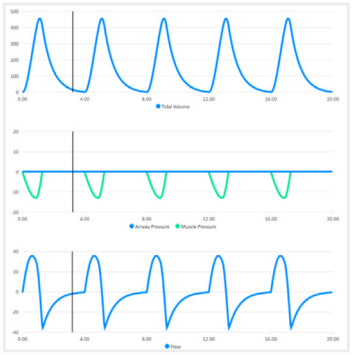


Figure 7 2: Waveforms

7.2 Live Data and Vitals

On the top left side of the Home Screen, the Live Data tab displays patient lung parameters, as calculated by the physical lungs, such as inspiratory tidal volume and PEEP.

Figure 7 3: Live Data

All Live Data parameters are defined in the table below

Parameter	Name	Definition
Pplat (cmH_2O)	Plateau Pressure	Pressure reading resulting from an inspiratory hold placed at the end of inspiration when there is no flow occurring.
Breath Rate (BPM)	Breath Rate	Total breath rate accounting for both spontaneous breathing and ventilated breaths.
I-time (s)	Inspiratory Time	The amount of time it takes to inhale one (1) breath's tidal volume (in seconds). This value is based upon flow.
E-time (s)	Expiratory Time	The amount of time it takes to exhale one (1) breath's tidal volume (in seconds). This value is based upon flow.
I:E	Inspiratory/ expiratory time ratio	Ratio of inspiratory time to expiratory time. Equation is written as 1 : (E-time/I-time).
Inspiratory Vt (mL)	Inspiratory Tidal Volume	Total volume delivered during the inspiratory phase which is measured at the end of inspiration. This is the total amount of volume received by the patient during inspiration.
Expiratory Vt (mL)	Expiratory Tidal Volume	Total volume exhaled at the end of expiration (spontaneous or from a ventilator). Amount volume exhaled from the patient Total tidal volume delivered to the patient seen on the expiratory phase.
MV (L)	Minute Ventilation	Inspiratory tidal volume multiplied by the total breath rate.
PEEP (cmH_2O)	Positive End Expiratory Pressure	Amount of pressure in the lungs at the end of exhalation.
AutoPEEP (total)	AutoPEEP	Calculation during zero flow, at the end of expiration, that accounts for the additional measured pressure above PEEP.
Pmean (cmH_2O)	Mean Airway Pressure	The average airway pressure during the inspiratory and expiratory phases of a breath.
Ppeak (cmH_2O)	Peak Airway Pressure	Peak pressure during the inspiratory phase.
P_0.1 (cmH_2O)	P_0.1	Calculated airway pressure 100ms after the start of inspiration.
Peak Flow (LPM)	Peak Flow	Highest flow measured during the inspiratory phase.
Trig Resp Time (ms)	Trigger Response Time	The amount of time it takes for the ventilator to sense that a patient is initiating a breath.
Patient WOB (mJ)	Patient Work of Breathing	Work by the patient from the start of inspiration to the end of expiration. Based on spontaneous effort by the patient.
Total WOB (mJ)	Total Work of Breathing	Combined patient work plus external work by the ventilator excluding PEEP.

Table 1: Live Data Parameter Definitions

The Vitals tab communicates directly with the Patient Monitor Application on the Learner Display (locally or external display). When connected, the vitals will populate based on the current applied Condition from the running Scenario. The Vitals tab is fully interactive with the Patient Monitor Application, so the instructor can make real-time changes to the vitals, as needed (e.g. to force an alarm on the Patient Monitor Application). If the Patient Monitor Application is not connected, no data will be present in Vitals screen.

The Live Data and Vitals can be customized by clicking the icon. This opens a screen where Live Data and Vitals parameters can be selected/ deselected from view during the simulation.

Figure 7 4: Vitals

7.3 Condition Detail/ Sounds/ Media/ Learner Actions

The bottom left side of the Home Screen displays the collapsible Condition Details/ Learner Actions tabs. The top tab provides information about the current Patient Condition that is applied in the running Scenario, as well as the optional Default Connection to another Condition.

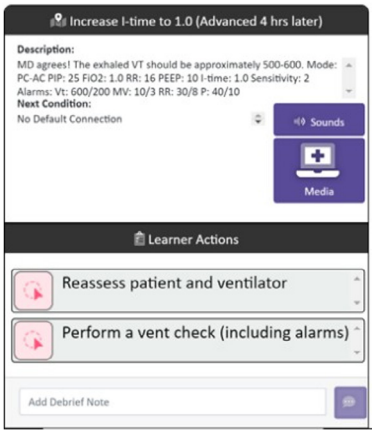


Figure 7 5: Condition Detail

Click the Media button to view the waveforms and images that are configured to display on the Patient Monitor Application for the current, applied Condition. As with the Vitals tab, the Waveforms and Media are interactive with the Patient Monitor Application and can be changed on-the-fly during a running Scenario.

Figure 7 6: Patient Monitor Images and Waveforms

Click the Sounds button to open the Active Condition Sounds screen including local and RespiScope® sound options. Like the Vitals tab and Media button, the Active Condition Sounds are interactive with the RespiScope®. See the RespiSim® Auscultation section below for details about working with the RespiScope® and local sounds.

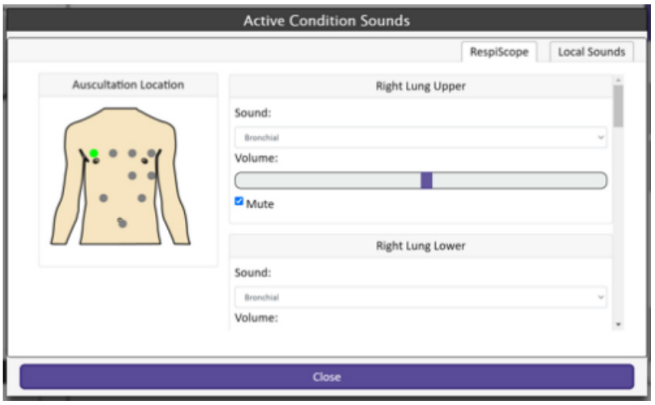


Figure 7 7: Active Condition Sounds

The bottom tab includes Learner Actions and the ability to add Debrief Notes. There are two (2) types of Learner Actions: Informational and Trigger-based. These are detailed in the Scenario Map section below. When a Learner Action is applied, the action changes from Red (incomplete) to Green (complete). The Add Debrief Note field is for entering free text during the simulation for any notes or debrief teaching points. All notes are saved for Debrief.

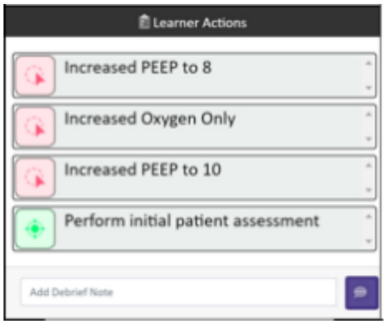


Figure 7 8: Learner Actions and Debrief Notes

7.4 Lung Model Library

When starting a new Scenario from scratch, the instructor is required to select a Lung Model from a dropdown menu. .

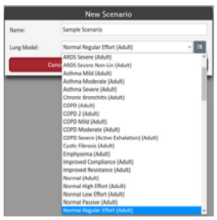


Figure 7 9: New Scenario Select Lung Model

The instructor can also click the icon to open the more detailed view of the Lung Model Library. Most of the Lung Models in the Lung Model Library have been clinically validated by research. A validated model includes the icon. The Lung Model Library includes additional features to help narrow down the search: Search field, filter by Patient Population, and a check box to filter by Validated Models. The Lung Model Library can also be accessed from the Lung Model Builder on the Home Screen.

Figure 7 10: Lung Model Library

NOTE: The Lung Model Library also includes three (3) Nonlinear compliance ARDS models for the adult patient population.

7.5 Lung Model Builder

The Lung Model Builder is at the heart of RespiSim® Software. From this environment, virtually any patient Lung Model can be created to serve a teaching need. The characteristics of the patient's Lung Model can be altered in a variety of ways, from resistance and compliance to breath rate and spontaneous muscle effort. The model can be defined as a simplified single-Lung Model consisting of one (1) resistance and one (1) compliance to a dual-chamber complex model with active exhalation. The Lung Model Builder can be viewed with basic information (default) or can be by clicking the icon. When creating custom Lung Models, it's best practice to start from a Lung Model in the Lung Model Library, make modifications to the appropriate parameter(s), then Save a Copy from the RespiSim® dropdown.

Figure 7 11: Lung Model Builder - Basic and Expanded View

7.5.1 Lung Model Complexity

The complexity of the Lung Model can be increased using the two (2) buttons at the top of the Lung Model Builder. Clicking these changes the lung from a single-Lung Model, where inspiratory and expiratory resistance values are equal, to a dual-Lung Model, where every resistance value is directional. Like resistance, a single-Lung Model will have a single compliance, whereas a dual-Lung Model can have separate left and right lung compliances. The next figures provide the variations in Lung Model complexity.

Figure 7 12: Single Lung Models

Figure 7 13: Dual Lung Models

7.5.2 Editing Lung Model Builder Parameters

Click any of the parameters to edit a value. Edits can be made by clicking on the number directly, using the + / -, or adjusting the value with the slider. Click Confirm to assign the new value.

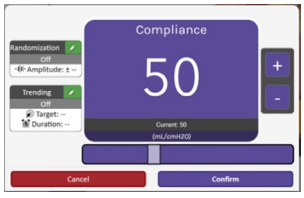


Figure 7 14: Lung Model Builder - Parameter Editor

Simulate a true-to-life interaction with the Randomization and Trending features. Randomize any parameter individually, within a set boundary, to provoke a more realistic patient. Turn the Randomization feature on and set the +/- range.

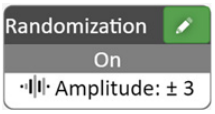


Figure 7 15: Lung Model Builder - Parameter Randomization

Additional realism can be introduced using the Trending feature. Trend any parameter individually to a new value over a set number of seconds. Turn the Trending feature on and set the target value. Then, set the time (in seconds) it will take for the trend to complete.

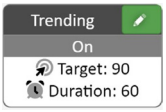


Figure 7 16: Lung Model Builder - Parameter Trending

The Time Per Change button is like Trending, however, it provides a global setting for all parameters, rather than trending an individual parameter. Set the number of seconds from one (1) parameter value to next in one (1) place.

Figure 7 17: Lung Model Builder - Time Per Change

Advanced breath parameters for active exhalation are available by clicking the Advanced button. These include active exhalation parameters (labeled Expiratory Muscle Pressure and Active E-Time) and the ability to adjust the time it takes the patient's muscle pressure to relax (labeled Passive E-Time)

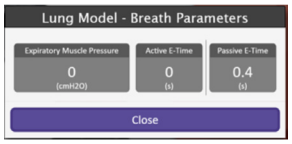


Figure 7 18: Lung Model Builder - Advanced Breath Parameters

7.5.3 Apnea and Cough

When a Scenario is running, two (2) additional features are included in the Lung Model Builder. These are the ability to enable/ disable Apnea and the ability to impose a Cough. As the simulation runs, the instructor may want to examine how a sedated patient might respond to a ventilator without changing the patient model. By clicking the Apnea Enabled button, the patient will no longer spontaneously breathe, requiring the ventilator or external device to perform all the work of breathing. Click the Apnea Disabled button and the patient resumes spontaneous breathing.

Figure 7 19: Lung Model Builder - Apnea Control

When clicked during a simulation, the Cough button exhibits a pressure profile that represents the high pressures associated with a patient coughing. Coughs can be clicked any time during a simulation, as well as repeatedly. The figure below shows the positive muscle pressure waveform with the volume and flow waveform response related to the Cough.

Figure 7 20: Lung Model Builder - Cough Response

7.5.4 CPR with Aurora Manikin

The RespiSim® 4.5 software, combined with the Aurora manikin, now includes CPR feedback. Within any running scenario, click the CPR button from the Lung Model Builder window. This will open the CPR operation, which includes real-time feedback to the Learner and Instructor. Set a timer, click Start and observe the response. Learners can also be given visibility through the Patient Monitor. See below for more details about CPR with RespiSim® and Aurora.

Figure 7 21: Lung Model Builder - Run Stand-Alone Model

7.6 Scenario Control

The Scenario can be started, stopped, and paused from the controls on the Home Screen. The Start Scenario button (if not connected) connects to the selected device (e.g. ASL Emulator) and starts the simulation with the applied Initial Condition. This button also serves to stop / end a Scenario and prompt for saving the Debrief recording

Status information is provided including manikin connection, what ASL 5000® device is connected, and the status of the simulation. Clicking the Pause button will not stop the Scenario. Instead, when the Scenario is paused, the debrief will not record. All varying parameters (random/ trend) will hold their current values including any Patient Vitals. This is especially helpful if the Instructor needs to pause to take a break or make an on-the-fly change that does not need to be included in the recorded Debrief.

Figure 7 22: Home Screen – Simulation Control

7.7 CPR Operation

Performing CPR with the Aurora manikin is initiated by the instructor. The CPR button is located within the Lung Model Builder below the Apnea button.

Open the CPR control window by clicking the CPR button inside the Lung Model Builder window. The CPR control can be moved around on the main screen and maintains visibility if switching between the Home screen and the Scenario Map screen.

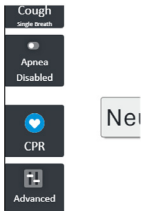


Figure 7 23: CPR Control

7.7.1 CPR window Components

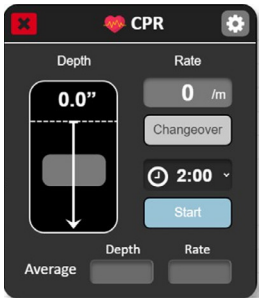


Figure 7 24: CPR Initial Open Screen

7.7.1.1 CPR Feedback Screen Components

- **Depth** – visualize the chest cavity dynamic movements (dashed line). See how well the student reaches the expected depth on each compression
  - Greed – within the recommended depth range
  - Red – outside the recommended depth range
  - Orange – idle, before starting or if no compressions occur within 15 seconds
- **Rate** – See the average compressions per minute over the past 5 compressions
- **Changeover** – Click this button to signify a changeover is occurring within a CPR session
- **Timer** – Set the duration for the CPR session
  - None – no timer set – Instructor starts and stops the session
  - 1min, 2min, 3min, 4min, 5min – Instructor starts the session and it ends when timer completes
- **Start/Stop** – Begins and ends the CPR session
- **Average** – At the conclusion of a CPR session, the average Depth (inches or mm) and Average Rate (compressions per minute) are displayed

Figure 7 25: CPR Feedback Screen

7.7.1.2 CPR Configuration Screen Components

- **Depth Range** – The AHA recommends compression dept to be between 2” and 2.4” (~51 – 61mm)
- **Rate Range** – The AHA recommends compressions per minute to be between 100 and 120 compressions per minute
- **Display Unit** – Displays the units in either Inches or Centimeters
- **Patient Monitor Visibility** – The instructor can allow the Learner to see the CPR feedback screen on the Patient Monitor by clicking the “Show on Monitor” button

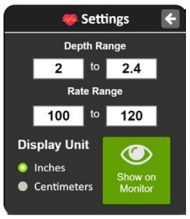


Figure 7 26: CPR Settings Screen

7.7.1.3 CPR Configuration Screen Components

The instructor controls whether the Learner has access to the CPR feedback window. Clicking the “Show on Monitor” button enables the CPR viewer from the patient monitor

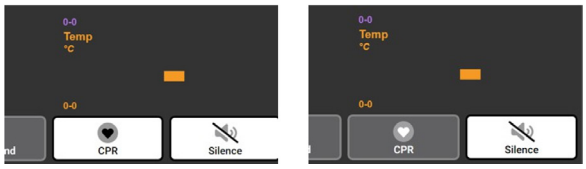


Figure 7 27: CPR Enabled vs. Disabled on Patient Monitor

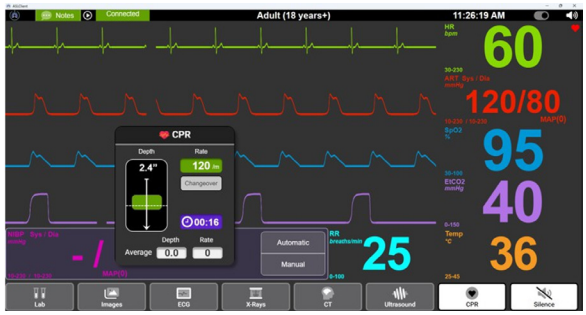


Figure 7 28 - CPR Visible on Patient Monitor

8. SCENARIO MAP

The Scenario Map is the primary environment for developing and building Scenarios. It is broken into three (3) main areas: Scenario Map, Scenario Builder, and Condition Panel. Also available on the Scenario Map are the same controls that exist on the Home Screen that allow an instructor to run Scenarios from either tab. When starting a Scenario from scratch, clicking on the Scenario Map has the same starting template.

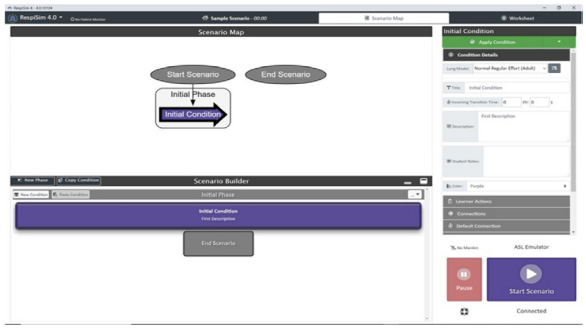


Figure 8 1: Scenario Map

8.1 Scenario Map and Scenario Builder — Layout and Zoom

The Scenario Map gives a birds-eye view of the Scenario flow with each map element representing a Condition. The Scenario Builder provides a more organized view of the Scenario and each Condition includes a Title and Description. The Scenario Map shows all Connections between Conditions and Phases from the Start Scenario to End Scenario blocks. The Scenario Builder aligns each Phase for easier navigation from Condition to Condition within a Phase. Clicking on any Condition on the Scenario Map or Scenario Builder selects it by a bold border and an update to the Condition Panel details. The Scenario Map can be adjusted with zoom and pan capabilities. The Scenario Builder bar includes the minimize/ maximize feature, as well. Below are some examples of Scenario Map and Scenario Builder views.

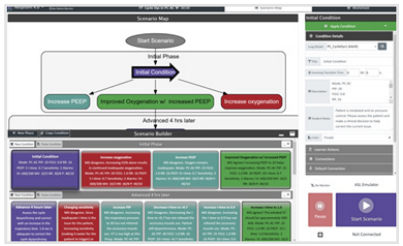


Figure 8 2: Scenario Map - Zoom View

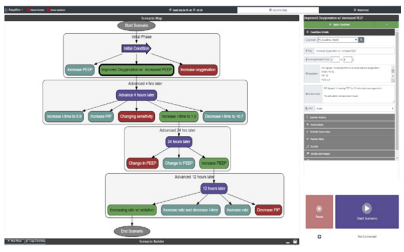


Figure 8 3: Scenario Map with Scenario Builder Bar Minimized

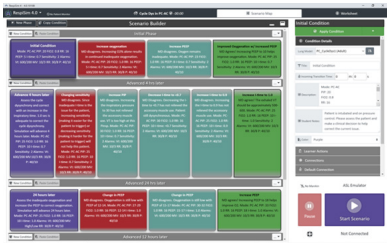


Figure 8 4: Scenario Map with Scenario Builder Bar Maximized

8.2 Building Phases and Conditions

Building a Scenario in RespiSim® Software is easy. The general concept is to have the Scenario broken into Phases and Patient Conditions. Below is an example of an IngMar validated Scenario, laid out in this process. Each Condition's Title is based on the expected learner interactions with the ventilator. As the Scenario progresses, the instructor applies the Conditions to reflect the results of the learner's actions. In the example below, the Green Conditions reflect the ideal path through the simulation. The instructor, however, is never forced to follow this path and can apply any Condition / make any on-the-fly changes with the goal of coercing the learner and their patient to a medically optimal outcome.

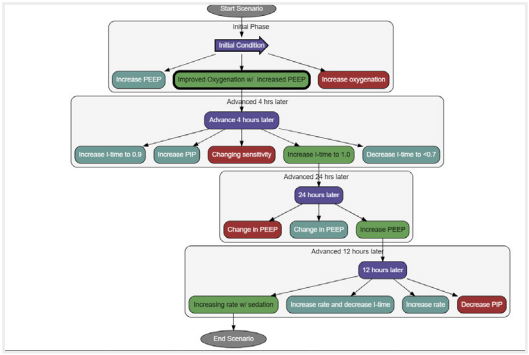


Figure 8 5: Cycle Dys in PC-AC Scenario Map

When a new Scenario is created, the Scenario Map always opens with an Initial Phase and Initial Condition. A new Condition contains, at minimum, a Lung Model and a Title. Using the Condition Panel, each Condition can be further adjusted with complex physiologies (Vitals, Media, Notes, etc.).

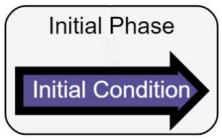


Figure 8 6: Scenario Map - Initial Phase and Condition

The Scenario Builder Bar and Phase Bar(s) are used to construct a Scenario.

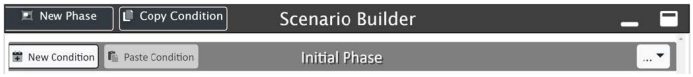


Figure 8 7: Scenario Map - Scenario Builder Bar and Phase Bar

The Scenario Builder Bar controls the amount of space divided between the Scenario Map and the Scenario Builder using touch gesture / mouse vertical movements. The typical Maximize and Minimize icons on the right of the Scenario Builder Bar will either maximize the Scenario map view or the Scenario details view.

Figure 8 8: Scenario Map - New Phase Dialog

Clicking the New Phase button opens a New Phase dialog and creates a Phase Bar that is always placed above the End Scenario block in the Scenario Builder.

Figure 8 9: Scenario Map - New Phase Created

Each Phase Bar contains dropdown menu items for renaming or deleting the Phase.

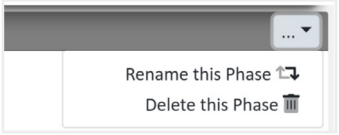


Figure 8 10: Scenario Map - Phase Bar Dropdown Menu

There are two (2) methods for creating a new Condition within in a Phase. The first method is to click the New Condition button. The second method is to select an existing Condition from the Scenario Map, click the Copy Condition button, then click the Paste Condition button on the Phase Bar where you want to paste the new Condition. When using the copy / paste feature, the pasted Condition is identical to the copied Condition, whereas a new Condition will require a new Lung Model and Title.

The bulk of the information and settings for each Patient Condition are contained within the Condition Panel tabs. his also includes Learner Actions and the Connections between Conditions.

8.3 Condition Panel

The Condition Panel stores all information pertaining to a selected Patient Condition. The tabs within the Condition Panel are organized to assist the instructor with a sequential approach to developing each Patient Condition.

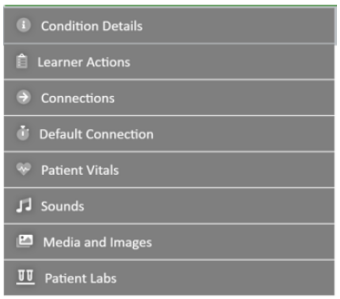


Figure 8 11: Condition Panel

8.3.1 Condition Panel Controls

The top of the Condition Panel includes the Apply Condition button and a dropdown menu. During a simulation, clicking the Apply Condition button makes the selected Condition active. If there are Transition Times involved, they will begin to take effect. The dropdown item, Apply Now, ignores any set Transition Times, and immediately applies the selected Condition. When building a Scenario, an undesired Condition can be deleted using the dropdown item, Delete Condition.

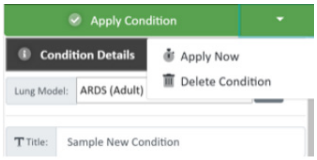


Figure 8 12: Condition Panel Controls

8.3.2 Condition Details

The Condition Details include the following:

4. **Lung Model** ® Load from the dropdown or click the icon to open the Lung Model Library (required).
5. **Title** ® Patient Condition Title which is visible as an element on the Scenario Map and on the Scenario Builder (required).
6. **Incoming Transition Time** ® The time it takes, in minutes and seconds, for the Condition to be applied. The Incoming Transition Time will trend all set paramters (Lung Model and Vitals) from the outgoing Condition's parameters to the incoming Condition's parameters This timer is overwritten if the Apply Now option is used. The Initial Condition does not allow for an Incoming Transition Time. Incoming Transition Time minimum value is 15 seconds when set.
7. **Description** ® This field is a free text field. When populated, it is visible on the Scenario Builder and on the Condition Information tab on the Home Screen.
8. **Student Notes** ® This field is a free text field. When a Condition is applied, the Student Notes will pop-up on the Learner Display requiring the learner to accept and close the note.
9. **Color** ® Color-fill for the selected Condition block, which appears in the Scenario Map and Scenario Builder. Available colors include: Purple, Orange, Red, Teal, Green, Other (gray), White, and Dark Gray. Colors can help instructors visually organize their Conditions. For example, Green could represent the Condition resulting from the most optimal decision, Orange for a moderate decision and Red for a less than optimal decision.

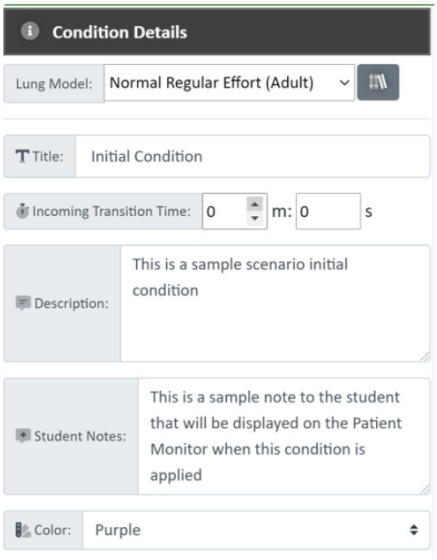


Figure 8 13: Condition Details

8.3.3 Learner Actions

Learner Actions are expected outcomes from the learner within each Condition. Learner Actions can also be defined as triggers associated with an automated Condition change. These triggers are discussed in the Connections section below.

Clicking Add Learner Action opens the New Learner Action screen. Text autofill aids with classifying the Learner Action name.

Figure 8 14: Scenario Map - Creating a Learner Action

Completed Learner Actions with and without the optional note are shown below.

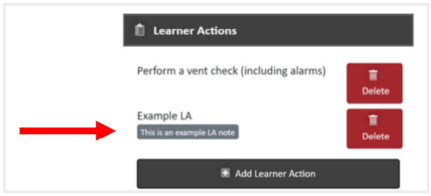


Figure 8 15: Scenario Map - Learner Action Examples

8.3.4 Connections

Connections provide the link between Patient Conditions. This is necessary for Learner Action Transition Triggers, which move to a predefined Condition when that Learner Action is completed. A Connection is also needed when using the Default Connection feature (explained in the next section).

Clicking Add Connection opens the Choose a Target screen. The current Condition and Phase are shown on the screen. When the instructor selects the target Condition from the Scenario Map or Scenario Builder, it populates the target's Condition and Phase information. Clicking Confirm opens the New Connection screen. Here, the Connection can be given an optional Description and/ or an optional Learner Action.

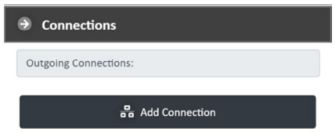


Figure 8 16: Scenario Map - Connections

Figure 8 17: Scenario Map - Connection Target

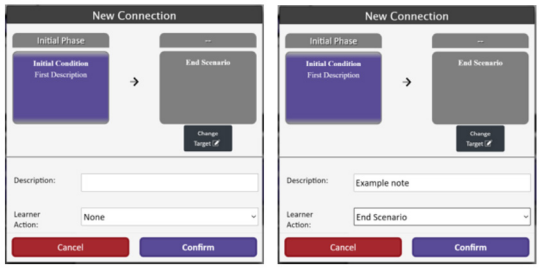


Figure 8 18: Scenario Map - Connection Confirmation Examples

After Connections are defined, the Connections tab shows Outgoing and Incoming Connections. In the figure below, the icon signifies that the Connection to End Scenario can be triggered by the completion of the End Scenario Learner Action.

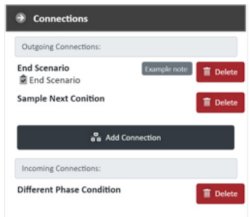


Figure 8 19: Scenario Map - Incoming and Outgoing Connections

8.3.5 Default Connection

The Default Connection is an optional setting for the connecting Conditions. When a Default Connection is selected from the dropdown, the instructor can set a Hold Time that defines how long the simulation will remain in the currently applied Condition before automatically transitioning to the Condition set by the Default Connection

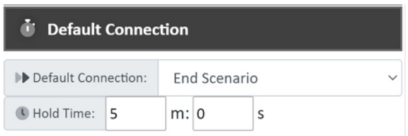


Figure 8 20: Scenario Map - Default Connection

Looking at the Cycle Dys Scenario example, the instructor could choose to create a Default Connection path that holds for 5 minutes in each Condition on the drawn path. In this Scenario, the instructor need only take notes or acknowledge planned Learner Actions as the Scenario progresses automatically from the Initial Condition to the end of the simulation.

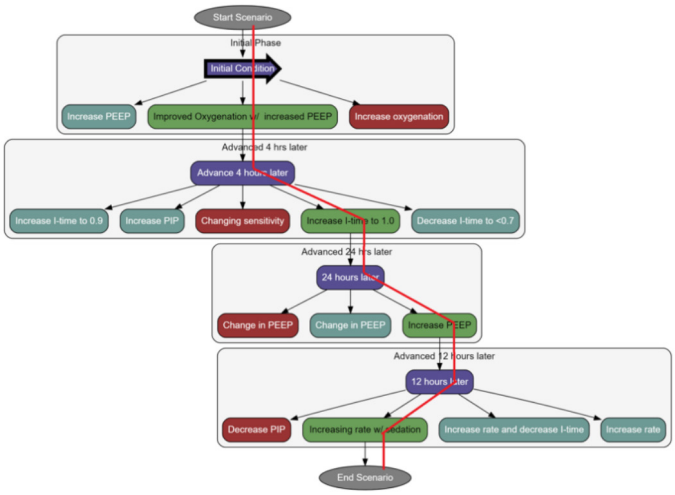
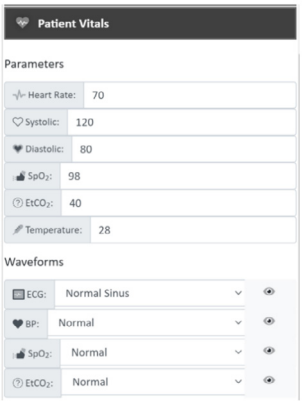


Figure 8 21: Scenario Map - Default Connection Example Path

8.3.6 Patient Vitals

The Patient Vitals are linked to the Patient Monitor Application running on the Learner Display. following tables provide the ranges for each of the Parameters as well as the available signal images for the Waveforms. The icon creates a preview of the selected Waveform.



Parameter	Range	Units
Heart Rate	0-300	BPM
Systolic	10-300	mmHg
Diastolic	10-200	mmHg
SpO_2	0-100	%
$EtCO_2$	10-80	mmHg
Temperature	30-40	°C

Table 2: Patient Vitals - Parameter Ranges

Figure 8 22: Scenario Map - Patient Vitals

ECG	BP	SpO2	EtCO2
None	None	None	None
1st Degree Block	Normal	Normal	Cardiac Oscillations
2nd Degree Block (2:1)	Over Damped		Emphysema
AF (Atrial Fibrillation)	Under Damped		Normal
AF - Digoxin Effect			Pigtail
Asystole			Saturated Soda Lime
Atrial Flutter			Subsiding Relaxant
Atrial Flutter (3:1 Conduction)			
Bigeminy			
Complete Heart Block			
Long QT			
Mild Hyperkalemia			
Normal Sinus			
Pacemaker with Capture			
Pacemaker without Capture			
Pulseless Ventricular Tachycardia 1			
Pulseless Ventricular Tachycardia 2			
Severe Hyperkalemia			
ST Depression			
ST Elevation			
SVT (Supra Ventricular Tachycardia)			
Ventricular Standstill/p-Wave Asystole			
Ventricular Tachycardia 1			
Ventricular Tachycardia 2			
Ventricular Tachycardia 3			

Table 3: Patient Vitals - Waveforms

8.3.7 Sounds
Please see the RespiSim® Auscultation section below for details on using Local Sounds and the RespiScope®.

8.3.8 Media and Images
Media and Images are linked to the Patient Monitor Application running on the Learner Display. The following table provides available images for each scan. The icon creates a preview of the selected media. The instructor can upload custom media using the icon. Acceptable file formats are .jpg and .gif.

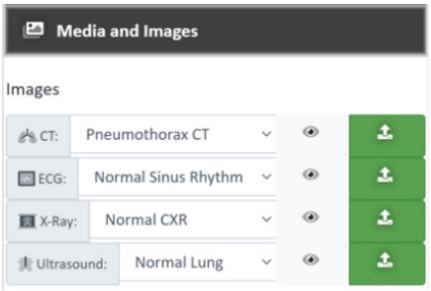


Figure 8 23: Scenario Map - Media and Images

CT	ECG	X-Ray	Ultrasound
None	None	None	None
Acute on Chronic SDH	Right Heart Strain	Tension Pneumothorax	AAA
Hepatosplenic Trauma	Atrial Flutter	600 CXR bilateral interstitial infiltrates with left effusion	Normal Aorta
Frontal SOL	Wolff Parkinson White	600 CXR left lower lobe infiltrate and effusion	LUQ With Free Fluid
Frontal Contusions	Wenckebach	300 CXR bilateral interstitial infiltrates with left effusion	9yo Appendicitis
Extradural Haem 3	Wellens Syndrome	300 CXR left lower lobe infiltrate and effusion	Large Haemothorax
Right Upper Lung Mass	Ventricular Tachycardia	Trigger Dys X-ray	Cardiac Tamponade
Pericardial Effusion with Consolidation	Tricyclic Toxicity	Rib Fractures Supine Hemothorax	Splenic Rupture 1
Chronic Subdural Hemorrhage	Atrial Fibrillation	Pneumoperitoneum	Large Periocardial Effusion
Aortic Dissection	Trifascicular Block	Pelvis Severe Trauma	Testicular Torsion
Acute Subdural 2	Atrial Flutter 2-1 Block	Paed Femur Fracture	Splenic Rupture 2
Acute Subdural	Bifascicular Block	Orbital Floor Fracture	Pleurodesis
GSW Skull	Torsades De Pointes	Multilobe Collapse	Aortic Dissection 1
Subarachnoid Haem	SVT (AVNRT)	Low Femoral Fracture	Pulmonary Embolism
Splenic Rupture	STEMI Inferolateral	Iron OD	Ectopic Rupture
Small Bowel Obstruction	STEMI - Inferior	Intracapsular Fracture NOF	Full Stomach
PCA Infarct	STEMI - Anterior	Bowel Obstruction	Aortic Dissection 2
Multiple Brain Mets	Sinus Bradycardia	Lung Mets	RUQ Normal
Massive ICH	Right Bundle Branch Block	Sternal Fracture	RUQ Free Fluid
Liver Laceration	Posterior MI	COVID19 Asymmetrical	Pneumothorax
Intracerebral Haem	Pericarditis	COVID19 Asymmetrical 2	Normal Lung
Pneumothorax CT	AF With Digoxin Effect	COVID19 Mild	LUQ Normal
Lymphangitis Carcinomatosis	Pacemaker With Capture	COVID19 Moderate	RUQ 2
Lung Mass	Normal Sinus Rhythm	COVID19 Moderate 2	RUQ
Tuberculosis	Left Bundle Branch Block	COVID19 Pacemaker	Pregnant 6 Weeks
Trauma Massive Head Injury	Left Axis Deviation	COVID19 Severe	Pregnant 15 Week
Trauma Acute Subdural Hematoma	HOCM	COVID19 Severe 2	Pericardial Effusion
	Hyperkalemia Severe	COVID19 Severe 3	Male Pelvis Transverse
	Hyperkalemia Mild	RSV infant	Male Pelvis Longitudinal

CT	ECG	X-Ray	Ultrasound
	Electrical Alternans	Neonate intubated normal	LUQ With Free Fluid 3
	Complete Heart Block	Normal infant	RUQ With Free Fluid 2
	Brugada Syndrome	Tension Pneumothorax during inspiration	LUQ With Free Fluid 2
	Pacemaker Variable Capture	Supine Pneumothorax 1	LUQ 2
	Sinus Tachycardia with Complete Heart Block	Subcutaneous emphysema	LUQ
	Sinus Bradycardia with PVC	Severe ARDS-intubated	Female Pelvis Transverse
	Sinus Tachycardia with Premature Atrial Complexes	Right Upper Lobe Pneumonia	Female Pelvis Longitudinal
	Sinus Tachycardia	Right Upper Lobe Pneumonia 01	Abdominal Aortic Aneurysm Transverse
	Sinus Tachycardia 2	Right Mainstem Intubation	Abdominal Aorta Proximal Transverse
	Sinus Tachycardia 3	Right Mainstem Intubation 2	Abdominal Aorta Longitudinal
	Acute MI 1	Pediatric Asthma	Intussusception-trans-720
	Bifascicular	Pediatric Ped PNA	Intussusception-long-720
	NSR with 1st degree AV block	Pediatric PNA1	Hypovolemic
	Normal ECG	Pediatric Left Lung Aspiration	Heterogeneous and Echogenic Thrombus in IJV
	Left Vent Hypertrophy in the Presense of Left Anterior Hemiblock	Left Diaphragmatic Hernia	Costochondral Separation
	Flutter SVT	Infant Pneumothorax	Cardiomyopathy
	First Degree Heart Block	Lateral Decub PTX	Acute-AAA
	Digitalis	Haemopneumothorax	Acute-AAA 2
	Early repolarization	GSW to back	Tracheal Intubation
	Acute Pulmonary Embolus	Emphysema	TAA-dissection
		Effusion Intubated	TAA-dissection 2
		Effusion	Subcutaneous Emphysema and Pneumothorax
		Diffuse alveolar hemorrhage	Sternal Fracture
		Diaphragm Rupture	Right Pleural Effusion
		Diaphragmatic Hernia	Pu.monary Embolism with McConnels sign and Paradoxical Septal Motion and a D-shapted Septum
		Bronchiolitis 1	Pulmonary Embolism in Transit

Table 4: Media and images

CT	ECG	X-Ray	Ultrasound
		Bronchiolitits	Pleural Effusion with Fine Echogenic Debris
		2yo Right superior mediastinal soft tissue mass	Pleural Effusion and Pericardial Effusion with Echocardiographic Signs of Tamponade
		Tuberculosis	Pleural Effusion and Pericardial Effusion with Echocardiographic Signs of Tamponade 1
		Tuberculosis 2	Pleural Based Metastatic Deposits with Associated Effusion
		Trig Dys x-ray	Mitral Stenosis-PSLX-1
		Tension Pneumothorax with a broken clavical	Massive Plumonary Embolism and Cardiac Arrest
		Bronchiectasis	Massive Plumonary Embolism and Cardiac Arrest-2
		Aspiration Pneumonia	Massive PE and DVT
		Aspergillosis	Lymphadenopathy
		ARDS	Left Sided Pleural Effusion with Associated Lung Collapse
		Alviolor Hemmorage	Left Atrial Tumor Atrial Myxoma
		Right Tension Pneumo	AAA-long
		Pneumomediastinum	AAA-cardiac-arrest
		Normal	
		Normal 1	
		NG tube in Bronchus	
		Mesothelioma	
		CXR Mass	
		COPD	
		COPD 1	
		Bronchiectasiss 2	

Table 4: Media and images

8.3.9 Patient Labs

Patient Labs are linked to the Patient Monitor Application running on the Learner Display. The following table provides the Labs and ABGs and their associated units.

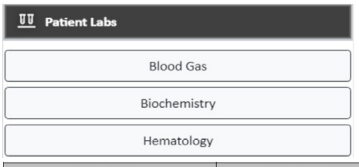


Figure 8 24: Scenario Map - Patient Labs

Blood Gas	Biochemistry	Hematology
pH	Na^+ (mEq/L)	Hb (g/dL)
pCO_2 (kPa)	K^+ (mEq/L)	WCC ($10^3/\mu L$)
pO_2 (kPa)	Urea (mg/dL)	PLT ($10^3/\mu L$)
Base Excess (mEq/L)	Creatinine. (mg/dL)	MCV (fL)
HCO_3 (mEq/L)	Mg^{2+} (mg/dL)	HCT (%)
SaO_2 (%)	Adjusted Ca^{2+} (g/dL)	ESR (mm/h)
F_iO_2 (%)	CRP (mg/dL)	D-Dimer (µg/mL)
Lactate (U/L)	Bicarb (mEq/L)	PT (s)
	Troponin T (ng/mL)	APTT (s)
		Fibrinogen (mg/dL)
		INR

Table 5: Patient Labs

9. WORKSHEET

The Worksheet holds all of the written information about the simulation environment surrounding the Scenario. The Worksheet includes the following sections:
•Scenario Information
•Learner Prerequisites
•Learning Goals and Objectives
•Pre-brief Information
•Setting Environment
•Ventilation Equipment
•Additional Medical Equipment Available for Learner
•Non-Medical Props
•Learner Roles
•Confederate Roles
•Patient Information

Each section includes text fields for free text (e.g. Scenario Overview) and bulleted list boxes where the instructor can click to add additional list items (e.g. Learning Objectives).

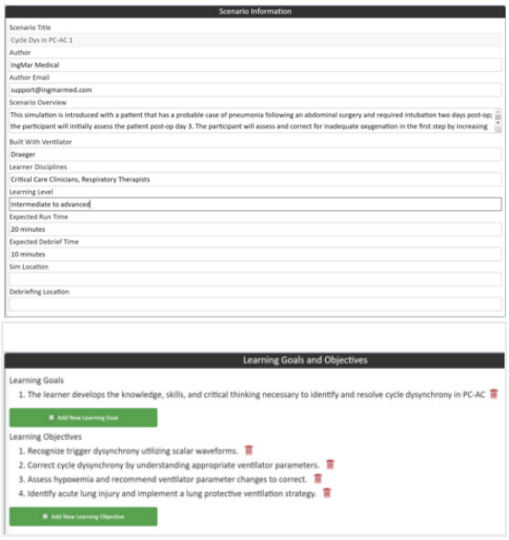


Figure 9 1: Worksheet - Free Text and List Fields

Navigate quickly to any section in the Worksheet by clicking a section name on the left side of the screen. Any section in the Worksheet can be exported for saving or printing. To export any section, check the applicable sections to export, then click the Export button. The checkboxes to the left of each section determine which sections will be exported. In many Scenarios, the instructor may provide the learner with a Patient Chart before starting a Scenario. The bottom section of the Worksheet, Patient Information, provides prompts to include the ideal information associated with the Patient Condition/ Patient Chart.

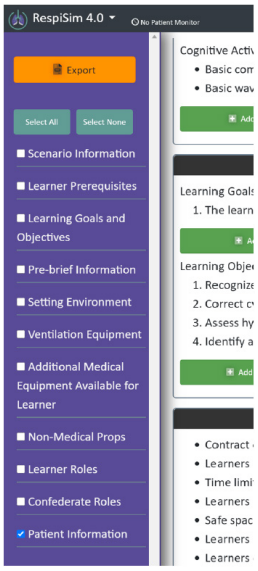


Figure 9 2: Worksheet - Export Patient Information

Below is a screen shot of the Patient Information export. The exported file is always named Scenario.pdf. It is recommended that you change the file name to manage additional/ future exports.

Figure 9 3: Worksheet - Export of Patient Information

10. RESPISIM® CONFIGURATIONS

RespiSim® has different configurations available depending on the intended training and educational goals, realism, and haptics responses. Customers with existing systems can also upgrade to the latest version

10.1 Aurora Manikin

The Aurora manikin includes the manikin with a realistic airway and the embedded ISL lung simulator, an internal router, the Patient Monitor Application on a separate display, and RespiSim® Software installed on the Instructor Display. This is a lower cost solution to the RespiPro® and Essential packages. This system is also teatherless with an internal battery providing at least two (2) hours of operation between charges.

Figure 10 1: Aurora Manikin and content of delivery.

10.2 Aurora Specifications and Technical Data

10.2.1 General Handling

Before using Atlas keep in mind these safety instruction

- Wear gloves as required during simulation scenarios.
- Avoid using colored plastic gloves, as they may cause discoloration.

- To maintain Atlas skin, wash hands before use and place Atlas on a clean surface.
- To avoid permanent staining avoid the use of ink pens, felt-tipped markers, acetone, or iodine.
- Avoid placing Atlas on newsprint or colored paper.
- After using Atlas, remove glue residue from Atlas's skin with 70% ethyl alcohol wipes, if necessary.

- Ensure that Atlas is properly secured during transportation to prevent personal injury or damage to the product.
- Always lubricate (silicon oil) the airway device (tracheal tubes, iGel) before inserting it in the airway.

- The device may only be stored and charged in dry rooms.
- Operating temperature: -10 °C up to +35 °C
- Storage temperature: -10 °C up to +35 °C
- Air humidity: 15% - 80%

- Only use the charger provided by the manufacturer.
- Charger connection specifications: Input 100-240 V
  Output 50-60Hz
  12.6V = 1000mA
- Recommendation: Once the battery is fully charged (the light on the charger turns green), take it out of the charger. Getting the manikin overcharged puts more stress on the battery and can shorten the battery life

- Follow the instructions and keep in mind the warnings while using the product.

10.2.2 Safety Instractions

To ensure optimum performance and durability of Atlas, read and follow the user information and warnings:

- Ø **DO NOT** perform mouth-to-mouth or mouth-to-nose rescue breathing on Atlas.
- Ø **DO NOT** introduce fluids into Atlas with the exception of IV/IO systems built into the arms.
- Ø **DO NOT** use electrotherapy or a live defibrillator or AED.
- Ø **DO NOT** use sharp objects in the airways.
- Ø **DO NOT** create a surgical airway.
- Ø **DO NOT** perform a relief puncture or inserting thoracic drains.
- Ø **DO NOT** use if there are signs of electrical malfunction, or unusual smell of smoke.
- Ø **DO NOT** use oxygen.
- Ø **DO NOT** use damaged chargers.
- Ø **DO NOT** take the battery apart. Never try to take the battery out of the device.
- Ø **DO NOT** try to repair the device yourself.
- Ø **DO NOT** use live defibrillators.
- Ø **DO NOT** use live cardiac pacing.

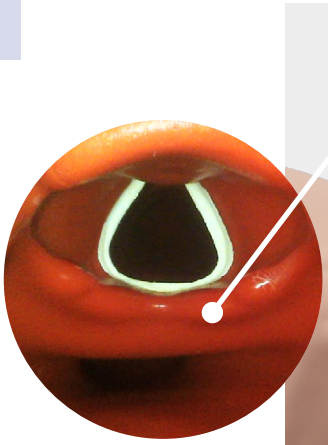
10.2.3 Airway

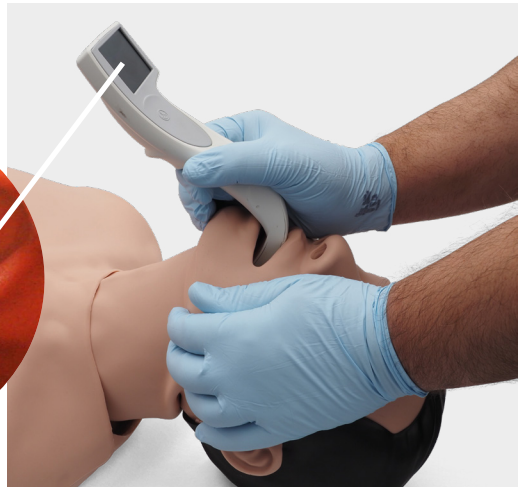
Aurora replicates the anatomy of the airways, complete with tongue, epiglottis, vocal cords, trachea and esophagus. Use Aurora to practice positioning of the head, manual maneuvers to open the airway and apply compatible aids for realistic airway management.

The airway can be opened by tilting back the head or by using the Esmarch maneuver. Other methods to clear the airway include simulated dry aspiration, removing inserted foreign bodies and inserting Guedel tubes (OPA) or Wendl tubes (NPA).

Nasal or oral intubation can be performed using a size 7.5 endotracheal tube (ET). For optimal intubation, use the improved Jackson position and the BURP maneuver. To intubate use a classic laryngoscopy, or video laryngoscopy.

Recommended tube sizes:
- Oraltracheal tube 7.5
- Nasotracheal tube 6.5 – 7
- iGel 4
- Laryngeal mask 4
- Laryngeal tube 4





Supra-glottic airway alternatives like, iGel, Laryngeal Masks (LMA) and Laryngeal Tubes (LT) can be used in accordance with manufacturers' instructions. Moreover a gastric probe can be inserted. Second generation airway option make it possible to insert a gastric probe.

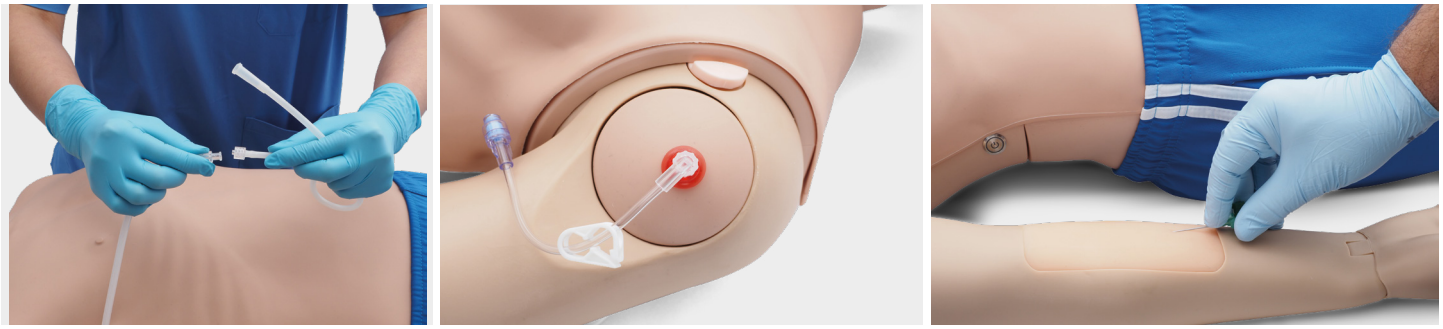
Note: Prior to using airway adjuncts, apply a small amount of silicon airway lubricant to the equipment.

10.2.4 Circulation

Aurora two IV pads on the forearm and dorsal side of the hand back of the right hand. We recommend 18G cannulas or smaller for ideal usage times. Aurora has one IO insert at the top of the Aurora's left arm. We recommend the use of drilling systems for this procedure.

When performing administration of medication via the IV pad and /or IO access site, use a drain bag which should be connected to the Luer lock adapter.
Aurora has one IO drain at the top of the Aurora's left arm and one at the top of the IV.

Recommended puncture sizes
- IV: ≤18G
- IO: drilling system



To change the IV pads and the IO insert, remove them from their original position and disconnect them from the drainage system. Then connect the replacement to the drainage system and place the new training pad in the slot. At the end of the training session, we recommend drying, removing the cannulas, and taking the drainage system apart.

When the day's sessions are done, flush the IV and IO sites with air to remove any fluid/liquid in the system. Connect a syringe filled with air to the IV/IO catheter and flush the IV pads/IO insert with air until only air exits the overflow tube.

Replacement of IV sites

Replacement of IO site

10.2.5 Internal Lung Technology Performance Specifications

Modes of Operation	Passive Spontaneous Interactive (change lung parameters in pseudo-real time)
Volumes	Total: 1000 mL Tidal: 900 mL
Flow	Peak Flow: 100 LPM
Resistance	8 to 150 cmH2O/L/s
Compliance	3 to 150 mL/cmH2O
Breath Rate	Passive to 100 bpm
Patient Effort (muscle pressure)	0 to 50 cmH2O
PEEP	>20 cmH2O
Neural Inspiratory Time	.1 to 3.6 seconds

10.2.6 Electrical Specifications

Supply Voltage	Input: Universal 100 to 240 VAC, 1.5A Max, 50-60Hz Output: 15.0V, 4.0A Max, 60W
ISL Electrical Specifications	12V Nominal, 4.0A Max

10.2.7 Physical Specifications

Dimensions		
	Manikin	5 feet 6 inches length (170cm length)
	ISL (internal) Lung	4.5 inches diameter (114.3 mm diameter) 9 inches length (228.6 mm length)
Weight		
	Manikin	33 lbs. (15 kg)
	ISL (internal) Lung	3.2 lbs. (1.45 kg)

10.2.8 Communication Specifications

Interface	Wireless Router (FCC ID: 2AFIW-AR300M)

10.2.9 Environmental Specifications

Operation	Temperature: 10°C to 40°C Humidity: 10 to 95%, non-condensing

10.2.10 Safety and Regulatory

The Aurora Manikin has received 3rd party testing for electrical safety and compliance.
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
1.This device may not cause harmful interference, and
2.This device must accept any interference received, including interference that may cause undesired operation.

The Declaration of Conformity is available upon request.

11. PATIENT MONITOR

The Patient Monitor is accessible on the Learner Display.

11.1 Patient Monitor

The Patient Monitor is the application running on the Learner Display that provides the Learner with patient physiology. This includes vitals, waveforms, labs, ABGs, notes and media (X-Ray, CT, etc.).

The RespiSim® Software notifies the instructor when the Patient Monitor connects.

NOTE: The Learner Display requires external power, and it is required to have a network connection (WIFI recommended) and be connected to the same network as the ASL 5000® and the computer running the RespiSim® Software.

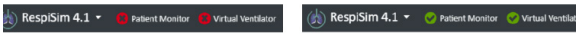


Figure 11 1: RespiSim® Software - Patient Monitor Status

NOTE: RespiSim® Software must be running to connect the Patient Monitor

The Patient Monitor is accessed via the Landing Application (see 4.2 above) and opens to the Patient Population window. After selecting the Patient Population, the Patient Monitor screen will look like the figure below.

Figure 11 2: Patient Monitor Connected to RespiSim® Software

11.1.1 Learner Controls

There are components of the Patient Monitor not “visible” to the Instructor when running Scenarios. At the top left of the screen, the icon is the Patient Monitor’s volume control. Clicking this button opens the Learner’s control of SFX (sound effects) and Alarms volumes.

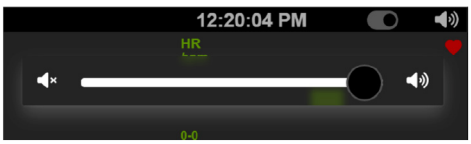


Figure 11 3: Patient Monitor Volume Control

The Patient Monitor also includes a set of alarms and alarm limits that can be set by the Learner. It is recommended that a Learner Action in the form of 'Set alarms on Patient Monitor' be added to the Initial Condition of your Scenario. Any value outside the alarms will trigger the value to blink on the screen along with an audible alarm. All alarms can be changed by clicking the number range.

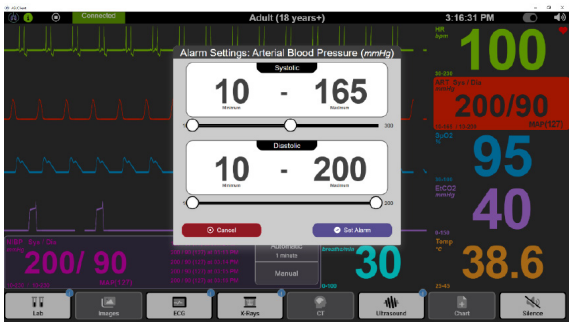


Figure 11 4: Patient Monitor Alarm Settings

The NIBP controls give the Learner control over automating the blood pressure reading. Select the Automatic button, then select a timing interval. Otherwise, take an immediate reading by clicking the Manual button.

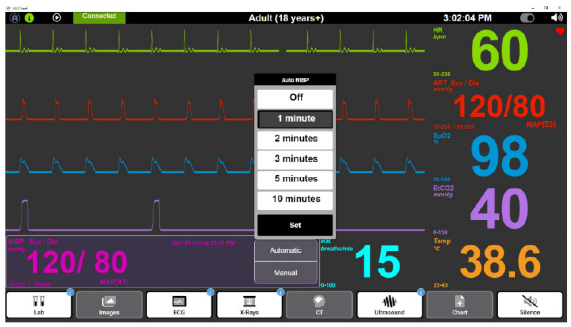


Figure 13 5: Patient Monitor Automatic NIBP

11.1.2 RespiSim® Software Controls

The Condition Panel on the Scenario Map has four (4) tabs that control information sent to the Patient Monitor: Condition Details, Patient Vitals, Media and Images, and Patient Labs. When the Instructor applies a Condition in RespiSim® Software, the Patient Monitor updates with these settings.

In the Condition Details tab, the Student Notes act as a pop-up notification to the Learner when the Condition is applied.

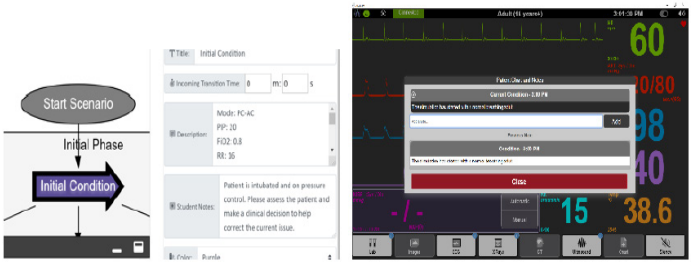


Figure 13 6: Patient Monitor Notes

Access the remaining information from the Scenario Map by clicking any of the items with a blue exclamation mark.

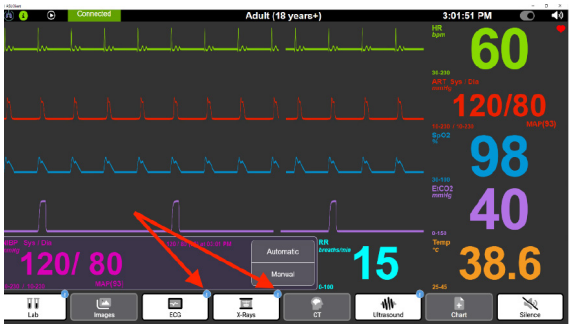


Figure 13 7: Patient Monitor Media Available

Click any of the items with the exclamation mark notification to view the media or labs. This includes Labs/ABGs, ECG, X-Rays, CT, and ultra-sound. The system also accepts .gif images (animated images).

When a Scenario ends, a message appears on the Patient Monitor to inform the Learner that the Scenario has ended. When closing the Patient Monitor, make sure to completely exit the application.

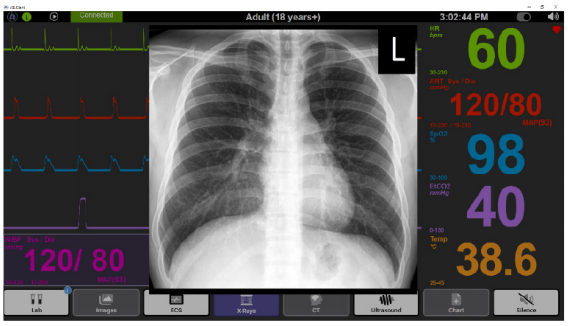


Figure 13 8: Patient Monitor Media Screen

12. RESPISIM® AUSCULTATION

There are two (2) options for auscultation when using RespiSim®: RespiScope® or Local Sounds. Local sounds can be uploaded and played to the Learner directly from the RespiSim® Software using the Instructor's computer speakers. The RespiScope® provides realistic lung, heart, and bowel sounds through a modified simulation-only stethoscope. The next section details use of the RespiScope® with the RespiSim® Software.

12.1 An Introduction to RespiScope®

The RespiScope® brings added realism to the RespiSim® system. When the RespiScope® is near RFID tags placed under the RespiPro® or Aurora Manikin skin, it produces auscultation feedback. The RFID tags are in the anatomically correct positions on the on the human body. The RespiSim® Software controls which sounds are defined at each RFID tag location. This includes volume and mute capabilities (e.g. minimizing the left lung sounds during a pneumothorax). The figure below gives a visual aid for the RFID tag locations.

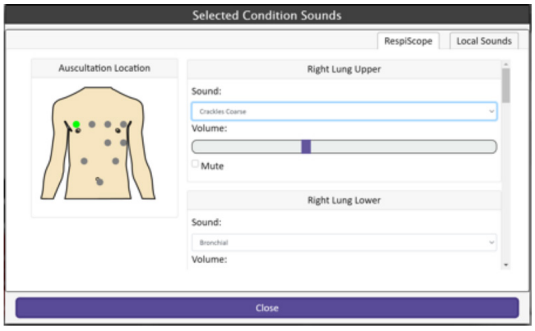


Figure 12 1: RespiScope® Interface

The physical scope communicates with the RespiSim® Software over WiFi connection to the saem network as the Instructor PC, the Patient Monitor / Learner Display PC, and the Auror Manikin (if applicable). The scope is powered by a AAA battery.

Figure 12 2: RespiScope®

The RespiScope® diaphragm houses an RFID sensor. When the sensor comes in range of an RFID tag under the manikin skin, the Learner hears a sound as defined by the RespiSim® Software.

Figure 12 3: RespiScope® Sensor / Control

12.2 Setting up the RespiScope®

12.2.1 Network Configuration

For the RespiScope® to work with the RespiSim® environment, it must be configured with the RespiSim® Software. When setting up the RespiScope®, the scope will need to be physically connected to the Instructor computer using the included USB cable. Plug the USB cable between the scope and the computer. As with any typical USB device, once a connection is successfully made, you will see a directory called "SIMSCOPE" coupled with a lettered drive (e.g. G:SIMSCOPE)

Figure 12 4: Scope with USB Cable

To save battery life, the RespiScope® does not require a battery during the setup process.

Start the RespiSim® Software and select any Scenario (connection to an ASL 5000® is not necessary during this setup). From the RespiSim® dropdown menu, select “RespiScope®...” under the Configuration section.

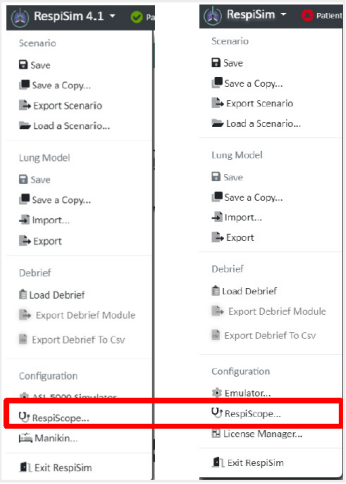


Figure 12 5: Configure RespiScope® (4.4 Left / 4.5 Right)

The RespiScope® screen opens providing a view of existing scopes as well as the ability to add, edit, or delete a scope.

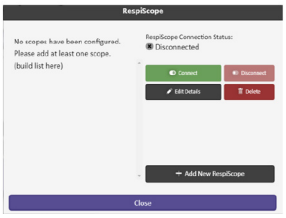


Figure 12 6: Available Scope Screen

Click Add New RespiScope® to add a new scope. The Add a New RespiScope® screen opens.

Figure 12 7: RespiScope® Network Configuration Screen

Fill in the network configuration screen with the following information:
•Scope Name – IngMar Medical recommends using the serial number found on the scope
•SSID – Wireless network name that is running RespiSim® Software
•Security – Router security, default WPA2
•Password – Wireless network password
•IP Address – Static IP address for the RespiScope®
a. RespiPro® recommended 192.168.1.98 (or lower)
b.Aurora recommended 192.168.8.98 (or lower)
•Subnet Mask – Network mask – default 255.255.255.0
•Gateway – Network gateway
a.RespiPro® default 192.168.1.1
b.Aurora default 192.168.8.1

Figure 12 8: Sample Complete RespiScope® Network Configuration

Clicking Confirm returns to the scope screen with the configured scope.

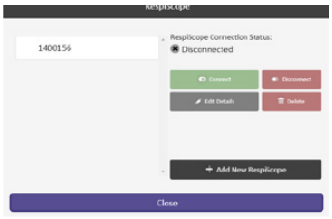


Figure 12 9: Scope Configured and Available

You now see the name of the scope located in the RespiScope® screen. Unplug the USB cable from the computer and the scope to complete the setup.

12.2.2 Connecting to the Network

Insert the battery into the scope and press the “+” button on the scope diaphragm to turn the scope power on. When the scope is powered, a voice in the earbuds will state, System Activation, Mode 1 followed by several beeps. If WiFi has been configured correctly, the voice will say, WiFi On. After hearing this message, click the RespiScope® name, then click Connect. A confirmation message reminds the user about the voice prompts.

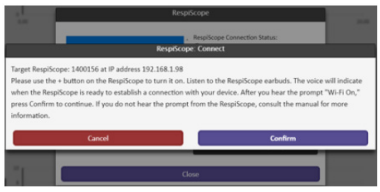


Figure 12 10: Connected RespiScope®

Click Confirm and the screen shows the connection status.

Figure 12 11: RespiScope® Confirmed Connection

The RespiSim® Software notifies the Instructor when the RespiScope® is connected.

Figure 12 12: RespiScope® Connection Status

12.2.3 RespiScope® RFID Tag Locations and Sounds

The software provides an image of the torso with each RFID tag position. When the user moves the mouse cursor over any of the sound locations, e.g. Right Lower Lobe, a GREEN dot shows the referenced location on the manikin. Below are the physical locations of the RFID tags used to provide the sounds to the RespiScope®.

Figure 12 13 - Aurora RFID Tag Sites

The RespiScope® includes a variety of heart, lung, and bowel sounds via dropdown boxes. To access any of the sounds, click a sound name and the dropdown will show the available sounds for that RFID tag location. The table below provides the sound locations and associated sound files.

Volume and mute options are also available. Volumes can be lowered for simulations where breath sounds are intended to be difficult to assess. Muting a sound can be useful for simulating, for example, a tension pneumothorax on one side of the body.

The connection between the scope and the RespiSim® Software creates a link from the internal lungs of the Aurora manikin to the lung auscultation sites. When the simulated patient is breathing (spontaneously or assisted) anywhere from 3 to 60 breaths per minute, the scope provides lungs sounds within 3 breaths per minute of the total breath rate.

Sound Locations	Sound Files
Lung Sounds: Right Upper Lobe Right Lower Lobe Left Upper Lobe Left Lower Lobe	Bronchial Broncho vesicular Crackles Coarse Crackles Fine Vesicular Normal Wheeze Wheeze Rhonchus
Heart Sounds: Aortic Pulmonic Tricuspid Mitral	Aortic Regurgitation Aortic Stenosis Mile Fourth Heart Sound Innocent Systolic Murmur Mitral Regurgitation Mild Mitral Stenosis Normal Heart Sound Paradoxical Split S2 PDA Patent Ductus Arteriosus Pericardial Rub Physiologic Split S2 Systolic Ejection Clicks Third Heart Sound Tricuspid Regurgitation Venous Hum
Bowel Sounds	Crohn's Disease Diarrhea Irritable Bowel Normal 4 Year Old Normal 20 Year Old Normal 60 Year Old

Table 6: Sound Files and Locations

12.2.4 RespiScope® with RespiSim® Software

When connected, the RespiScope® can be controlled in two (2) different ways. The first is directly controlling the RespiScope® from the Home Screen using the Sounds button. Clicking this opens the RespiScope® screen where on-the-fly changes can be made during a simulation.

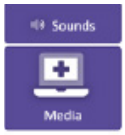


Figure 12 15: Access RespiScope® Control from Home Screen

Alternately, when building a Scenario, each condition can be defined with specific sounds assigned to that condition. In the example Scenario in the figure below, each condition can have unique sounds and volumes assigned.

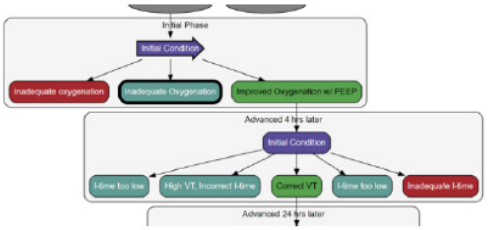


Figure 12 16: Sounds can be specific to each condition

On the Scenario Map, open the Condition Panel for the Sounds tab and create the appropriate sounds (local or from the scope) for each selected condition. Clicking this button opens the same interface as shown above.

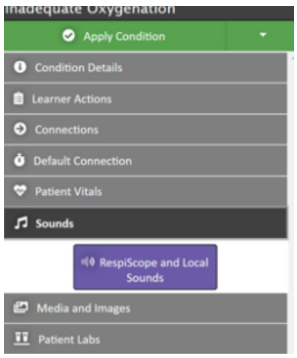


Figure 12 17: Accessing Sounds from the Scenario Map

12.2.5 Local Sounds

In addition to using the RespiScope® for location-based auscultation feedback from the manikin torso, the Instructor also has the ability to import / upload sounds that may be more relevant to the Scenario. Like the sounds defined within the RespiSim® Software controlling the RespiScope® sounds, local sounds can be defined unique to each condition within a Scenario.

The Local Sounds control is a tab on the same sounds control screen as RespiScope®.

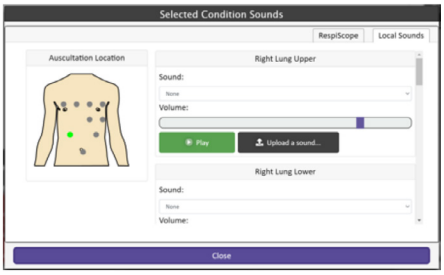


Figure 12 18: Local Sounds Control

To add a sound to the Scenario, click the Upload a sound... button from any of the sound locations. This opens the dialog to navigate to the sound, add an appropriate title and description, and save the sound to the Scenario.

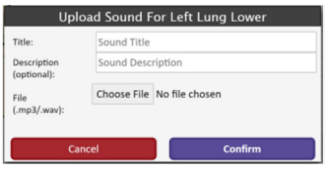


Figure 12 19: Upload Local Sounds

Click Choose File to navigate to the sound file.

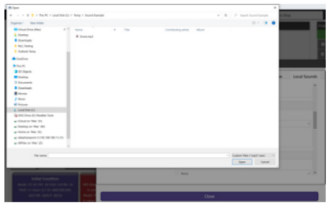


Figure 12 20: Navigate to a Local Sound File

Add the title to display in the software and any description about the sound and click confirm to save the sound to the Scenario database.

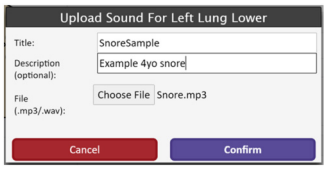


Figure 12 21: Completed Local Sound Upload Process

The local sound can now be added to any condition within a Scenario. When a Scenario is running, click the Play button and the sound will play from the Instructor's computer. The sound can be played back to the Learner from within the Scenario Map via the Sound tab on the Condition Panel or from the Home Screen using the Sounds button.

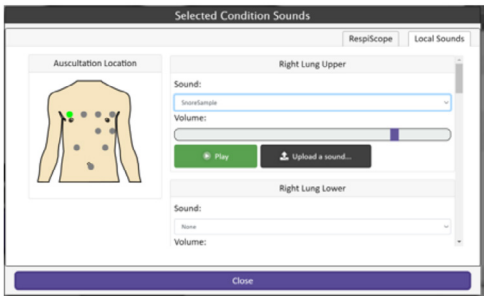


Figure 12 22: Local Sound Uploaded

13. GLOSSARY

Active E-Time - Active expiratory time is the positive portion of the muscle pressure waveform. This is the time it would take for the active part of the breath to return to baseline. In order to use Active E-Time, expiratory muscle pressure must have a set value greater than zero. It can be adjusted by clicking the Advanced button on the Lung Model Builder.

Assessments - Information used by the Learner to assess the patient's condition at a given point in the simulation (e.g., vital signs, ABGs, x-rays, labs, sounds, etc.) in addition to the ventilator screen. Used by the Learner to make decisions during the scenario and all Assessments display on the Patient Monitor.

Condition Panel - The group of eight (8) tabs on the Scenario Map used to define a selected Patient Condition

Connection - A link between two (2) Patient Conditions in a Scenario.

Debrief Environment - Environment by which the Instructor is able to replay the events of a previously completed Scenario.

Default Connection - The Connection between two (2) Patient Conditions which is followed if the Hold Time expires on a Patient Condition.

Expiratory Muscle Pressure - Pressure generated by the diaphragm to force air out of the lungs. This is not a part of the normal muscle waveform. Expiratory muscle pressure must be set to a value greater than zero in order to activate active exhalation, such as when coughing or fighting the ventilator.

Hold Time - The amount of time you want to elapse inside a Patient Condition before the Scenario proceeds to the next Patient Condition (joined with a default connection).

Home Screen - The main screen used to adjust Lung Model parameters, check off Learner Actions, and monitor data during the simulation. Contains the Lung Model Builder, waveforms, and Live Data.

Incoming Transition Time - The time it takes to transition to a selected condition after clicking the Apply Condition button. This time is optional and set by the Instructor in the Condition Panel.

Investigations - This is a button on the bottom of the Patient Monitor. Provides the learner with assessment information such as x-rays, ABGs, labs, CT Scan, and ultrasounds.

Learner Actions - A list of actions defined by the Instructor which can be pre-defined for each Patient Condition within a Scenario.

Learner Display - The device used by the Learner which displays the Patient Monitor.

Live Data - Data points measured by the ASL 5000® which are presented to the Instructor in real-time during a simulation.

Lung Model - The object which contains all parameters used to simulate a breath pattern (resistance, compliance, effort, etc.). The Lung Model can be combined with Assessments and Patient Monitor information in the form of a Patient Condition using the Scenario Map.

Lung Model Builder - The screen used to control all Lung Model parameters (resistance, compliance, and effort). The Lung Model Builder can be expanded or collapsed.

Lung Model Library - A library of Lung Models. Can be either customer-created and IngMar-created.

Passive E-Time - Passive expiratory time is the negative portion of the muscle pressure waveform, which can be found on the home screen. This is the passive neural exhalation due to the elastic recoil of the diaphragm. It can be adjusted by clicking the Advanced button on the Lung Model Builder.

Patient Chart - Set of exportable data derived from a section of the Scenario Worksheet titled 'Patient Information.'

Patient Condition or "Condition" - The Lung Model combined with all Assessments that are presented to the Learner in conjunction with the ventilator interactions.

Patient Monitor - The software application displayed on the Learner Display used to show the assessment tools (vital signs, x-rays, ABGs, labs, case description, etc.).

Pause - Pausing suspends the progress of the simulation indefinitely until the Instructor resumes by clicking the Play button. Time elapsed during the pause is not recorded in the Debrief. All Trends and Transitions are suspended during this time, and Learner Actions cannot be recorded.

Phase - Stage of a Scenario which may contain one (1) or more Patient Conditions. Often related to a period of time within a multi-stage simulation in which the Learner works towards a particular outcome.

Randomization - When applied, allows Instructor to introduce random breath-to-breath variability for any parameter by setting the Amplitude to the desired +/- range.

Scenario - A comprehensive learning module which combines multiple Patient Conditions, Assessments, Instructor notes, and information for the learner.

Scenario Map - The environment used to define all aspects of Scenarios (excluding Scenario Worksheet information), such as linking Patient Conditions together, entering information to be displayed for Instructor and Learner. Contains a depiction of the Scenario in a flow sheet format, with the Scenario Builder section at the bottom, and the specific details of each individual Patient Condition (Condition Panel).

Scenario Worksheet - A form containing information which can be entered by the Instructor to accompany a Scenario such as the learning objectives, patient information, equipment list, etc. This information is optional.

Simulation - Any form of running the system from simply adjusting parameters on-the-fly to pre-scripted Scenarios.

Startup Screen - Screen which is displayed upon opening the software which allows you to choose a Scenario, start a new Scenario, or configure user settings.

Trend - An individual parameter changes automatically from a start point to an end point over a specified duration of time. Multiple parameters may trend simultaneously.

Waveforms - Volume, flow, and pressure waveforms presented to the user in real-time during a simulation. Waveforms are rendered by the ASL 5000® and are from the perspective of the patient.

AURORA USER MANUAL

CONTACT INFORMATION

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