ESME Workbench User's Guide

July 25, 2011

Table of Contents

List of Figures

In this chapter:

Chapter 1: Overview

Purpose

The purpose of the ESME Workbench is to link several open-source programs and environmental databases together via a single graphical user interface (GUI) which can be used by anyone in the scientific research community (Gisiner 2006) (Shyu 2006). External programs for modeling propagation and marine mammal behavior are automatically installed with the ESME Workbench. Environmental databases are downloaded separately, and linked to the workbench by the user. The workbench computes propagation and mammal movement in four dimensions (3D space and time) to compute the exposure level for simulated animals, called "animats". The exposure levels are compared with federally established thresholds and reports are automatically generated to estimate the number of mammals that would be affected. The ESME Workbench is currently configured to simulate sound exposure due to Naval training exercises, but can be modified to include other anthropogenic activities, such as oil exploration or pile driving.

Sound Sources

Sound pressure level (SPL) at every point in the simulation space is determined by adding the source level (in dB: re 1µPa) to the Transmission Loss (TL). The Naval Undersea Warfare Center (NUWC) developed NAEMO as an application to model naval sound source platforms and marine mammal distributions. The ESME Workbench currently uses NAEMO's sound source database to specify naval platforms. A wide variety of Navy sonar platforms, sources and ship tracks can be defined.

Propagation Models

Four propagation models are included in the ESME Workbench. Bellhop is a ray-tracing model that can quickly calculate TL in ocean environments that are many wavelengths deep (Porter 1987). The Comprehensive Acoustic System Simulation / Gaussian Ray Bundle (CASS/GRAB) model is a ray-tracing tool used by the U.S. Navy (Keenan 2000). The Range-dependent Acoustic Model (RAM) uses the Parabolic Equation (PE) to calculate TL in areas with range-dependent propagation properties and/or multiple layers of sediment (Collins 1996). Reflection and Refraction in Multi-Layered Ocean/Ocean Bottoms with Shear Wave Effects (REFMS) is a tool that can be used to

simulate the propagation of shock waves from an underwater explosive charge (reference ????).

Each of the propagation models in the ESME Workbench accesses environmental databases which store bathymetry and other acoustic parameters (sound speed in the ocean and sediment layers, wind velocity, etc). The models compute transmission loss (TL) in 2D grids of range and depth along transects extending outward from the source position. The user can configure the transect size and spacing, as well as the range and depth increments to be used in the calculations. ESME automatically runs a propagation model for each transect and then interpolates TL for points between them.

Marine Mammals

The ESME Workbench defines animal locations using 3MB, from BIOMIMETICA. Within 3MB, the 3 dimensional movements of artificial animals ("animats") can be defined using a number of species-dependent behavior settings (Houser 2006). The SPL at each point along an animat's dive path is used to calculate its maximum SPL exposure as well as its total sound energy level (SEL) exposure. These values can then be compared with acoustic thresholds to estimate the number of marine mammals that would be affected by the sound.

Take Calculations

The ESME Workbench uses auditory thresholds to determine the number of mammals that will be affected, or "taken". For odontocete cetaceans (toothed whales), the U.S. Navy currently implements three sets of criteria and thresholds for estimating Level A and Level B harassment resulting from exposure to MFA sources (Navy 2008). The criterion for a Level A take is considered to be the onset of Permanent Threshold Shift (PTS) which is defined as a permanent reduction in hearing sensitivity. Two criteria exist for Level B takes. The first criterion is the onset of a Temporary Threshold Shift (TTS which is defined as a temporary reduction in hearing sensitivity. The second criterion is a behavioral response, in the absence of auditory threshold changes, which represents a significant alteration of a species' normal behavioral patterns.

Thresholds for harassment determined by the onset of PTS and TTS are based on the sound exposure level (dB re: 1 μPa^2 s) of an animal accumulated over the duration of an exercise. Sound exposure level is defined as,

$$SEL = 10\log_{10}\left(\frac{\int_0^T p^2(\tau)\,d\tau}{p_{ref}^2\,\tau_{ref}}\right) \qquad (1\text{-}1)$$

where P_{ref} = 1 μPa and T_{ref} = 1 s. Level B harassment due to a behavioral alteration (i.e. in the absence of auditory fatigue) occurs when the maximum sound pressure level (SPL) received over the duration of the exercise is great enough to cause the mammal to significantly alter its normal behavioral patterns. Sound pressure level is defined in terms of the root-mean-squared pressure field P as,

$$SPL = 10\log_{10}\left(\frac{p_{rms}^2}{p_{ref}^2}\right) \qquad (1\text{-}2)$$

The number of harassments estimated to occur from an exercise is calculated by evaluating a risk function (defined in Appendix J of the HRC EIS) that relates the risk of harassment to the maximum sound pressure level received by a marine mammal (Navy 2008). The risk function varies between 0 (no risk) and 1 (maximum risk) and can be interpreted as the probability that an individual may alter its behavior in response to a given maximum SPL. The risk, R, is given by

$$R = \frac{\left(\frac{L-B}{K}\right)^A}{1+\left(\frac{L-B}{K}\right)^A} \qquad (1\text{-}3)$$

where L is the maximum received SPL level (dB). The basement value, B, is 120 dB, and K is set to 45 dB so that a received level of 165 dB corresponds to a 50 % probability of harassment. We note that the algebraic form of the risk function in the literature (Navy 2008) has been recast into the form shown in Equation 3 in order to avoid a divide-by-zero error that would occur in the original formula when L - B = K. The risk transition sharpness parameter, A, depends on the marine mammal classification. For all odontocetes (toothed whales, dolphins and porpoises), except the harbor porpoise (Phocoena phocoena), A = 10. (The harbor porpoise is given special consideration as a particularly sensitive species.) The risk function for odontocetes is plotted in Figure 1-1.

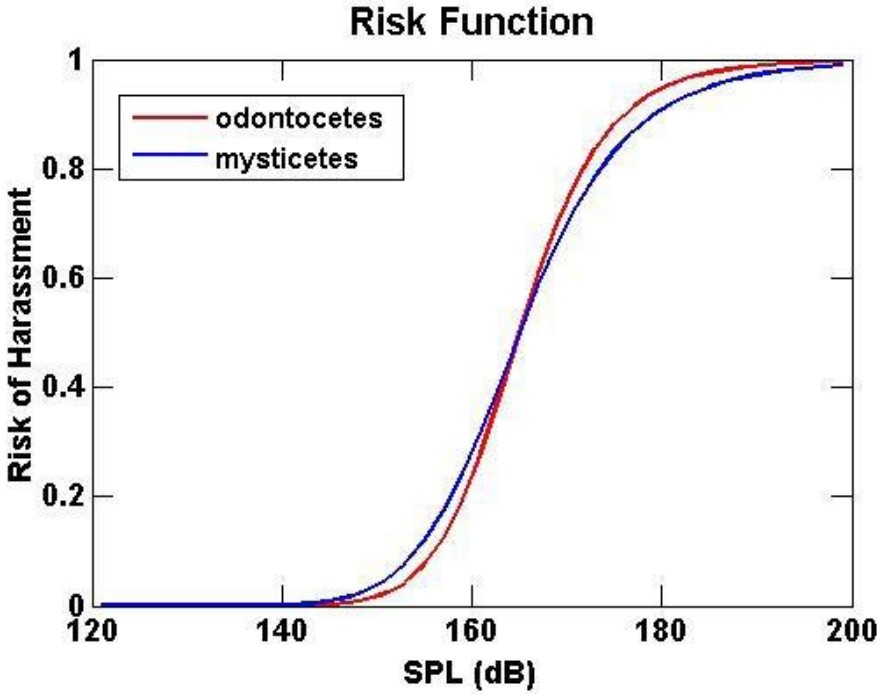

Figure 1-1 Behavioral risk function for odontocetes and mysticetes.

When the maximum received SPL is near 120 dB, the risk of harassment is low. The risk rises

sharply as the maximum received SPL approaches 160 dB and reaches a maximum value of 1 when the maximum received SPL is 195 dB.

The ESME Workbench calculates the number of animats taken during a simulation. A spreadsheet report summarizes the number of each species that exceeded each of the three take thresholds described above.

Using This Guide

The ESME Workbench user guide is intended to help new users set up and run simulations, called "scenarios". Chapter 2 describes how set up the directory structure for the ESME Workbench. It provides detailed instructions for downloading and installing the main program, as well as the supplemental databases needed to run simulations. Chapter 3 guides the user through the initial startup of the ESME Workbench. It highlights the layout of the main components in the GUI and defines some of the terminology used in subsequent discussions. Instructions are given to link the ESME Workbench with the supplemental databases and programs, and flow charts illustrate the basic steps necessary to create and run an experiment. Chapters 4 through 8 describe the different modules used to create and run simulations as well as to analyze the results and Chapter 9 takes the user through some example simulations.

Conventions Used in This Guide

Chapter 2: Getting Started

In this chapter:

Creating a Local Directory Structure

Installing the Workbench

Supplemental Files

In this chapter:

Chapter 3: The User Interface

This chapter guides the user through the initial startup of the Workbench. The graphical user interface (GUI) is briefly described, and options are set to link the supplemental data files and programs. Finally, flow charts are presented to summarize how to set up and run experiments.

Workbench GUI

This section provides a brief survey of the main ESME Workbench screen and defines some of the terminology used to reference various functions.

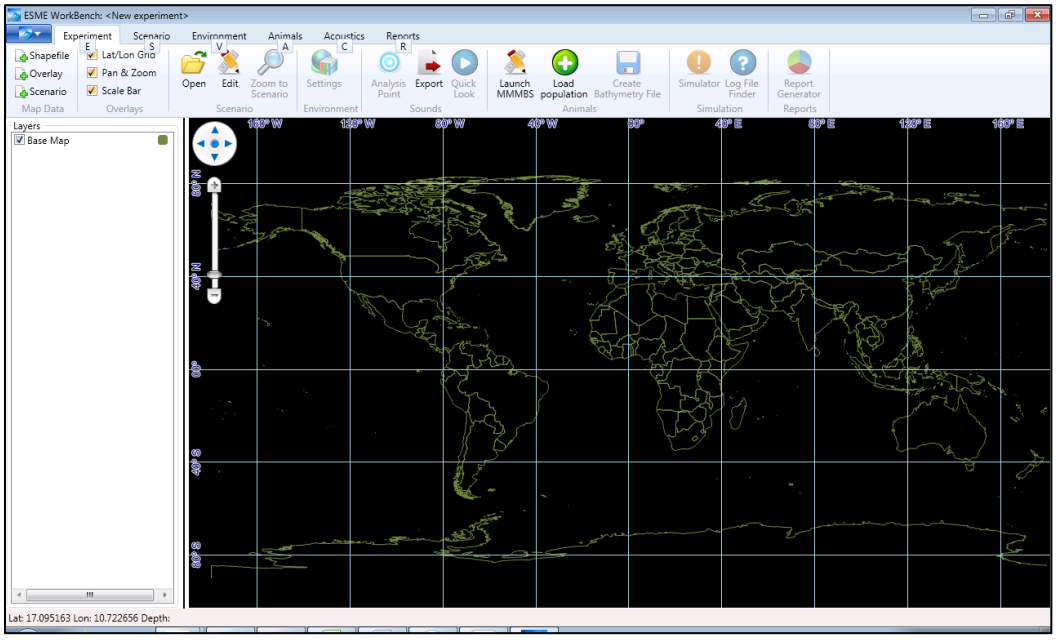

Figure 3-1. The ESME Workbench GUI

ESME Workbench 2011 can be started from the "All Programs" menu or by double-clicking on the ESME Workbench 2011 shortcut. After ESME starts, expand the main window to see the entire screen as shown in Figure 3-1.

Menu Bar

The "Menu Bar" across the top of the screen contains the **Applications Button** (drop-down menu in upper left corner) and six "tabs." The tabs are used to choose among the major components of the workbench. The **Scenario** tab is used to launch the **Scenario Builder** which is used to choose the acoustic sources to be simulated and to define their behavior. The **Environment** tab is used to launch the Environment Builder which is used to define the environmental variables (e.g. bathymetry, sound speed profile) that will be used in the simulation. The **Animals** tab is used to populate the simulation with virtual animals (animats) and the **Acoustics** tab is used to choose the analysis points for the acoustic propagation calculations. The **Reports** tab is used after a simulation is completed to analyze the sound levels received by the animats and to generate standard reports summarizing the exposure statistics.

Applications Button

The applications button appears as a blue button with a downward pointing arrow, at the left end of the menu bar. Clicking on the applications menu button displays a drop-down menu that allows the user options to be set and files to be opened, closed, and saved. Note, a number of options must be defined before an experiment can be saved.

Defining User Options

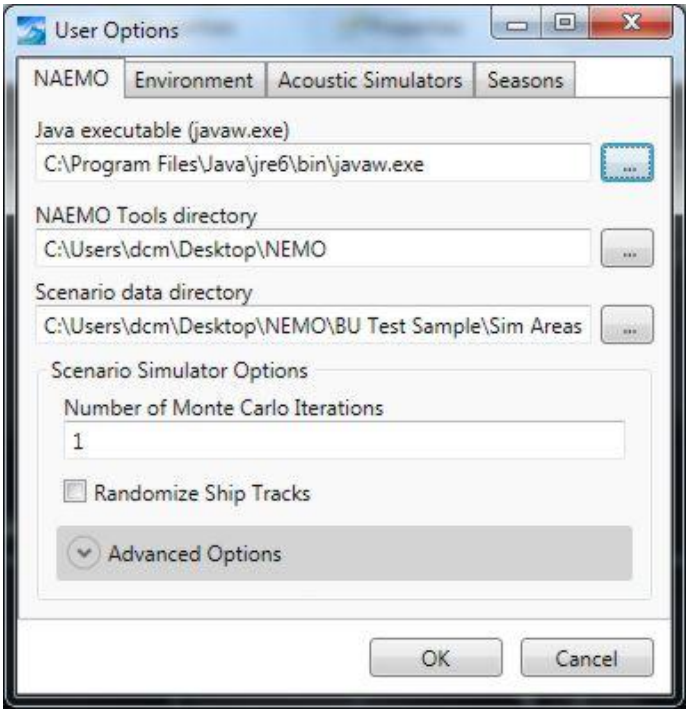

Figure 3-2

This section provides instructions to link ESME Workbench with the supplemental files for

Scenario Builder and the OAML databases. Once these options are defined, the ESME Workbench can be used to run a wide variety of simulations.

The NAEMO options (Figure 3-2) define the settings for the Scenario builder. The paths should be set as shown below. Note, the file locations will depend on the directory structure of the local computer. See Chapter 4.

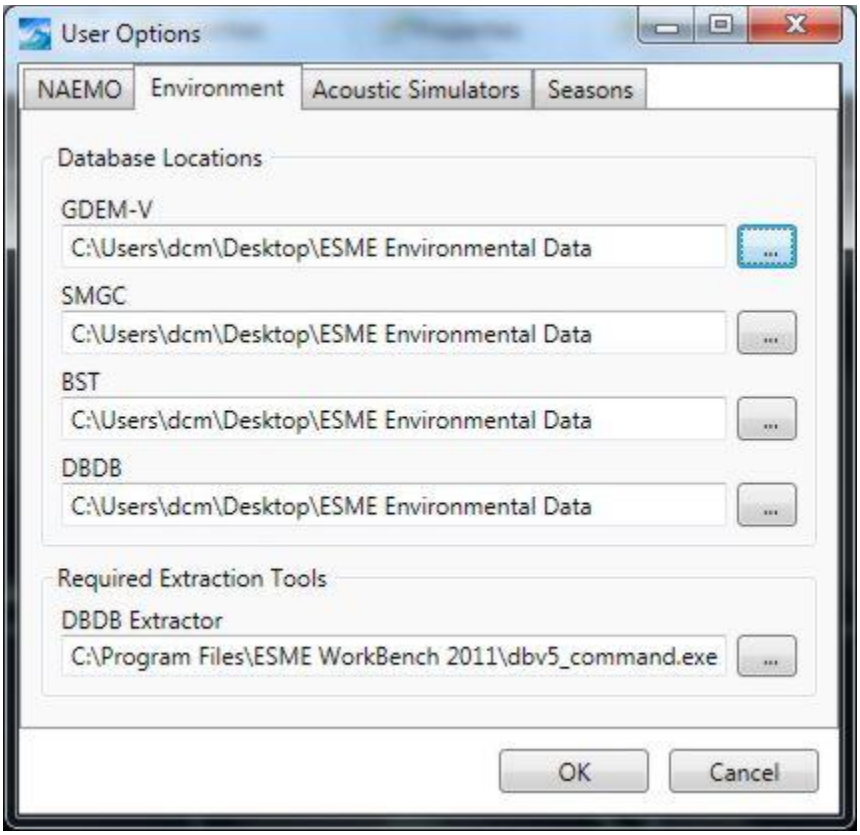

Figure 3-3

The **Environment** option (Figure 3-3) links the ESME Workbench with the files in the OAML databases. The paths should be set as shown below. Note, the file locations will depend on the directory structure of the local computer. See Chapter 2 for more information about environmental file locations.

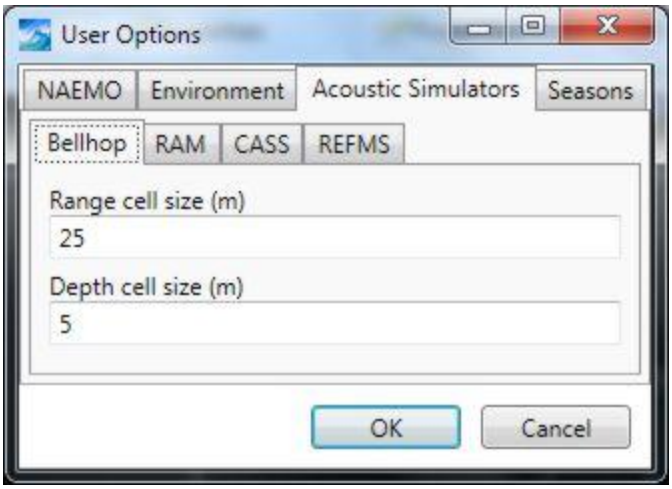

Figure 3-4

The **Acoustic Simulator** option (Figure 3-4) allows the user to change the default resolution for each of the four simulators used in the workbench.

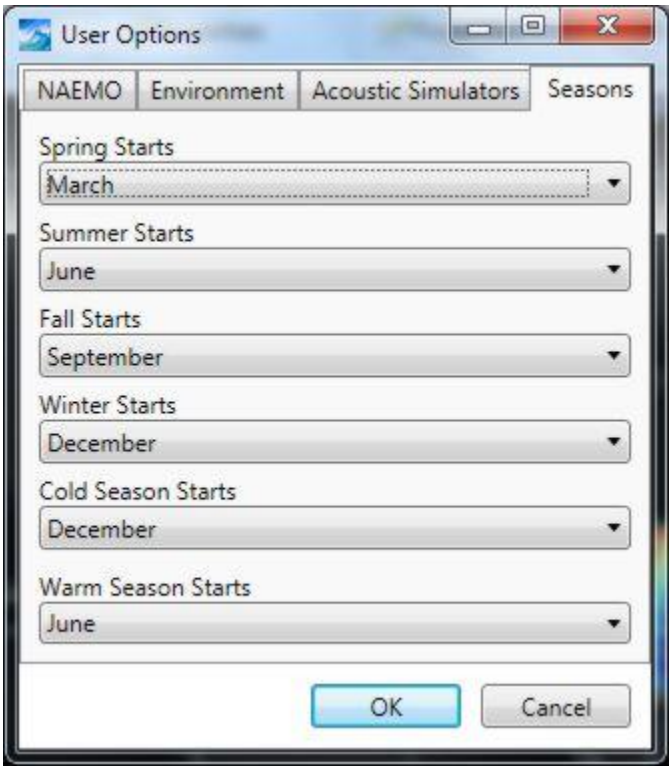

Figure 3-5

The **Seasons** option (Figure 3-5) is used to set the months that are included in each of the seasons.

Ribbon Bar

Each tab on the menu bar displays a different "ribbon bar" containing commands below it. Vertical lines on the ribbon bar divide the commands into "groups" of related commands.

Map Window Controls

The map and layer control windows are below the icon menu. The layers control window is used to set the display options for the data displayed in the map window.

The center position of the map can be changed by clicking on the up/down or left/right arrows of the pan control in the upper left corner of the map. Alternatively, the map center can be adjusted by left-clicking anywhere on the map and dragging the map. Release the left mouse button to stop dragging the map.

The zoom level of the map can be adjusted by sliding the marker on the zoom control up or down. It can also be changed by clicking on the plus or minus sign at the upper or lower ends of the zoom control. If the mouse has a scroll wheel, it can also be used to zoom in and out.

By default, the ESME Workbench shows the pan control, zoom control and latitude and longitude grid lines on the map window. These can be turned off by removing their respective checkmarks in the "Overlays" group of the icon menu, under the "Experiment" tab.

Map Layer Controls

The layer box contains a list of the layers that can be displayed in the map window. When the ESME Workbench starts, it defaults to a single map layer, called "Base Map", which shows national boundaries on all of the continents outlined in green. A square color box in the layer control box indicates the color used to outline the Base Map layer. The color and thickness of the lines outlining the countries can be changed by right-clicking on the green square next to the base map in the layer control window. The map background is always black.

The Base Map layer can be turned off by removing the checkmark to the left of the layer name in the layer control window.

Additional layers can be added manually to the map window using the options in the "Map Data" group of the icon menu, under the "Experiment" tab. Typically, layers will be added automatically by the ESME Workbench as a simulation is created and run.

Some layers may have an additional color fill option in the layer control window. This option will be displayed as another colored square to the left of the line-color square. The fill color can be changed by right-clicking on the colored box in the layer control window.

In this chapter:

Chapter 4: Scenario Builder

Purpose

The Scenario Builder creates the scenario for tying together platforms, animats and operational boundaries used by the simulation. It is the precursor to running the actual simulation which generates the raw exposure numbers. Basically, the Scenario Builder application will create the files in the directory it needs to store data. Typically, when using NAEMO, it is a good idea to start with the Scenario Builder application.

Scenarios group test platforms (submarines, weapons, surface ships) and animals (whales, dolphins, etc.) together to mimic the physical environment used for Navy R&D and training (AKA the range or operational area). The basis for a scenario is the platforms, their sound sources, and the modes the sources operate in. A scenario contains a time line for each platform, the geometries of their tracks and geographical limits that contain their activity. These parameters are determined by customer requirements. The animal population is determined by the area the scenario is staged in (operational area). Animal behaviors and densities will vary by season. The effect of acoustic energy on the animal population is the ultimate purpose of Marine Acoustic Effects Modeling. The type of effect is determined by how much energy (acoustic pressure) the animal receives over a certain amount of time. The animals in the model are referred to generically as animats.

The Scenario Builder application uses a file to save and restore parameters that describe a scenario. The file format is XML. For information on the scenario file format, the user should refer to the NAEMO Scenario File Definition document.

User Interface

To launch the Scenario Builder,

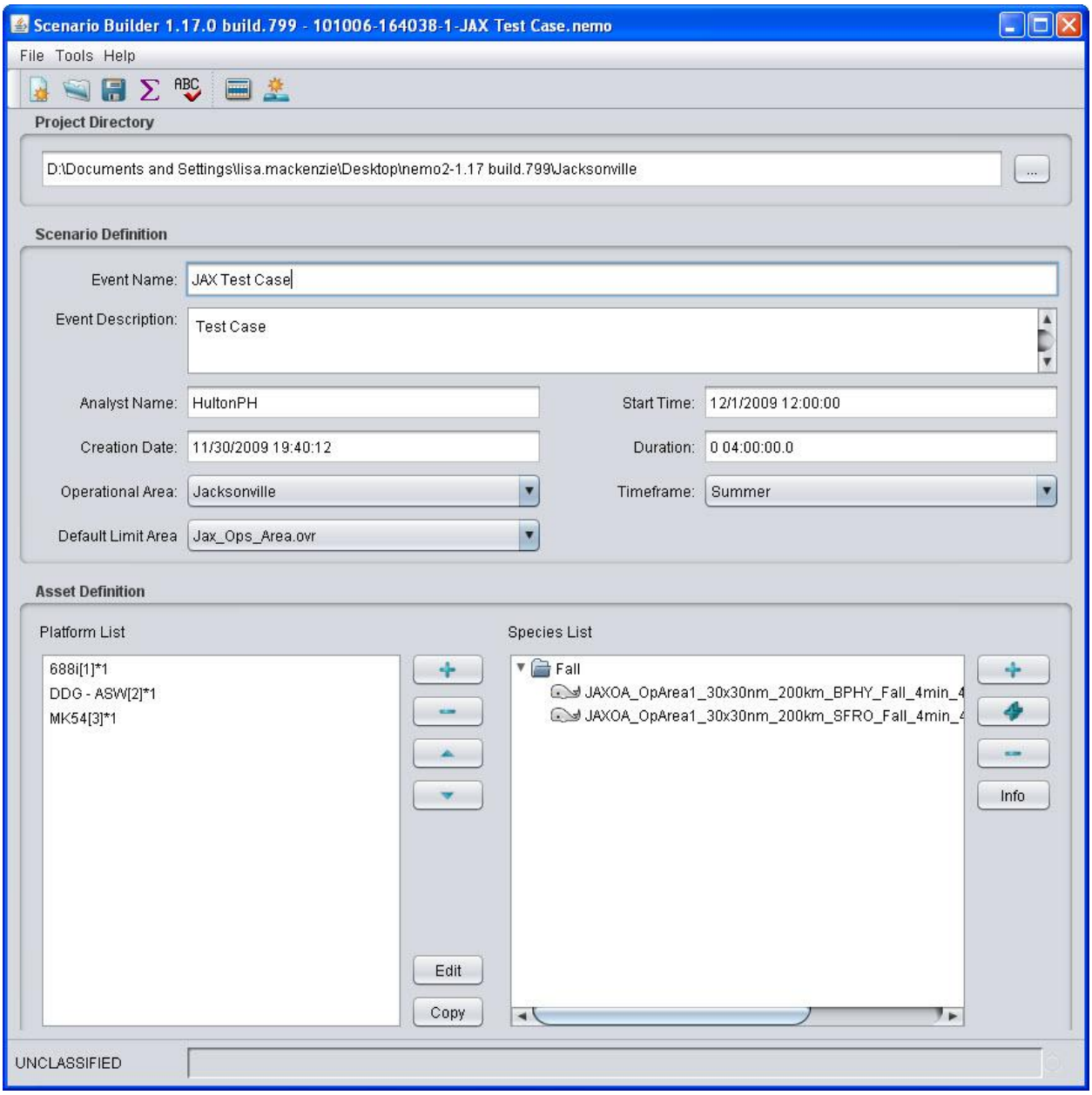

Figure 4-1. The Scenario Builder Window

In addition to the usual menu bar and tool bar, the Scenario Builder window is split into three display areas. The top display area shows the location of the project directory, the middle display area provides the scenario definition which is discussed in detail below. The bottom display area provides the asset definition which is also discussed in detail below.

Getting Started with Scenario Builder

Setting the Data Directory

The first time Scenario Builder is used, the data directory for the Platform-Source-Mode file

(PSM.csv) must be specified. Choose the **Set Data Directory** option in the **File** pull-down menu (Figure 4-2).

Figure 4-2. Setting the Data Directory

The Set Data Directory Window (Figure 4-2) will appear. Browse to the directory containing the PSM.csv file, select it, and click on **Open**.

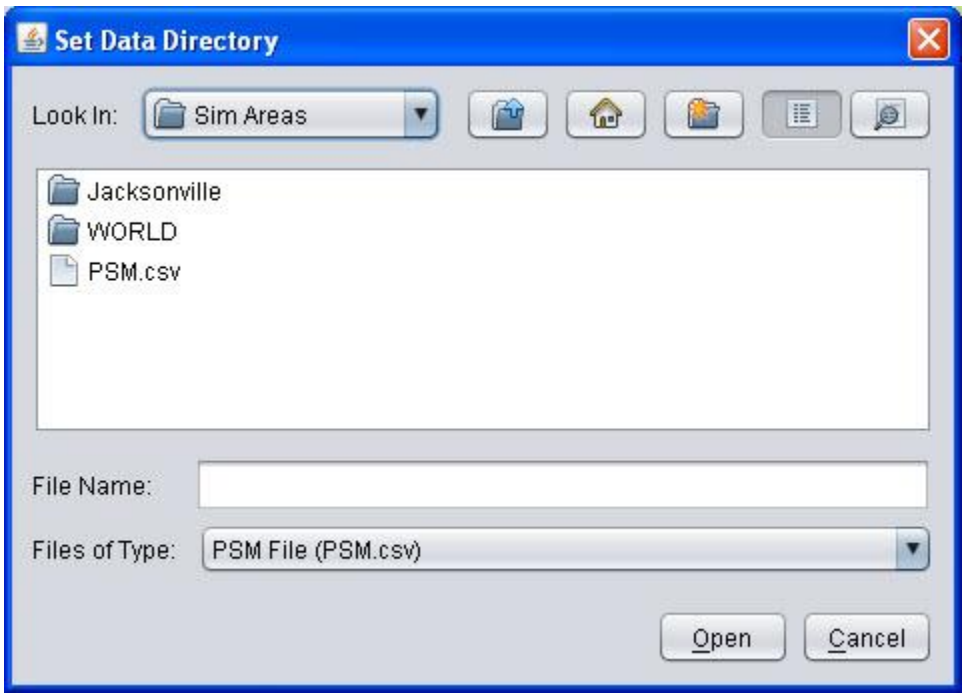

Figure 4-3. The Set Data Directory Window

Creating a Project Directory

Before using any NAEMO application, the first thing that needs to be done in Scenario Builder is to create the files in the directory that will be used to store data. This is done when you create a new Project Directory by browsing. This is the directory or folder in the computer where all files associated with the analysis will be stored. From the Scenario Builder application press the **Browse**

Directory button (). The Set Data Directory (Figure 4-3) window appears. Select the **Create New Folder** button () and type in a name (preferably Projects). Once you press the **Open** button, the required sub directories (Propagation, Reports, and Tsunami) will be created. This also can be done separately in the user's File Explorer. See Data Directories section **Error! Reference source not found.** for more information.

Scenario Definition

The scenario definition area provides specific information on the scenario file the user will be building. As one can see, some fields are prefilled for traceability and accountability. The first step is to enter an **Event Name**. Suggest a name that appropriately describes the scenario file. If the **Event Name** includes acronyms, they must be defined in the **Event Description**. The **Event Description**, allows the user to enter information specific to the event, such as a scenario summary, sponsoring organization, point of contacts, etc. The next step (unless you take the opportunity to fill in an **Event Description** – always a good idea) is to select the **Operational Area** and **Default Limit Area** from the associated pulldown menus. If the operational area is not listed as a predefined tracking range in the pulldown menu, then follow the instructions for "Selecting a Simulation Area" in the Environment Builder section **Error! Reference source not found.** to create a new one. The **Analyst Name** is prefilled according to the person who is logged in to the computer. If the analyst conducting the analysis is different from that displayed, then the name must be updated. The **Creation Date** indicates the date and time at which Scenario Builder was launched and the scenario was initially created/defined. This date and time are displayed as Greenwich Mean Time (GMT) and cannot be modified. The **Start Time** is the day and time at which the event is scheduled to begin. If the exact date and time are unknown, the user may enter a generic date and time to which the analysis will be reference, however, the month must be correct. The **Duration** refers to the length of the scenario or event and should be modified accordingly. The **Duration** is entered by number of days, hours, minutes, and seconds. The **Timeframe** allows the user to indicate the calendar month or season when the event is to take place. If the **Timeframe** is defined as a season, the season, its definition must be included in **Event Description** (e.g., Fall = September through December).

It should be noted, based upon the Operational Area selected, the Default Limit Area gets populated with overlay files. Currently, there are 96 pre-defined overlay files. Refer to the NAEMO Software Operating Procedures for more information.

Asset Definition

The asset definition area is split into two display areas. The left display area provides specific information on the platforms and the right display area provides specific information on species to be used in the scenario. Most of the default platform information will come from the Platform Source Mode (PSM) file. Even so, detailed information of the event being modeled will be needed. Basically, in this section, the user defines all platforms involved in the scenario and marine mammal species present in the area.

Platform List Display Area

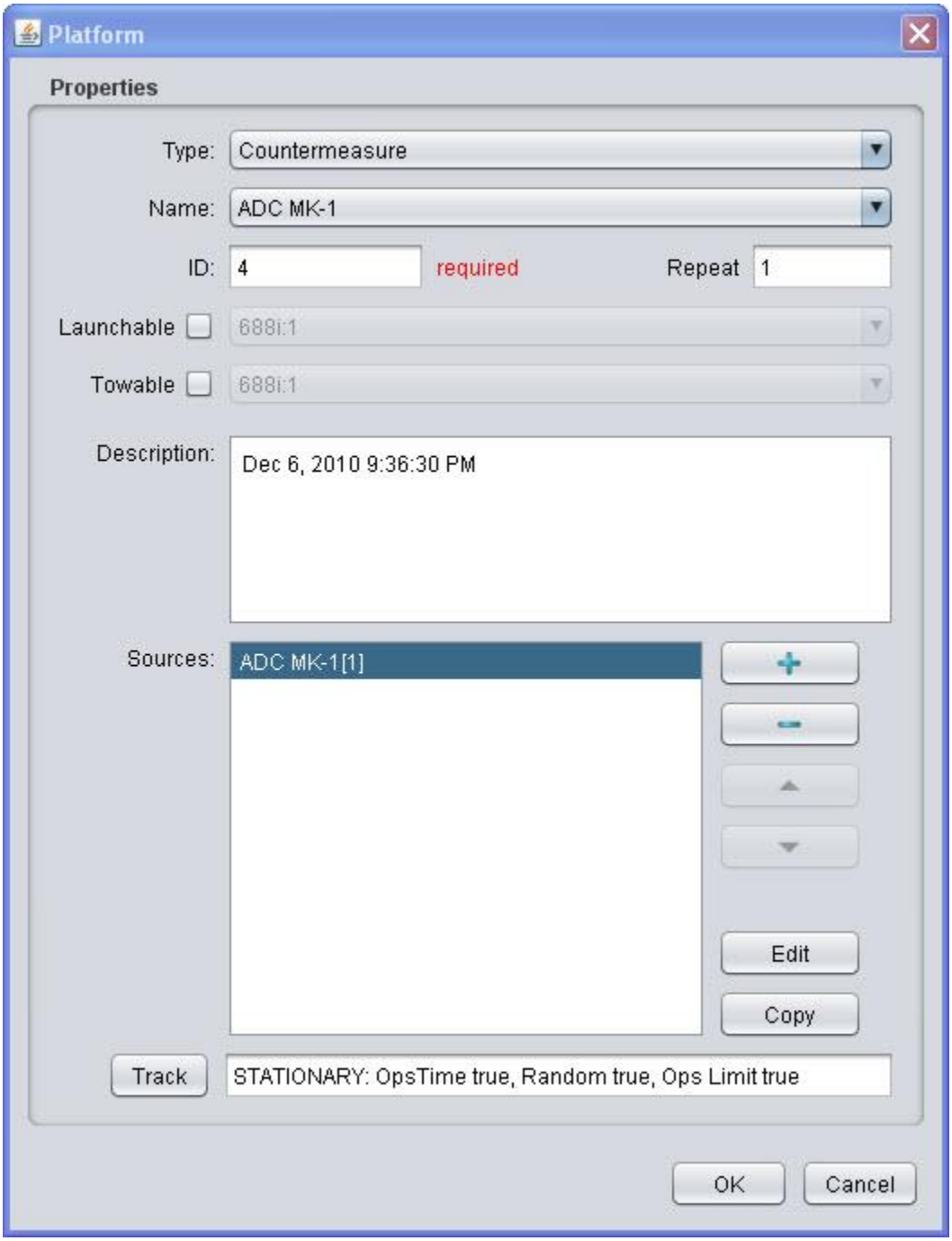

Figure 4-4. Platform Window

In the Platform List display area, a user can add, delete, scroll through, edit/save, and copy platforms via the Platform window. All these features are discussed below. In addition, through the Platform window, the user can perform similar functions in the Source, Mode, and Track Definition windows.

To add a new platform (similar steps applied for a source and mode):

1. Press the **Add** button (), which will produce the Platform window shown in **Error! Reference source not found.**. Note, the **Event** Name field must be
2. Select the **Type** and **Name** from the appropriate pulldown menu. For the **Type** the user should select the type of platform. The platform is defined as the object which contains the active sonar or can launch an object containing the active sonar (e.g. a Helo carries dipping sonar). The available choices are: Countermeasure, Explosive, Helo, Range Communications, Sonobuoy, Submarine, Surface Ship, Target, Torpedo – Heavyweight, and Torpedo – Lightweight. The **Name** documents the type of platform. For example, Helo contains three different platform names, SH60B, SH60C and SH60F. Each platform type has a name associated with it. All possible names have been defined in this window.
3. Type in the values for **ID** and **Repeat** fields. Note, the default for these fields is so that they are automatically set. The **ID** is a unique identifier for each platform. This is to distinguish the platform in the event that there are two of the same platforms involved in the event, but may have different acoustic sources associated with each **ID**. The Repeat takes a platform (source) and repeats it based on the value entered in the field. The values entered for both the ID and Repeat fields are shown in the Platforms List display area. The ID is shown in brackets and the Repeat is appended at the end of the platform (e.g. MK54[3]*5, where ID = 3 and Repeat = 5).
4. In order to change the launchable and towable platforms, select the toggle button so that a check mark (☑) appears in the box and then select from the pulldown menu the Launchable and Towable platforms. **Launchable** means that the acoustic object is launched from the platform. **Towable** means that the acoustic object can/will be towed from the platform.
5. A description of the platform can be entered into the **Description** field. The **Description** contains the date and GMT at which the Platform window was launched. This is where any additional information pertaining to the platform is entered.
6. Once all modifications are completed, press the **OK** button to add the new platform to the Platform List. To close the Platform window without making changes, press the **Cancel** button.
7. In the Platform window, the Sources area is prefilled with the active acoustic sources available on each platform. A user can add, delete, scroll through, edit/save, or copy a source. To add a new source, press the **Add** button (), which will produce the Source window as shown in **Error! Reference source not found.**. A Source is simply a grouping of Modes. To delete a source, select the source so that it is highlighted in blue then press the **Delete** button (). The source deleted will be removed from the Sources display area. To scroll through the source shown in the Sources display area, select the source so that it is highlighted in blue and select the associated scroll button. To scroll a source to the top press () or to scroll a source to the bottom press (). To edit/save a source, select the source so that it is highlighted in blue then press the **Edit** button or double click on a source. Press the **OK** button to edit/save the source. To close the Source window

without making changes, press the **Cancel** button. To copy a source, select the source so that it is highlighted in blue then press the **Copy** button. The source copied will be added to the Sources display area.

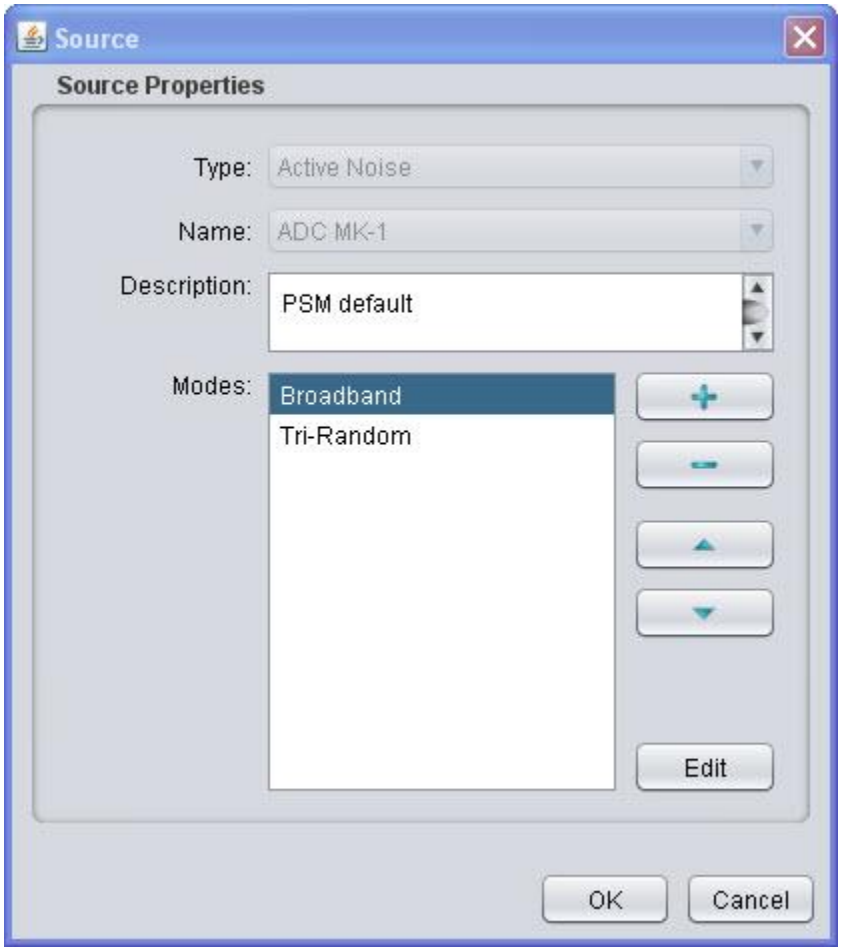

Figure 4-5. Source Window

8. In the Source window, the Modes area is prefilled with the active acoustic modes available on each source. A user can add, delete, scroll through, or edit/save a mode. Note, the Modes display area has the same buttons as the Source window that work the same operationally, with the exception of the **Add** and **Edit** buttons, which will produce the Mode window as shown in **Error! Reference source not found.**. Once the Mode window is present, provide the appropriate information. Modes are how the sound source is specified for the platform. The mode describes the emitter characteristics in a particular configuration. To change the values shown in the **Start Time** text field, the **Use Platform Time** toggle button has to be unselected (no check mark in toggle box). The **Use Platform Time** checkbox (☑) means that the platform will use the platform time defined on the initial setup form. The default **Start Time** is the start of the event. The **Duration** cannot be modified and has been defined as the average active time based on its typical use.

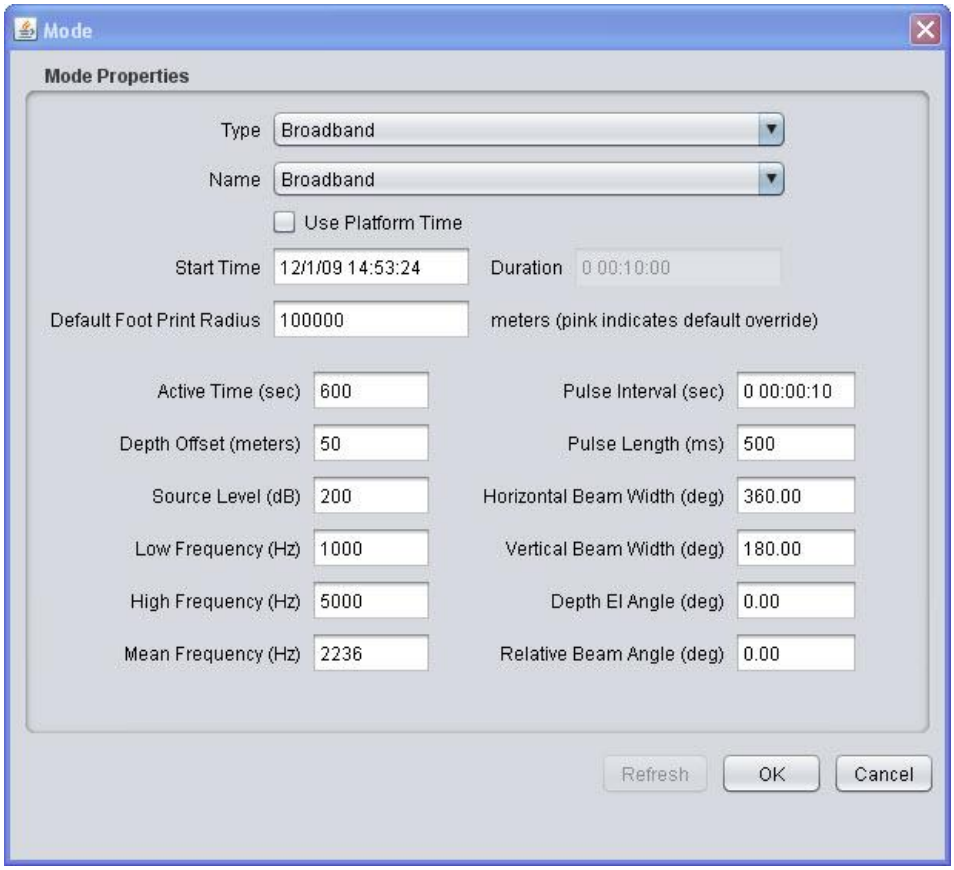

Figure 4-6. Mode Window

Part of setting up a scenario is entering the **Default Foot Print Radius** for each mode. Unfortunately there is no automatic way to do this as the value depends on mode characteristics and environment. A good number to enter is 100,000 meters. If this number is forgotten, it can be changed in the .inp file. The Default Foot Print Radius comes from the PSM file, but is based on furthest propagation distance from previous CASS runs for each specific mode. Until some idea of what this distance is, the default radius was set to 100,000 meters. However, this was not sufficiently far enough for some sources like the BQQ-10 and AEER which went as far as 230,000 meters or more. The lower portion (below the foot print radius) of the Mode window, shows all acoustic characteristics associated with the active acoustic source mode. These are predefined according to their operations and cannot be modified by the user. This is intentional so that the parameters can be standardized via the PSM file. It should be noted, that the foot print radius affects the size of the horizontal beam pattern generated by the simulator for this mode. The other parameter that affects the horizontal beam pattern is the **Horizontal Beam Width**. Together, these parameters create an area (AKA horizontal beam pattern) that is used to determine what animats are exposed to the energy. If the parameters are changed in the PSM file, then the user should press the **Refresh** button to get the latest values from the PSM file. Those parameters that have been changed will be shown in red text in the Mode window. If the **Refresh** button is grayed out then all the parameters match the PSM and

there isn't a need to refresh. Once all modifications are completed in the Mode window, press the **OK** button, to cancel the changes, press the **Cancel** button.

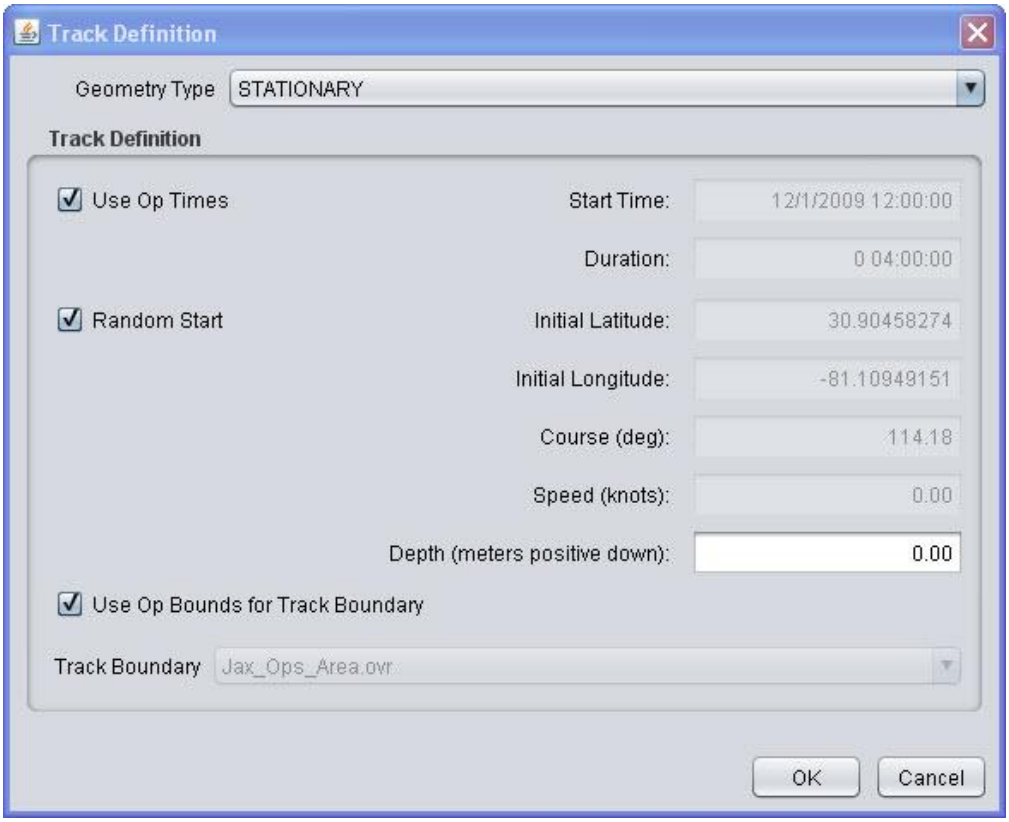

Figure 4-7 Track Defininition Window

9. The last step in the Platform window is to define the platform's Track. From the Platform window, select a track definition by pressing the **Track** button which will bring up the Track Definition window as shown in **Error! Reference source not found.**. The first thing to be defined is the **Geometry Type**. From the **Geometry Type** pulldown menu select the platform to be either **stationary** or moving (straight line, perimeter bounce, or way point). The moving source is defined to move in either a **straight line,** through a **perimeter bounce,** or a **way point**. The **Perimeter Bounce** option means that the platform will move in different directions, but not outside of the predefined perimeter or operational area. Once the platform encounters the boundary, it "bounces" and turns direction back towards the inside of the area. The **Way Point** option means that the platform will move in directions based upon the way points defined in the overlay file for the specified operational area. Next, the user chooses when and how to start the active acoustic source. If **Use Op Times** is checked (☑), the default is to start the active source with the start time defined as the start time for the scenario. If the starting time of the specified Platform window is not the same as the **Start Time** or **Duration** of the scenario, then the user needs to enter values for the **Start Time** and **Duration.** To change the values shown in the **Start Time** and **Duration** text fields, the **Use Op Times** toggle button has to be unselected (no check mark

in toggle box). If **Random Start** is checked (☑), the geographical location of the active acoustic source is default to be random. To define the actual starting location for the selected platform, uncheck **Random Start** and edit the **Initial Latitude**, **Initial Longitude**, **Course**, and **Depth** (defined as negative is underwater) text fields. The **Speed** value is only editable for non-stationary sources; it is not editable for stationary sources. If the **Platform** is **Stationary**, then the **Speed** defaults value is zero and cannot be modified. However, if the **Platform** is not **Non-Stationary,** then its **Speed** can be entered. The track boundary is defined by the Operational Area chosen in the Scenario Builder window. If the **Use Op Bounds for Track Boundary** box is checked (☑), it means that the platform will use the Operational Area defined on the initial setup. If the track boundary is different, to change the value shown in the Track Boundary text field, the **Use Op Bounds for Track Boundary** toggle button has to be unselected. Uncheck the **Use Op Bounds for Track Boundary** box then from the pulldown menu, choose the predefined **track boundary** associated with the Operational Area. In addition, if **Use Ops Times** or **Use Op Bounds for Track Boundary** is checked (☑), then the platform will be updated if the scenario parameters change. Once the track is defined, press the **OK** button to edit/save the track definition. To close the Track Definition window without making changes, press the **Cancel** button.

To delete a platform (similar steps applied for a source and mode):

1. Select the platform so that it is highlighted in blue then press the delete button (). The platform deleted will be removed from the Platform List.

To scroll through the platforms/sources/modes shown in the list (similar steps applied for a source and mode):

1. Select the platform so that it is highlighted in blue and select the associated scroll button. To scroll a platform to the top press () or to scroll a platform to the bottom press ().

To edit/save a platform/source/mode (similar steps applied for a source and mode):

1. Select the platform so that it is highlighted in blue then press the **Edit** button or double click on a platform. Once the Platform window is present, provide the appropriate information.
2. Press the **OK** button to edit/save the platform.
3. To close the Platform window without making changes, press the **Cancel** button.

To copy a platform (similar steps applied for a source):

Select the platform so that it is highlighted in blue then press the **Copy** button. The platform copied will be added to the Platform List.

Species Definition

The Species List display area is used to add species that habitat the Operational Area via the Stationary Mammal Behavior Simulator (SMBS) and the Marine Mammal Movement and Behavior Simulator (3MBS) files that were created previously.

In the Species List display area, a user can add, delete, browse/load multiple species/animat model files (.3mb, .smb, or .ddb), and get species information. All these features are discussed below. Note, species files need to be loaded into the Sim Area directory prior to adding them to the scenario. Choose the species and make sure the proper species name is associated with the file. The species list is in the Sim Area local folder with the PSM file. All that is saved from the Species.csv file is the index number of the species record. The species list, Species.csv is the mapping of species numbers (used by applications) to species names (used by humans). To expand the tree structure for all the species in a season folder (e.g. Fall), click the left mouse button on the right arrow (▶) button so that all species get displayed. To collapse the tree structure click the left mouse button on the down arrow (▼) button. Note, red text shown in the Species List display area as shown in **Error! Reference source not found.**, indicates there are missing species files. The user should refer to the Mammal Distribution User Guide when loading species (mammal) data.

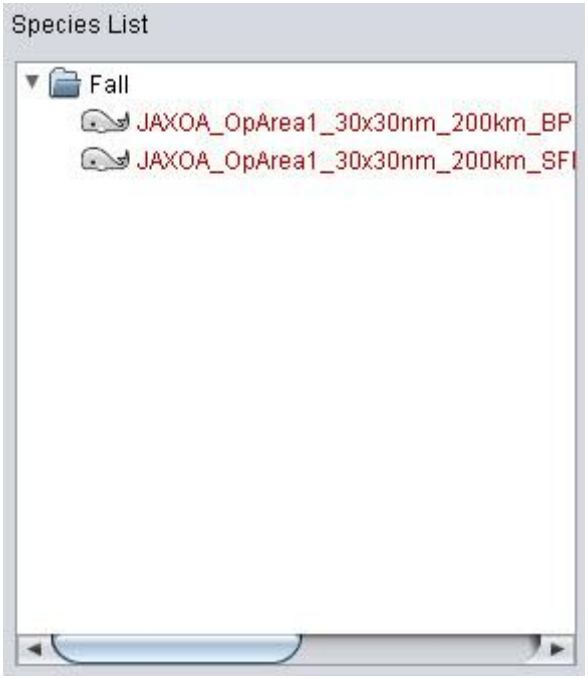

Figure 4-8 Species list display area showing red text

To add a new species:

1. Open up the specified season folder by clicking left mouse button on the right arrow (▶) button so that all species get displayed.

2. Select the species so that it is highlighted in blue then press the add button (). Once the Select Species File window is present, provide the appropriate information. See Query Species section **Error! Reference source not found.** below for all details relating to the Select Species File window. The species added will be shown in the Species List.

To delete a species:

1. Select the species so that it is highlighted in blue then press the delete button (). The species deleted will be removed from the Species List.

To add multiple species (animat) files at one time instead of selecting them one at a time:

1. Press the browse species button (). The Open window appears. The user can select multiple species at the same time by holding the **CTRL key + left click** or all species at one time by holding the **SHIFT key + left click** in the Open window. See Common Toolbar Buttons and Menu Options→Open Scenario section **Error! Reference source not found.** for similar window instructions.

To view the summary of a species file:

1. Select the species so that it is highlighted in blue then press the **Info** button. The Select Species File window is present which provides all pertinent information on the selected species. See Query Species section **Error! Reference source not found.** below for all details relating to the Select Species File window. Note, the **Browse** and **Cancel** buttons will be disabled in the Select Species File window for this configuration.

Saving and Editing

Scenario Validation

In this chapter:

Chapter 5: Environment Builder

Purpose

User Interface

Item

In this chapter:

Chapter 6: Acoustic Builder

Purpose

User Interface

Item

In this chapter:

Chapter 7: Animat Populator

Purpose

User Interface

In this chapter:

Chapter 8: Scenario Simulator

Purpose

User Interface

Choosing a Scenario

Running a Simulation

In this chapter:

- *Purpose*
- *User Interface*
- *Summary Data*
- *Graphing Data*
- *Creating Reports*

Chapter 9: Report Generator

Purpose

User Interface

Summary Data

Graphing Data

Creating Reports

In this chapter:

Chapter 10: Example Experiment

Purpose

Bibliography

Collins, M.D., Cederberg, R.J., King, D.B., Chin-Bing, S.A. "Comparison of algorithms for solving parabolic wave equations." *Journal of the Acoustic Society of America* 100, no. 1 (July 1996): 178-182.

Gisiner, R., Harper, S., Livingston, E. and Simmen, J. "Effects of Sound on the Marine Environment (ESME): An Underwater Noise Risk Model." *IEEE Journal of Oceanic Engineering* 31 (January 2006): 4-7.

Houser, D. S. "A method for modeling marine mammal movement and behavior for environmental impact assessment." *IEEE Journal of Oceanic Engineering* 31 (January 2006): 76-81.

Keenan, R.E. "An Introduction to GRAB Eigenrays and CASS Reverberation and Signal Excess." *IEEE Oceans Conference.* Providence, RI, USA: IEEE, 2000. 1065-1070.

Navy, U.S. Department of the. *Hawaii Range Complex, Final Environmental Impact Statement/Overseas Environmental Impact Statement.* Washington, DC: U.S. Department of the Navy, 2008.

Porter, M.B. "Gaussian beam tracing for computing ocean acoustic fields." *Journal of the Acoustic Society of America* 2, no. 84 (1987): 1349-1359.

Shyu, H-J. and Hillson, R. "A Software Workbench for Estimating the Effects of Cumulative Sound Exposure in Marine Mammals." *IEEE Journal of Oceanic Engineering* 31 (January 2006): 8-21.

Index