Earshot User Guide

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Advanced Simulation Technology inc.
500A Huntmar Park Drive ▪ Herndon, Virginia 20170 USA
(703) 471-2104 ▪ asti-usa.com

Product Name: Voisus

Earshot User Guide

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ASTi
500A Huntmar Park Drive
Herndon, Virginia 20170 USA

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Revision history

Date	Revision	Version	Comments
02/21/2017	B	0	Updated "Viewpoints," "Earshot Statistics," Environmental Sounds," and "Earshot Sound Files" sections. Added new "MetaVR Terrain Data," "Custom Mappings," and "VR-Forces Weather" sections. Edited content for grammar and accuracy.
07/13/2017	C	0	Updated screenshots in "Custom Mappings" and split content into "Add a custom mapping" section. Added new "Define custom fire and detonation overrides" and "Export custom mappings to spreadsheet" sections.
03/20/2019	D	0	(7.2.0) Updated **Speakers** table in "Viewpoints" and documented FIPS warning message in "MetaVR™ Terrain Data." Removed broken hyperlink in "Add a custom mapping."
6/25/2019	E	0	(7.3.0) Added "VoisNet Synchronization."
12/6/2019	E	1	Corrected support email address in "MetaVR™ Terrain Data."
9/18/2020	F	0	(8.0.0) Updated screenshots in the Voisus web interface.
10/26/2020	F	1	Updated the restricted rights statement in the front matter.
8/10/2021	G	0	Updated "Enable VoisNet Synchronization on the Voisus server" to include the new **Features** page. Updated all screenshots of table header styles.
3/8/2023	G	1	Added Red Hat Enterprise Linux subscription and export statement to front matter.

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1.0 Introduction

Earshot creates a virtual auditory environment that distributes sound based on sound sources and listener locations. Built for training in an open area, it allows trainees to move around in their environment and experience a full, realistic sound scape. Earshot is compatible with any training medium, including domes, ship bridge simulators, and serious games.

As shown in the figure below, the entity generator sends Distributed Interactive Simulation (DIS) protocol data units (PDUs) that represent fire, detonation, entity, and environmental sound effects to Earshot running on the Voisus server. Earshot then generates sound by detecting a listener on the network and identifying nearby sounds he or she would hear (e.g. trucks, planes, gunfire in the distance, explosions).

Earshot calculates the source's volume based on its position in the virtual environment. Based on this calculation, it distributes the sound among the speakers, which tells the listener where the sound is coming from. To distribute sound in the 3D environment, Earshot needs to know the number of speakers and their locations. If a new speaker is added to the setup, Earshot automatically adjusts the sound coming out of all speakers to compensate.

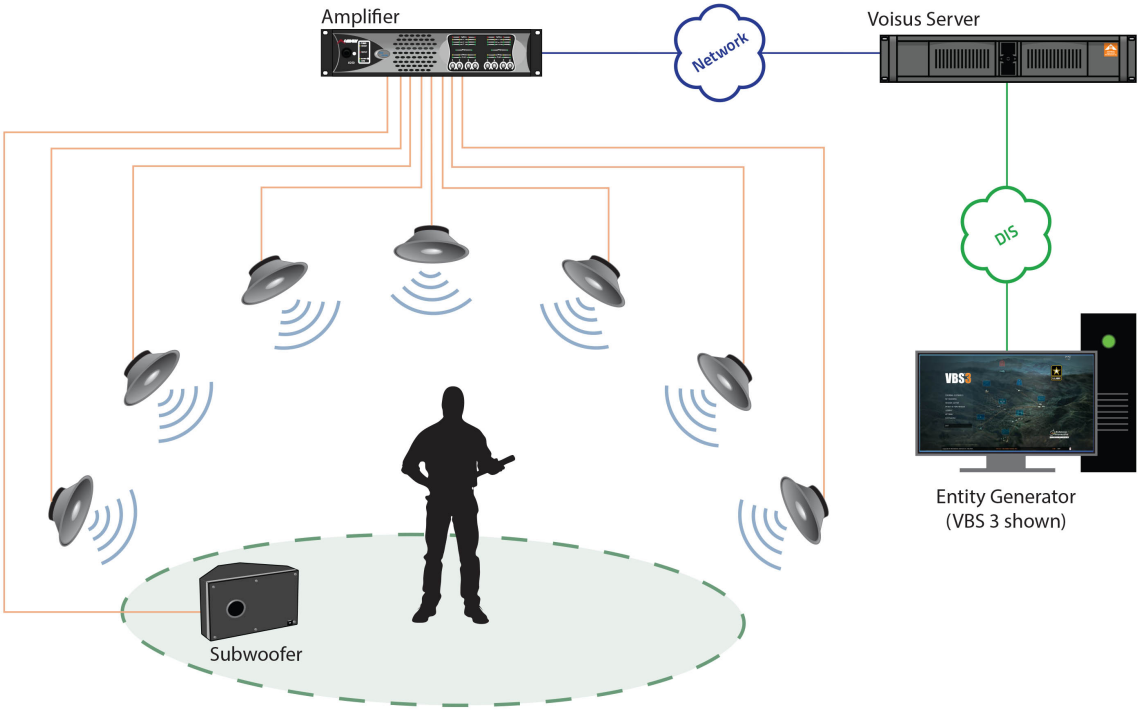

Figure 1: Earshot theory of operation

Intended for maintenance technicians and/or users, the *Earshot User Guide* explains how Earshot works and describes how to set up a viewpoint, add sound files, create custom mappings, and complete other configurations. Additionally, this user guide explains how to monitor the system's connectivity on **Earshot Statistics**.

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2.0 Viewpoints

Viewpoints is the primary configuration tool for Earshot. On this page, you can create a viewpoint, assign it to a virtual entity, and set up speakers. To add a new viewpoint, follow these steps:

1. From the top-left navigation bar, go to **Earshot** ( ) > **Viewpoints**.

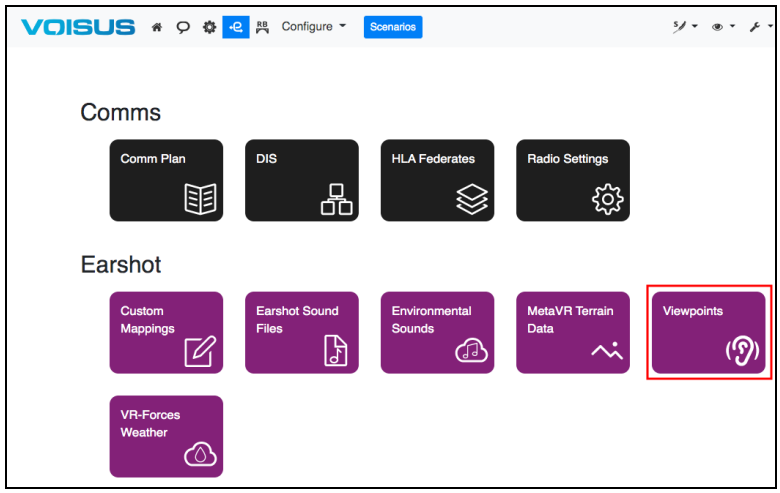

Figure 2: Viewpoints navigation

2. From the left toolbar, select **Add Viewpoint** ( ).
3. In **Name**, enter a new name if desired.
4. Select **DIS Exercise**, and choose an exercise.

Figure 3: Viewpoint Network Settings

5. Under **Location**, assign the viewpoint to a virtual entity using one of the following options:
   - ***X, Y, Z****:* enter the location of the viewpoint using the geocentric X, Y, and Z coordinates as well as a heading.
   - ***Lat, Long, Elevation****:* enter the location of the viewpoint using the geodetic latitude, longitude, and elevation coordinates as well as a heading.

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- ***DIS Entity Location****:* examines the DIS network entity state protocol data units (PDUs) for the Site ID, Application ID, and Entity ID. Earshot then uses the location and orientation fields of the PDU.
- ***BSI MACE® Display Lock Location****:* refers to a set data PDU that attaches to the MACE display lock entity. Define **Site**, **App**, and **Entity ID**, which range from 0–65,535. Within MACE, on **Visual**, these values must match the **Ownship/Man-in-the-Loop** values.

6. In **Default Audio Volume**, enter a volume percentage.
7. Under **Public Address**, select **Net**, and choose the net on which you will broadcast. To add or delete nets in the Comm Plan, select **Edit Nets** ( ). For more information about the Comm Plan, go to "Comm Plan" in the *Voisus Client User Guide*.
8. Under **Speakers**, add a speaker location for each speaker that will connect to Voisus, including subwoofers. Measure the distance of the speaker from the listener's position.

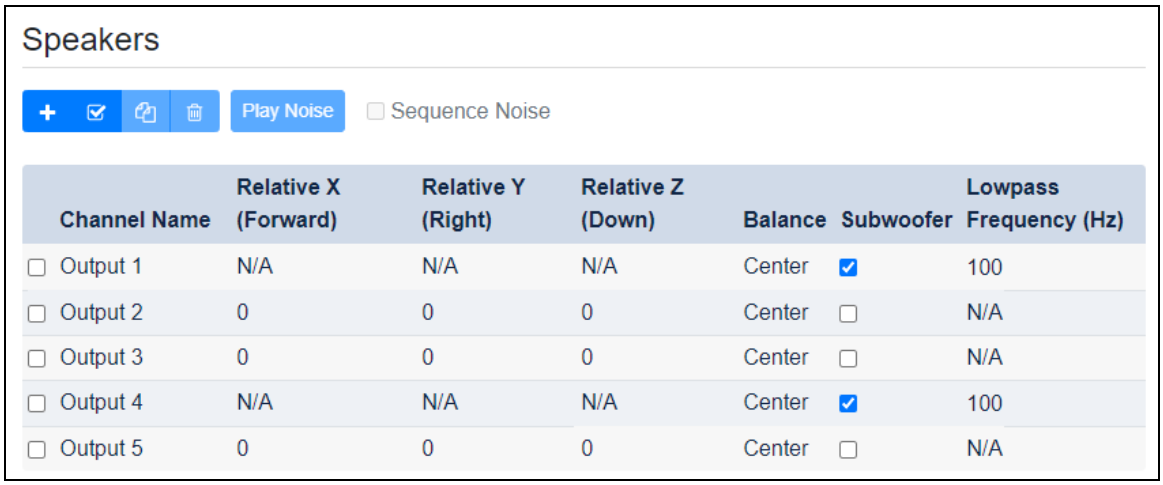

Figure 4: Viewpoint Speakers

9. To balance the speaker output's audio, under **Balance**, choose **Left**, **Right**, or **Center**.
10. To designate the speaker as a subwoofer, select **Subwoofer**.
11. To set the cutoff frequency of a subwoofer channel's lowpass filter, select **Lowpass Frequency (Hz)**, and specify a frequency between 20–300 Hz. The default value is 100 Hz.
12. To test the speaker setup, choose a channel, and select Play Noise. This button plays sound out of all the speakers that are selected with a check mark. To stop the speaker test, select Stop Noise.
13. To test each selected speaker one at a time and then repeat, select **Sequence Noise**. When cleared, all speakers play noise simultaneously.

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3.0 Earshot Sound Files

To go to the **Earshot Sound Files** page, go to **Earshot** ( ) > **Earshot Sound Files**.

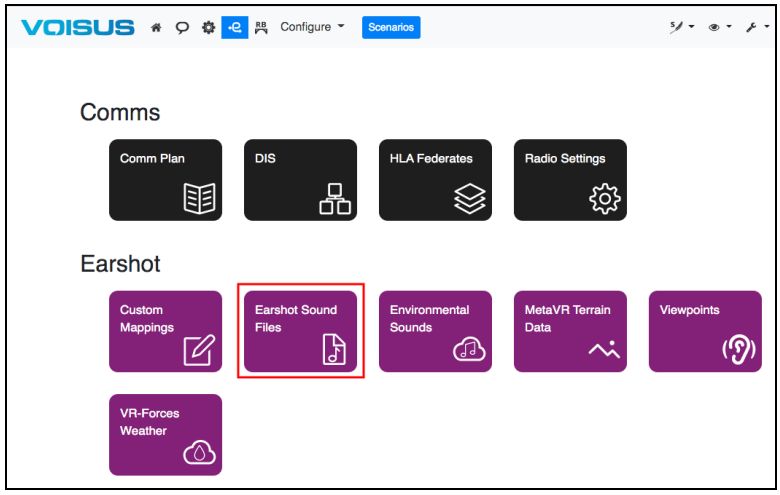

Figure 5: Earshot Sound Files navigation

Use **Earshot Sound Files** to upload and install sound files that Earshot uses for custom mappings and environmental sounds.

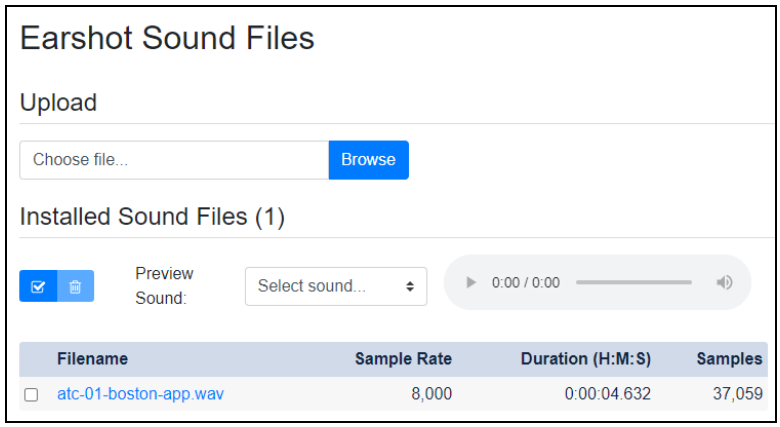

Figure 6: Earshot Sound Files

Under **Upload**, select **Browse**, and choose a file. **Installed Sound Files** automatically organizes the files alphabetically.

To preview sounds, under **Installed Sound Files**, select **Preview Sound**.

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4.0 Custom Mappings

The **Custom Mappings** page maps DIS entities and events to sound effects within the simulation. Earshot creates these mappings using the **DIS Entity Type**, a combination of seven numbers identifying the entity's unique features (i.e., kind, domain, country, category, subcategory, specific, extra). When Earshot locates an entity or event matching one of these types values, it plays the associated audio.

Available sound effects include **Fire** (e.g., gunfire, missile launches, misfires) and the associated **Detonation** events (e.g., bullet impact, gas bombs, grenades, other explosions). Sound files are managed on the **Earshot Sound Files** page. For more information about Earshot sound files, go to Section 3.0, "Earshot Sound Files" on the previous page.

Entity State allows you to define the sound model for an entity (e.g., Tank Medium, Transport Helicopter). ASTi provides these sound models.

With the exception of missiles, most mappings do not require you to set the ammunition events and entity state at the same time. In the figure below, **DIS Entity Type** is mapped to **61mm Mortar Fire** and **Detonation** sound files, but **Entity State** is blank.

Figure 7: Custom Mappings

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4.1 Add a custom mapping

To add a custom mapping, follow these steps:

1. From the top-left navigation bar, go to **Earshot** ( ) > **Custom Mappings**.

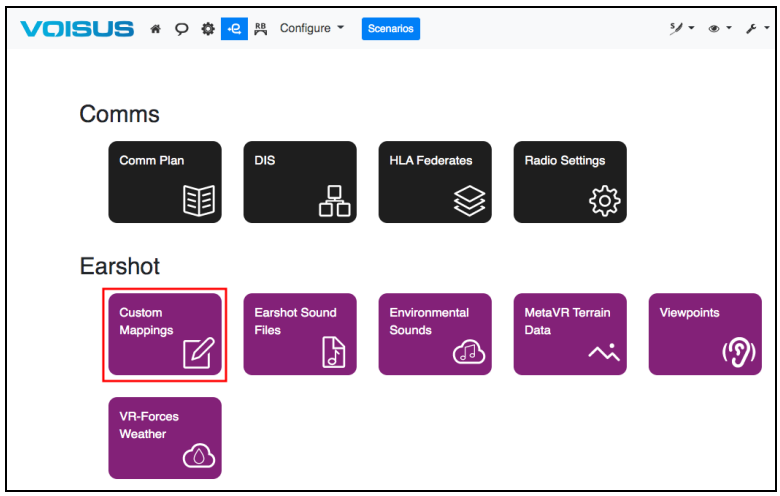

Figure 8: Custom Mappings navigation

2. To add a new mapping, under **Custom Mappings**, select the plus sign ( ). The mapping appears in the list.
3. In **Name**, enter a descriptive name for the new mapping.
4. Under **DIS Entity Type**, enter the following values:
   a. *Kind*: kind of entity; ranges from 0–255.
   b. *Domain*: domain of entity (e.g., air, surface, subsurface, space, etc.); ranges from -1–255.
   c. *Country*: country to which the design of the entity is attributed; ranges from -1–65,535.
   d. *Category*: category of entity; ranges from -1–255.
   e. *Subcategory*: subcategory of entity; ranges from -1–255.
   f. *Specific*: specific information based on subcategory field; ranges from -1–255.

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g. *Extra*: additional specification for **DIS Entity Type**; ranges from -1–255.

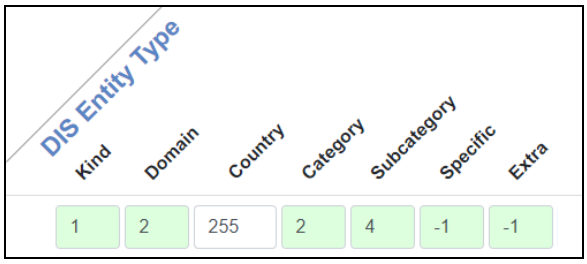

Figure 9: DIS Entity Type values

As stated at the top of **Custom Mappings**, a -1 value specifies a "wild card," which means that any value is applicable to that field. Once you set a field to -1, subsequent fields must also be -1, as shown in the figure above. All boxes except for **Kind** accept wild card values. Boxes with invalid numbers are outlined red.

5. *(Optional)* Under **Fire**, select **Sound File**, and choose a fire event. Asterisks display next to custom sound files:

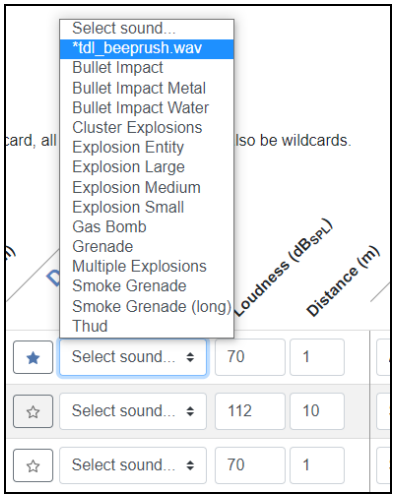

Figure 10: Custom sound file

To add custom sound files, go to Section 3.0, "Earshot Sound Files" on page 4.

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6. **Loudness (dB_{SPL})** and **Distance (m)** measure the intensity of the firing sound at a specified distance from the entity. Loudness is measured using sound pressure level in decibels, while distance is measured in meters.

   a. In **Loudness (dB_{SPL})**, enter a value ranging from 50 dB–200 dB.

   b. In **Distance (m)**, enter a minimum value of 1 meter.

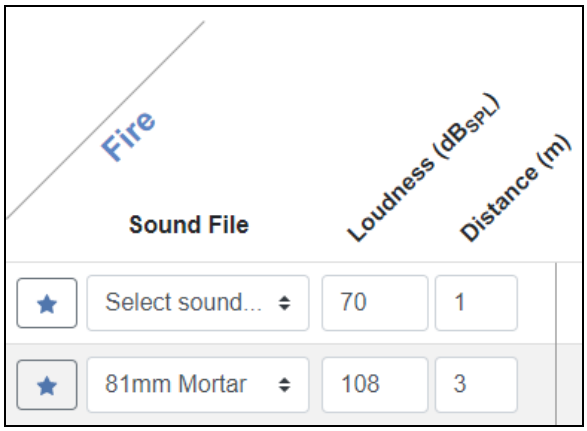

Figure 11: Fire sound effect settings

7. *(Optional)* Under **Detonation**, select **Sound File**, and choose detonation event.

8. **Loudness (dB_{SPL})** and **Distance (m)** measure the intensity of the detonation sound at a specified distance from the entity. Loudness is measured in decibels, while distance is measured in meters.

   a. In **Loudness (dB_{SPL})**, enter a value ranging from 50 dB–200 dB.

   b. In **Distance (m)**, enter a minimum value of 1 meter.

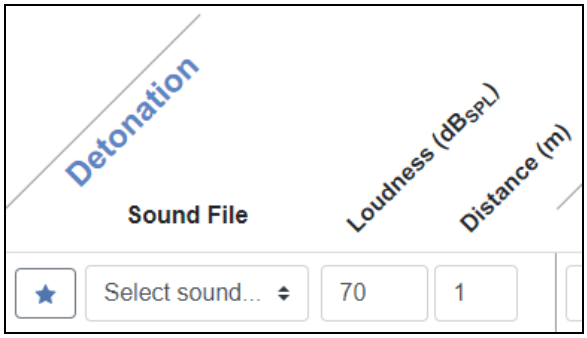

Figure 12: Detonation sound effect settings

9. *(Optional)* Under **Entity State**, select **Sound Model**, and choose a model for the entity state.

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4.2 Define custom fire and detonation overrides

On **Custom Mappings**, you can define custom overrides for individual fire warheads or detonation results. To define custom overrides, follow these steps:

1. In **Fire** or **Detonation**, select the star icon (☆). A blue star (★) means that overrides currently exist. A pop-up window shows the default settings and any existing overrides:

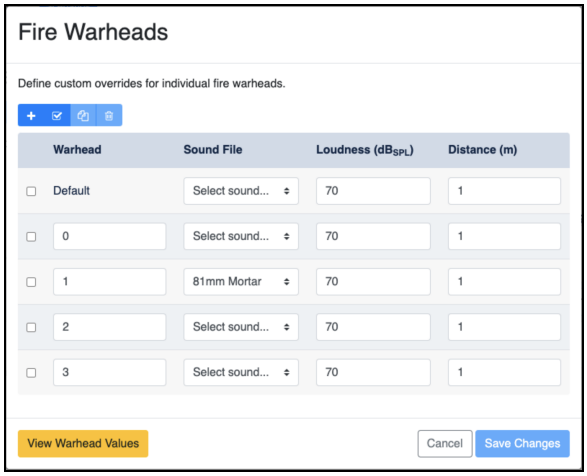

Figure 13: Fire Warheads custom settings

2. To add a new override, select the plus sign (+).
3. In the first column, enter a new value for the override.
4. To view common warhead or result values, select **View Warhead Values** or **View Result Values**.

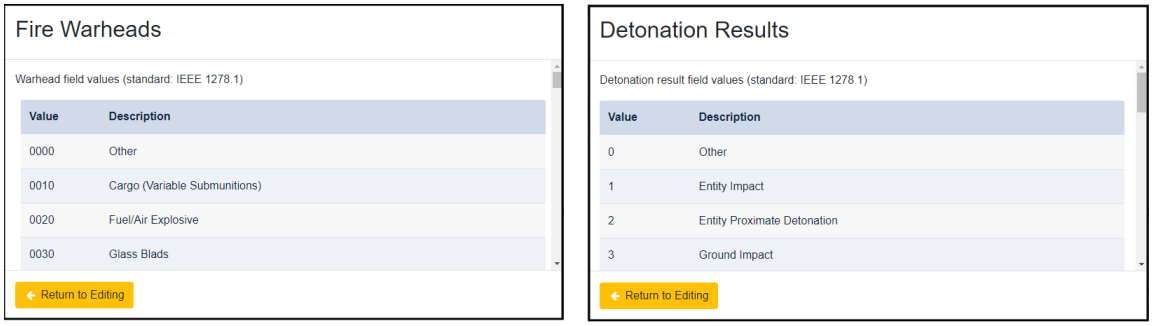

Figure 14: View Warhead/Result Values

5. Next to the new override, select **Sound File**, and choose a sound file.
6. **Loudness (dB_{SPL})** and **Distance (m)** measure the sound's intensity at a specified distance from the entity. Loudness is measured using sound pressure level in decibels, while distance is measured in meters.

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a. In **Loudness (dB_{SPL})**, enter a value ranging from 50 dB–200 dB.

b. In **Distance (m)**, enter a minimum value of 1 meter.

7. When finished, select Save Changes.

4.3 Export custom mappings to spreadsheet

When you're finished creating custom mappings, export your finished work to a spreadsheet in comma-separated values (.csv) format. To export your custom mappings, follow these steps:

1. On **Custom Mappings**, select **Export Custom Mappings** (Export).

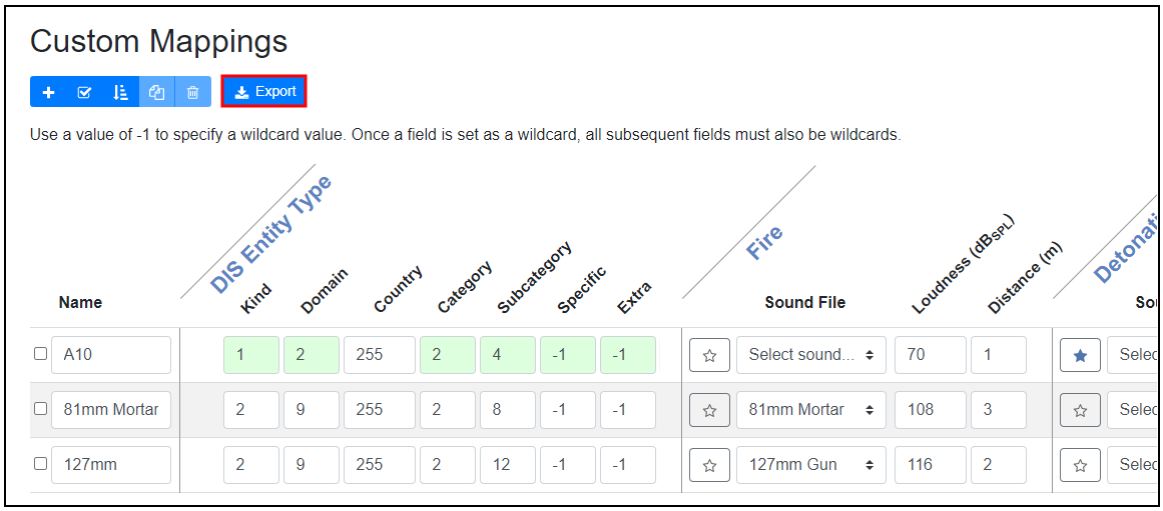

Figure 15: Export Custom Mappings

A .csv file downloads to your local computer in *scenario*_**custom_mappings.csv** format, where *scenario* represents your current scenario's name. An on-screen message states, "Successfully generated custom mappings file."

2. Find the file in your **Downloads** folder, and save it to your computer.

3. Open the file in a spreadsheet program such as Microsoft Excel, Open Office Calc, or Google Sheets. The spreadsheet lists each custom mapping component (i.e., **DIS Entity Type**, **Fire**, **Detonation**) and its associated value:

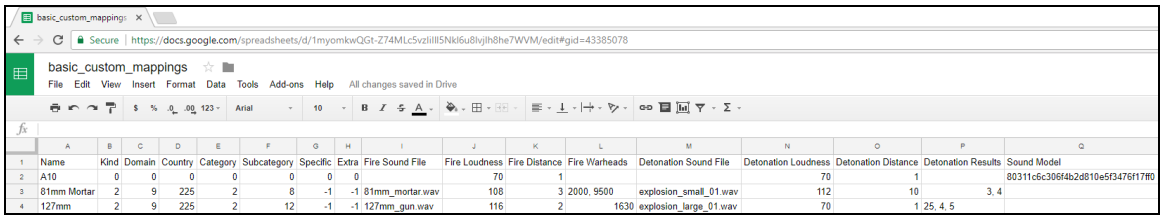

Figure 16: Custom Mappings spreadsheet

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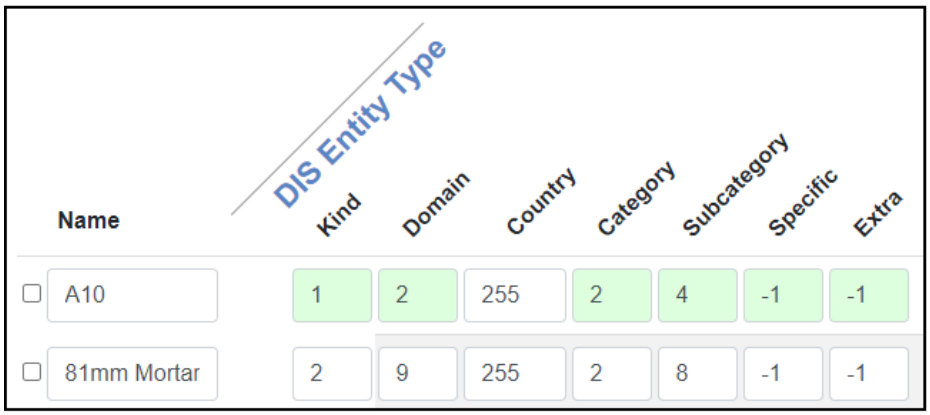
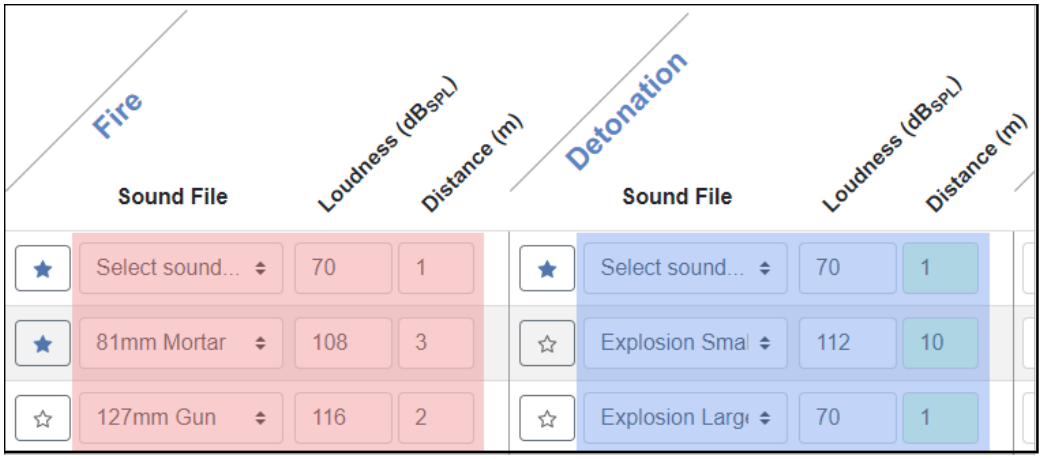
Column A shows the mapping's name, while **Columns B–H** show the **DIS Entity Type** settings:



A	B	C	D	E	F	G	H
Name	Kind	Domain	Country	Category	Subcategory	Specific	Extra
Mapping-1	0	0	0	0	0	0	0
Mapping-2	1	2	255	2	4	-1	-1

Figure 17: Name and DIS Entity Type view

Columns **I–K** show **Fire** settings on **Custom Mappings**, while Columns **M–O** show **Detonation** settings:



I	J	K	L	M	N	O
Fire Sound File	Fire Loudness	Fire Distance	Fire Warheads	Detonation Sound File	Detonation Loudness	Detonation Distance
	70	1			70	1
81mm_mortar.wav	108	3	2000, 9500	explosion_small_01.wav	112	10
127mm_gun.wav	116	2	1630	explosion_large_01.wav	70	1

Figure 18: Fire and Detonation view

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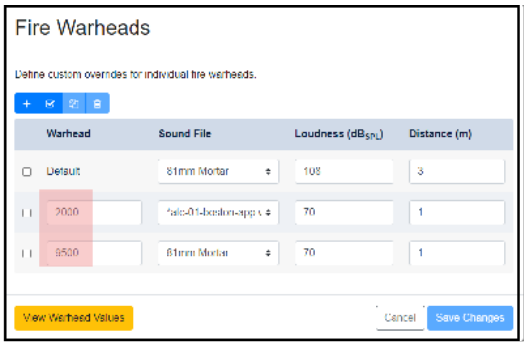
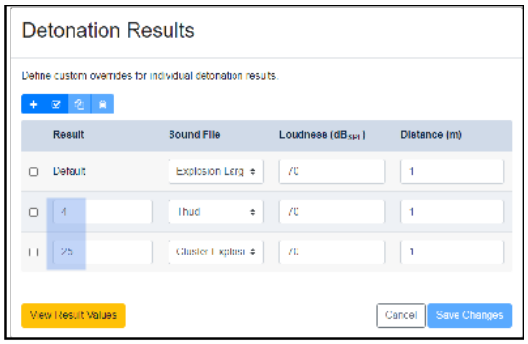
Columns **L** and **P** show the fire warhead and detonation result overrides in order of appearance:

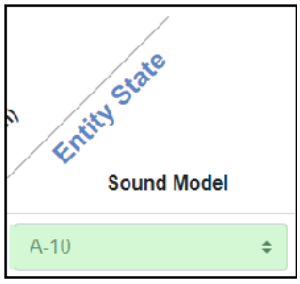




L	M	N	O	P
Fire Warheads	Detonation Sound File	Detonation Loudness	Detonation Distance	Detonation Results
		70	1	
2000, 9500	explosion_small_01.wav	112	10	3, 4
1630	explosion_large_01.wav	70	1	25, 4

Figure 19: Fire Warhead and Detonation Result override view

Column **Q** shows entity state sound model settings:



Q
Sound Model
A-10

Figure 20: Entity State Sound Model view

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5.0 Environmental Sounds

To go to the **Environmental Sounds** page, go to **Earshot** ( ) > **Environmental Sounds**.

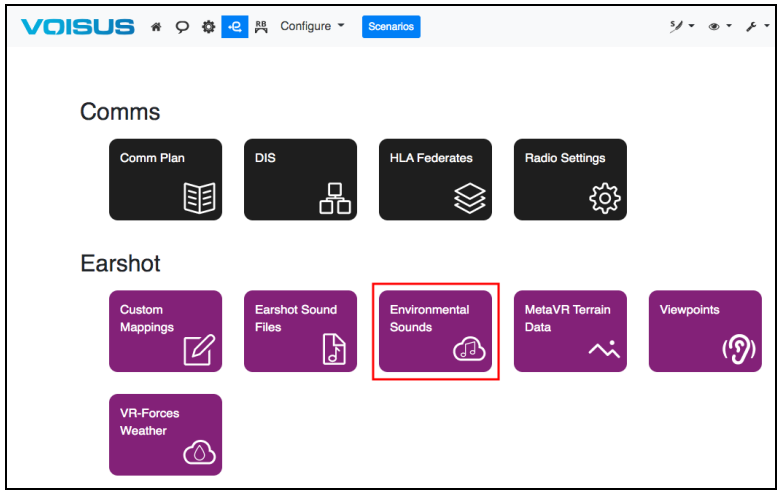

Figure 21: Environmental Sounds navigation

Environmental sounds generate sound in a specific area. An environmental process protocol data unit (PDU) determines the sound's intensity and location. You can insert sounds into the simulation that do not have an associated Distributed Interactive Simulation (DIS) entity (e.g., background noise from a market area, wind noise in an open field). An environmental process PDU also defines the sound's spherical shape and position. Specifically, the system responds to Sphere 1 and Bounding Sphere types.

Figure 22: Earshot concept

To use this element, match the DIS parameters to those of the desired environmental process PDU on the network. Once the system detects the PDU, the audio file in **Sound File** plays.

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Select from uploaded sounds in the **Sound File** library. The sound continues to play as long as the environmental process persists on the network.

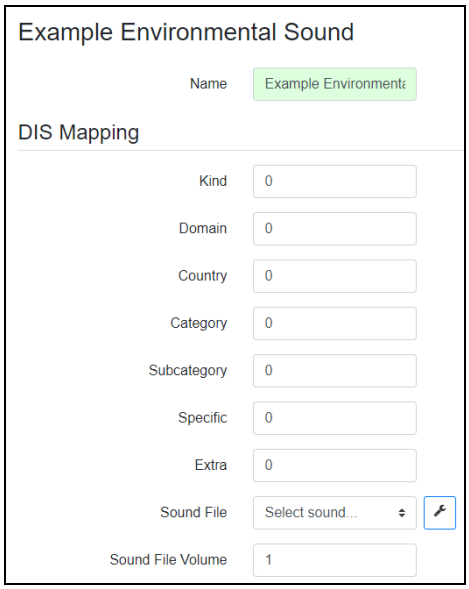

Figure 23: Environmental Sounds page

Use the **Sound File Volume** control to adjust the level to a desired value ranging from 0–2.0.

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6.0 MetaVR™ Terrain Data

MetaVR Terrain Data links the Voisus server to a customer-furnished PC sharing terrain data via Samba network-sharing protocol. To enable MetaVR terrain data access, follow these steps:

1. From the navigation bar at the top of the page, go to **Earshot** ( ) > **MetaVR Terrain Data**.

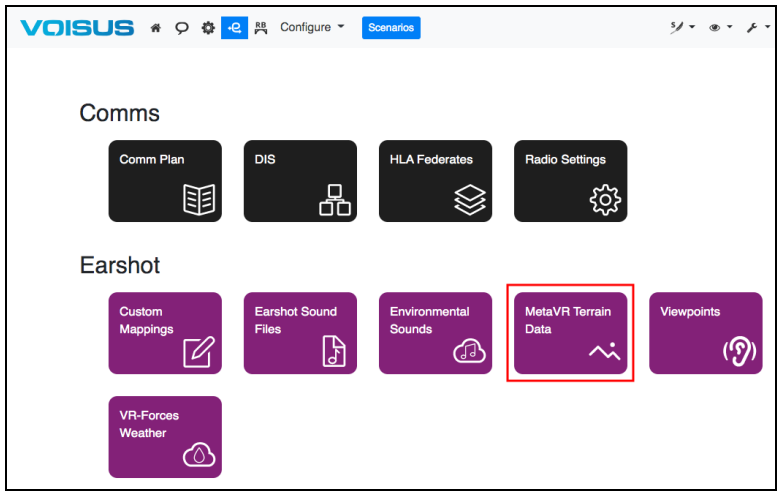

Figure 24: MetaVR Terrain Data navigation

2. In **Server IP Address**, enter the IP address of the computer hosting MetaVR terrain data.
3. **Directory on Network Share** points the Voisus server to a shared directory folder on the host computer. Enter the directory folder's name.
4. In **Username** and **Password**, enter the login credentials of the computer hosting MetaVR terrain data.
5. When finished, select Connect.

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6. Confirm **Status** displays a green check mark (✔):

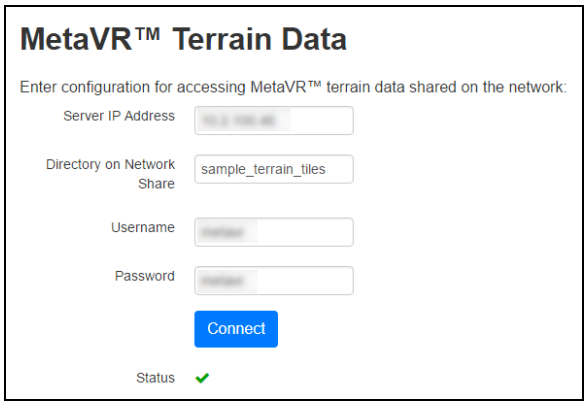

Figure 25: MetaVR Terrain Data page

A red X (✖) indicates that the Voisus server is disconnected from the host computer. If Federal Information Processing Standards (FIPS) mode is enabled, the Voisus server may not be able to authenticate the network share. To manually disable FIPS mode, contact support@asti-usa.com.

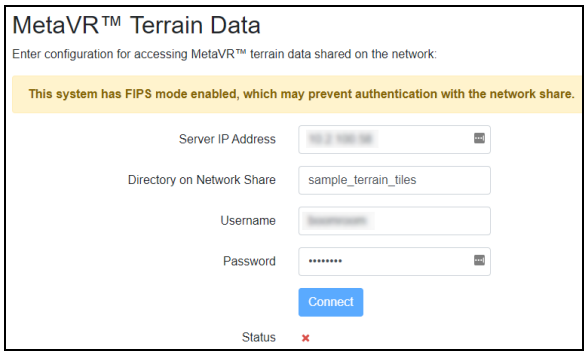

Figure 26: FIPS mode warning

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7.0 VR-Forces Weather

VR-Forces® Weather allows you to customize weather sounds. Specifically, you can differentiate levels of rain intensity, sea state, and wind speed.

To add sound files to **Earshot Sound Files**, select **Edit Sounds** ( ) at the top of the page. For more information about Earshot sound files, go to Section 3.0, "Earshot Sound Files" on page 4.

7.1 Rain Intensity

To customize rain intensity sound effects, follow these steps:

1. Under **Rain Intensity**, select **Sound File** corresponding with **Light**, **Medium**, or **Heavy**, and choose an effect.
2. In **Gain**, enter a gain value.
3. In **Range (%)**, enter percentage values ranging from 0–100 percent.

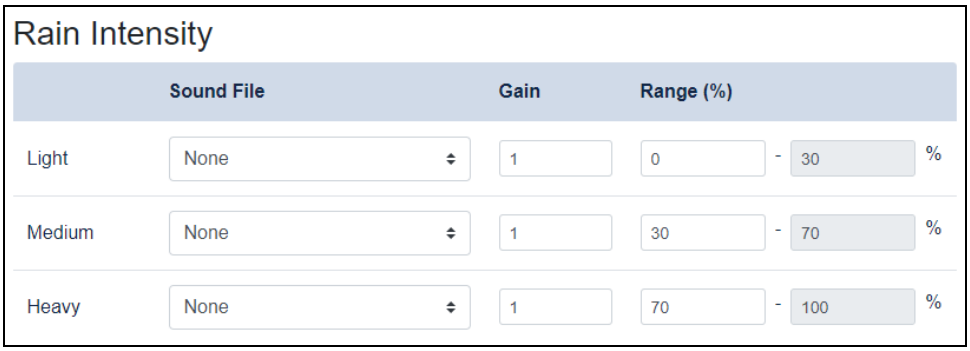

Figure 27: Rain Intensity settings

7.2 Sea State

To customize sea state sound effects, follow these steps:

1. Under **Sea State**, select **Sound File** corresponding with **Low**, **Medium**, or **High**, and choose an effect.
2. In **Gain**, enter a gain value.

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3. In **Range (Douglas Sea State)**, enter low, medium, and high values according to the Douglas Sea Scale:

Value	Description
0	Calm (glassy)
1	Calm (rippled)
2	Smooth (wavelets)
3	Slight
4	Moderate
5	Rough
6	Very Rough
7	High
8	Very High
9	Phenomenal

Table 1: Douglas Sea Scale

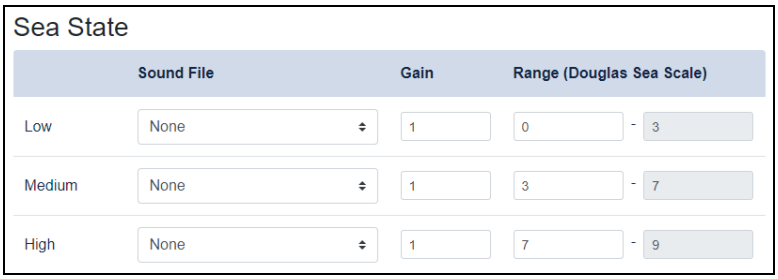

Figure 28: Sea State settings

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7.3 Wind Speed

To customize wind speed sound effects, follow these steps:

1. Under **Wind Speed**, select **Sound File** corresponding with **Low**, **Medium**, or **High**, and choose an effect.
2. In **Gain**, enter a gain value.
3. In **Range (km/h)**, enter wind speed values ranging from 0–118.5 km/h.

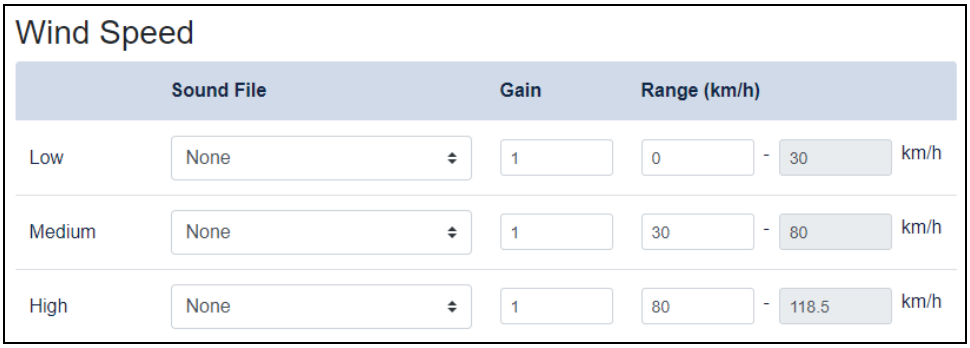

Figure 29: Wind Speed settings

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8.0 Earshot Statistics

From the top right, go to **Monitor** ( ) > **Earshot**.

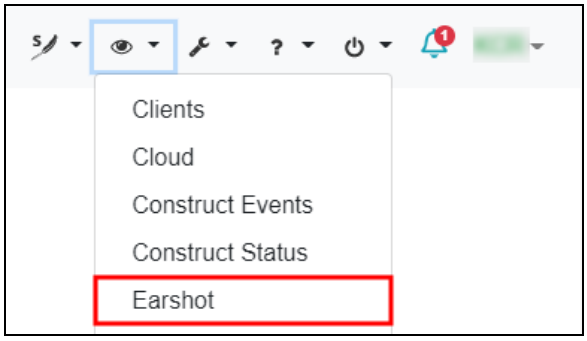

Figure 30: Earshot Statistics navigation

As Earshot's main troubleshooting utility, **Earshot Statistics** lists detected viewpoints and virtual entities close enough to hear, showing their status within the simulation.

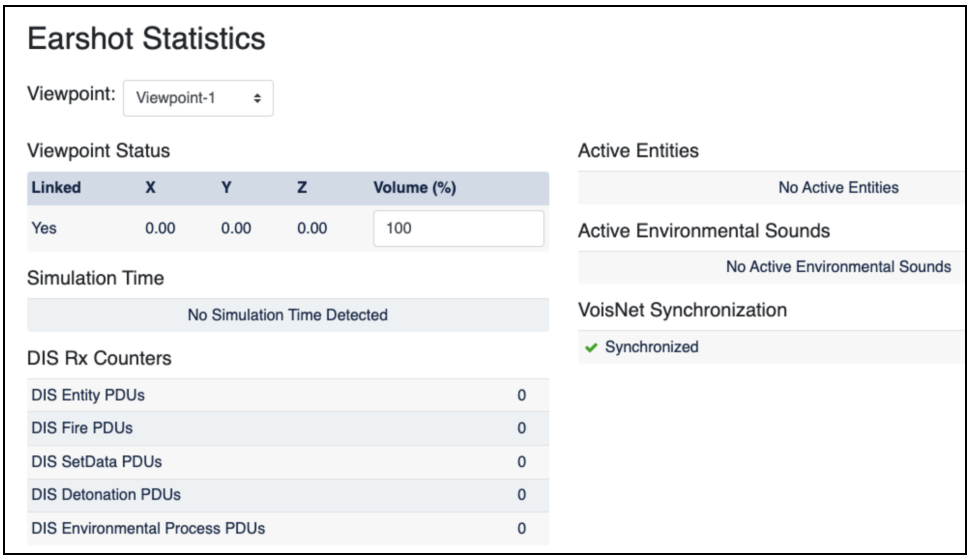

Figure 31: Earshot Statistics

Note: ***Earshot Statistics*** *only shows features enabled in the license file. Depending on your configuration, some features may not display.*

At the top of the page, **Viewpoint** allows you to choose from the available Earshot viewpoints. For more information about viewpoints, go to Section 2.0, "Viewpoints" on page 2.

Viewpoint Status indicates whether the selected viewpoint is linked to its corresponding DIS entity received from the network. Once linked, the X, Y, Z values represent the viewpoint's location.

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Simulation Time shows the current time and date within the simulation. If the simulation time is not provided, the display shows “No Simulation Time Detected.”

DIS Rx Counters shows the total received protocol data units (PDUs) categorized by type.

Viewpoint Speaker Locations indicates whether the user-created speaker locations are connected to a corresponding amplifier channel.

Active Entities displays DIS entities received from the network that are currently producing audio. The following information displays in this area:

- ***Entity****:* shows the virtual entity's ID number and type; the simulation automatically generates the ID, and the type is derived from ASTi's built-in library or **Custom Mappings**.
- ***Range (m)****:* shows the relative distance in meters from the viewpoint.
- ***Loudness (dB$_{SPL}$)***: shows the entity's volume using sound pressure level in decibels.
- ***Terrain Factor****:* if enabled, shows the terrain’s level of sound obstruction; ranges from 0–1, where 0 represents full sound obstruction, and 1 represents no sound obstruction; works in conjunction with the Earshot terrain server.
- ***Forward (m)****:* displays the entity's X coordinate distance from the viewpoint.
- ***Right (m)****:* displays the entity's Y coordinate distance from the viewpoint.
- ***Up (m)****:* displays the entity's Z coordinate distance from the viewpoint.

Active Environmental Sounds displays actively playing environmental sounds based on Environmental Process PDUs received from the network. For more information about active environmental sounds, go to Section 5.0, "Environmental Sounds" on page 13.

Fire Events and **Detonation Events** show the last 20 sound effects as they occur in real time. Currently playing sounds light up green and show a green speaker (), while delayed sounds display a clock ().

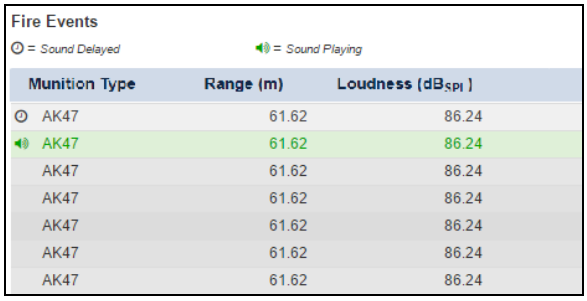

Figure 32: Fire Events

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Munition Type shows the weapon type (e.g., AK-47), including custom weapons created on **Custom Mappings**. **Range (m)** shows how far away the weapon was fired from the listener, while **Loudness (dB_{SPL})** displays the sound's volume using sound pressure level in decibels.

MetaVR Terrain Data Network Status shows the Voisus server's connection status to the computer hosting MetaVR™ simulation software. For more information about MetaVR terrain data, go to Section 6.0, "MetaVR™ Terrain Data" on page 15.

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Appendix A: VoisNet Synchronization

VoisNet Synchronization outputs Earshot aural cue audio using an AI-Delta audio distribution device instead of an Ashly Power Amplifier. Each Voisus server requires one AI-Delta. Because an AI-Delta only uses two channels, this configuration is ideal for programs seeking a smaller hardware footprint.

Before starting, you'll need to complete a few setup tasks:

1. Plug in the AI-Delta, and connect it to the Voisus server's network. For more information about the AI-Delta's network configuration, go to the *AI-Delta Technical User Guide* at support.asti-usa.com/media/pdf/ai_delta_ug.pdf.
2. Set up the AI-Delta, add it to the Voisus cloud, and give it a channel identifier on **Hardware Devices**. To add and name hardware clients in the Voisus web interface, go to "Name hardware clients" in the *Voisus Client User Guide* at support.asti-usa.-com/media/pdf/voisus/voisus_client_ug.pdf.
3. Add a viewpoint, as described in Section 2.0, "Viewpoints" on page 2. Make sure the AI-Delta's **Chan A** identifier on **Hardware Devices** matches the corresponding speakers' **Channel Name** on **Viewpoints**.

This chapter discusses how to:

- Enable VoisNet Synchronization on the Voisus server
- Enable Sync Mode on the AI-Delta
- Verify VoisNet Synchronization

A-1 Enable VoisNet Synchronization on the Voisus server

To enable VoisNet synchronization, follow these steps:

1. From the top right, go to **Manage** ( ) > **Features**.

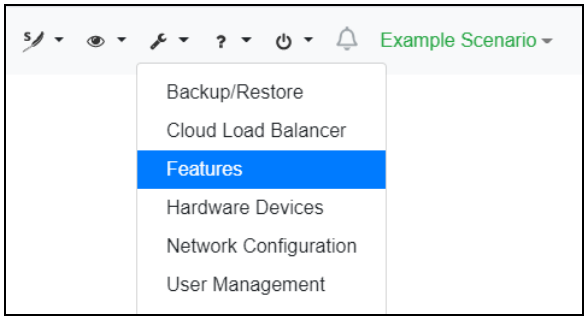

Figure 33: Features navigation

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2. On **System Features**, turn **VoisNet Synchronization** ON.

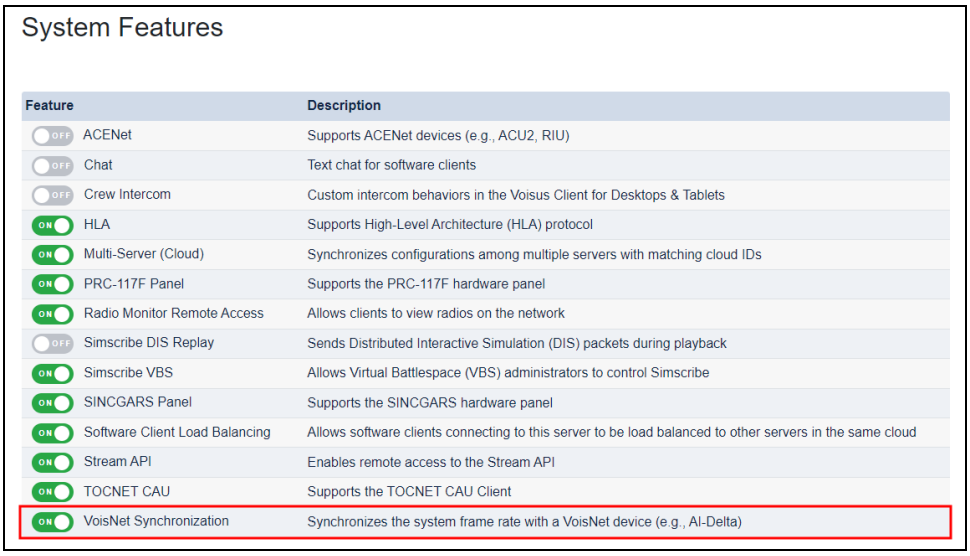

Figure 34: turn on VoisNet Synchronization

3. To activate changes, select Reboot.

A-2 Enable Sync Mode on the AI-Delta

To enable **Sync Mode** on the AI-Delta, follow these steps:

1. Open a web browser on a computer or tablet sharing a network with the Voisus server.
2. In the address bar, enter the Voisus server's IP address.
3. Log into the Voisus web interface using the following default credentials:

Username	Password
admin	astirules

4. From the top right, go to **Manage** ( ) > **Hardware Devices**.

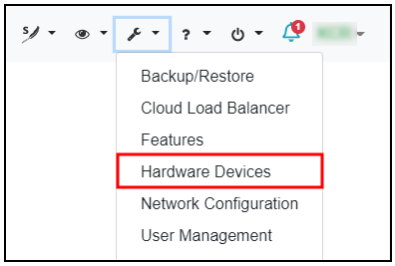

Figure 35: Hardware Devices navigation

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5. Under **AI-Delta assigned to Cloud** *ID*, where *ID* is the cloud ID, find the new device, and select Show Options.

6. To sync the AI-Delta with the Voisus server, under **Device Audio Settings**, select **Sync mode**.

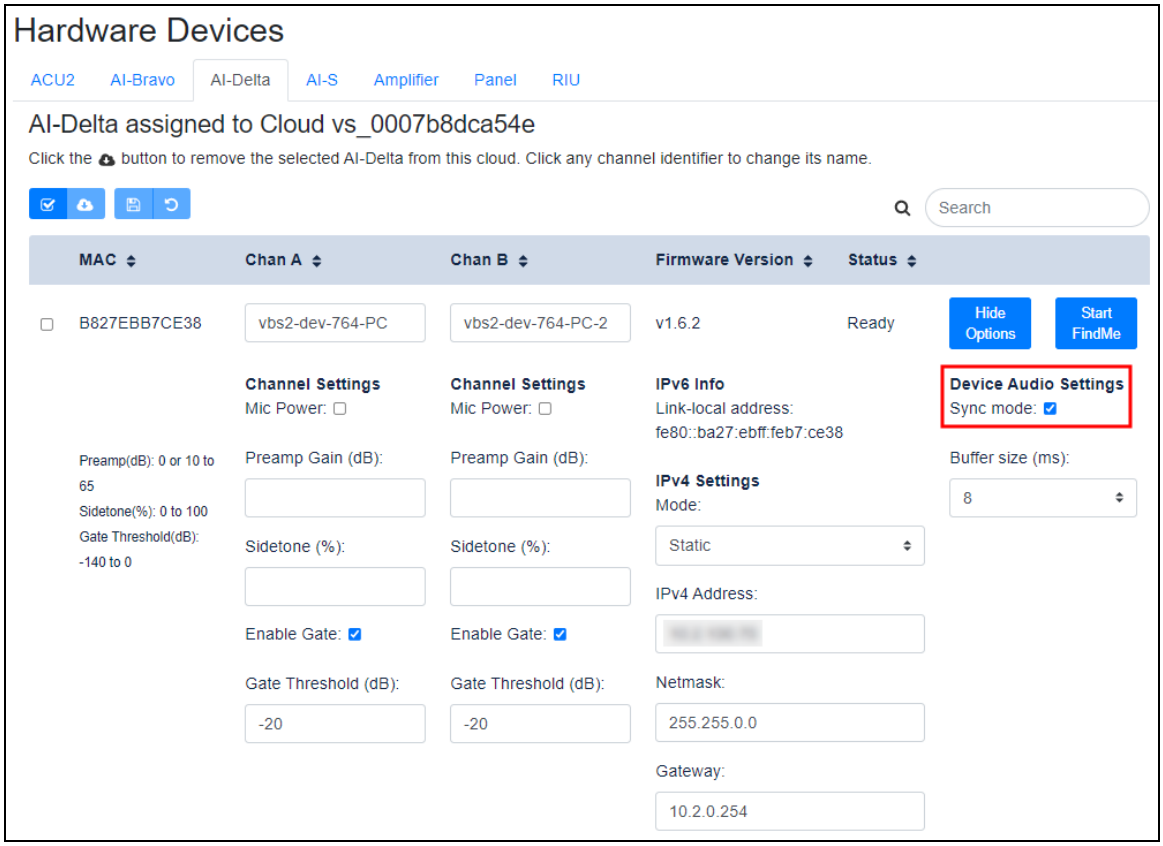

Figure 36: Enable Sync mode

7. Select **Save Changes** ( ).

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A-3 Verify VoisNet Synchronization

To verify that the AI-Delta successfully synced with the Voisus server, follow these steps:

1. From the top right, go to **Monitor** ( ) > **Earshot**.

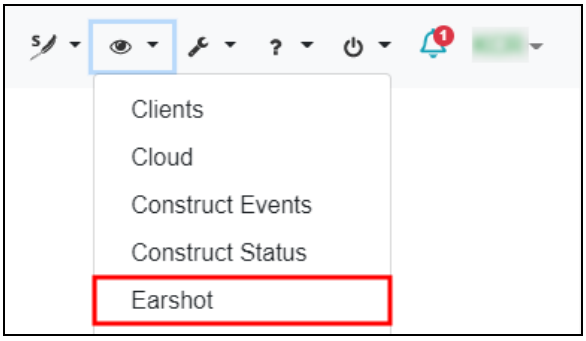

Figure 37: Earshot Statistics navigation

2. Under **VoisNet Synchronization**, confirm that ✔ **Synchronized** appears:

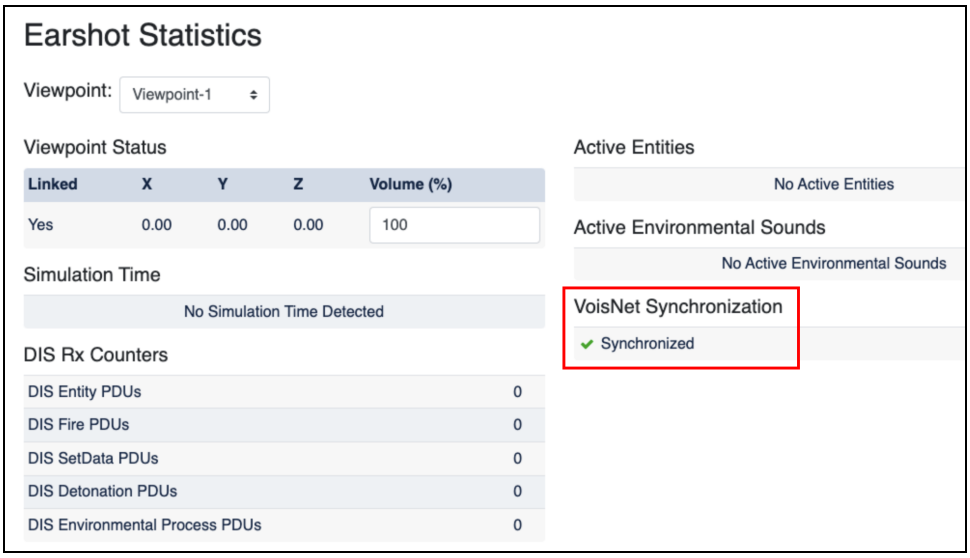

Figure 38: Confirm VoisNet Synchronization

If ✖ displays or **VoisNet Synchronization** is missing, check the following:

- VoisNet synchronization is enabled on the Voisus server.
- On **Hardware Devices**, the AI-Delta is connected to the cloud, and **Sync Mode** is enabled.
- On **Viewpoints**, the **Channel Name** of one or more speakers match the AI-Delta's **Chan A** name on **Hardware Devices**.

If you're still unable to synchronize VoisNet, contact ASTi at support@asti-usa.com.

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