

HOW TO USE IT

To use this sound library in your project, you will need the following parameters (all parameters should be normalized from 0 to 1):

- $[0..1]$ *RPM* - engine RPMs (revolutions per minute).
- $[0..1]$ *RPM_T* - main turbine RPMs of the vehicle. You can also use the engine RPM, but you'll need to modify (most often reduce by half) the rate at which the RPM increases and decreases.
- $[0..1]$ *Speed* - vehicle's speed, Where 1 represents approximately the maximum speed of the vehicle. You can use 1 for a vehicle speed of 70 km/h.
- $[0..1]$ *Throttle* - whether the gas pedal is pressed. It would be more effective if this parameter had some inertia, allowing it to have values between 0 and 1 rather than just binary states.

It would be better if these variables do not change abruptly, but are interpolated. You can adjust the interpolation for each of them separately.

Additional variables we will be using:

$$rpmSpeed = RPM * (k_speed * Speed + (1 - k_speed)),$$

$$rpmTSpeed = RPM_T * (k_speed * Speed + (1 - k_speed)),$$

where $[0..1]$ *k_speed* determines the impact of the vehicle's speed on sound changes. For this vehicle, $k_speed = 0.6$ will work well.

All '*_Loop*' sounds should start after the user has initiated the engine start, with a slight fade-in. The timing for this depends on the "Startup" sample. When the user turns off the engine, the sounds should fade out smoothly as well. The '*_Loop*' sounds should play with the following volume and pitch parameters:

File Name	Volume	Pitch
Idle_Loop Idle_Cpt_Loop	$\begin{aligned} &\text{If } (rpmSpeed \leq 0.5) \\ &0.5841 * rpmSpeed + 0.7079 \\ &\text{else} \\ &-4 * rpmSpeed^2 + 4 * \\ &\quad * rpmSpeed \end{aligned}$	$rpmSpeed^2 + 1.0$
Idle+_Loop Idle+_Cpt_Loop	$Throttle * RPM^{0.5}$	$1.0336 * rpmSpeed + 0.8217$
IdleT_Loop IdleT_Cpt_Loop	$\begin{aligned} &\text{If } (rpmTSpeed \leq 0.3) \\ &(0.4177 * rpmTSpeed + 0.1259) \\ &\quad * (0.6 * Throttle + 0.4) \\ &\text{else if } (rpmTSpeed \leq 0.5) \\ &(3.7441 * rpmTSpeed - 0.872) \\ &\quad * (0.6 * Throttle + 0.4) \\ &\text{else} \\ &(-0.6322 * rpmTSpeed + \\ &1.3161) * (0.6 * Throttle + 0.4) \end{aligned}$	$1.2369 * rpmTSpeed + 0.7631$
Max_Loop Max_Cpt_Loop	$\begin{aligned} &\text{If } (rpmSpeed \leq 0.25) \\ &0.7622 * rpmSpeed * Throttle \\ &\text{else if } (rpmSpeed \leq 0.55) \\ &(2.1057 * rpmSpeed - 0.3359) \\ &\quad * Throttle \\ &\text{else} \\ &(0.9704 * rpmSpeed + \\ &+ 0.2885) * Throttle \end{aligned}$	$1.0336 * rpmSpeed + 0.8217$
Tracks_Loop_1	$\begin{aligned} &\text{If } (Speed \leq 0.03) \\ &33.3333 * Speed \\ &\text{else if } (Speed > 0.34) \\ &\text{Maximum}(0, -14.7929 * \\ &Speed * Speed + 10.0592 * \\ &Speed - 0.7101) \\ &\text{else} \\ &1.0 \end{aligned}$	$1.733 * Speed + 0.8909$
Tracks_Cpt_Loop_1	$\begin{aligned} &\text{If } (Speed \leq 0.6) \\ &Speed^{0.3} \\ &\text{else if } (Speed \leq 0.8) \\ &-13.3044 * Speed^2 + \\ &+ 14.6349 * Speed - 3.1931 \end{aligned}$	$\text{Minimum}(1.0, 0.3114 * Speed + 0.8507)$

	else 0.0	
Tracks_Loop_2	If (<i>Speed</i> <= 0.5) $-4.1659 * Speed^2 + 4.1659 * Speed$ else 1.0	$0.3833 * Speed + 0.8195$
Tracks_Cpt_Loop_2	If (<i>Speed</i> <= 0.6) $Maximum(0, 1.5096 * Speed - 0.6039)$ else $-4.363 * Speed^2 + 8.7259 * Speed - 3.363$	$0.2034 * Speed + 0.8409$
Noise_Loop	1.0	1.0
Noise_Cpt_Loop		

For maximum realism, it's important to correctly limit each sound radius. The minimum distance is the sound radius with constant volume = 1. The maximum distance is the radius beyond which the sound volume = 0.

If necessary, you can calculate the sound volume at any distance between the minimum and maximum:

$$Distance_Volume = (distance - Min_Distance) / (Max_Distance - Min_Distance)$$

	MIN Distance (m)	MAX Distance (m)
Distant sounds '*_Dist' and '*_Tail'	1000	5000
All Other Sounds	50	1500

All cockpit sounds with the name '*_Cpt' should only play inside the vehicle cabin.

'Hit' sounds:

Play one of the 'Hit' sounds randomly when the vehicle collides with a surface or obstacle.

'Stress' sounds:

Play randomly selected 'Stress_Cpt' sound when the vehicle makes a sharp turn or drives over a small bump.

'Gear shift' sounds:

Play randomly selected sounds 'GearChange' and 'GearChange_Cpt' simultaneously when you change the gear.

'GearChange_Start' and 'GearChange_End':

When changing gears, you can first play the 'GearChange_Start' and 'GearChange_Cpt_Start' sounds, and after a short delay, play the 'GearChange_End' and 'GearChange_Cpt_End' sounds. During this time, it would be better to slightly decrease the volume of all loop sounds.

'Startup' and 'Shutdown':

Play 'Startup' and 'Startup_Cpt' sounds when you start the vehicle engine.

Play 'Shutdown' and 'Shutdown_Cpt' sounds when you turn off the vehicle engine.

'Load' and 'Unload':

Play 'Load' and 'Load_Cpt' sounds when you press the gas pedal.

Play 'UnLoad' and 'UnLoad_Cpt' sounds when you release the gas pedal.

'120mmGun':

Play randomly selected '120mmGun', '120mmGun_Short', '120mmGun_Dist', '120mmGun_Tail' and '120mmGun_Cpt' sounds. After a short delay you can play '120mmGun_Reload' and '120mmGun_Reload_Cpt' sounds.

'MG3A1' Machine Gun sounds:

At the beginning of firing, play ' _Start' sounds simultaneously.

Then, after an offset of 0.055 sec, start playing all the “_Loop” sounds from a

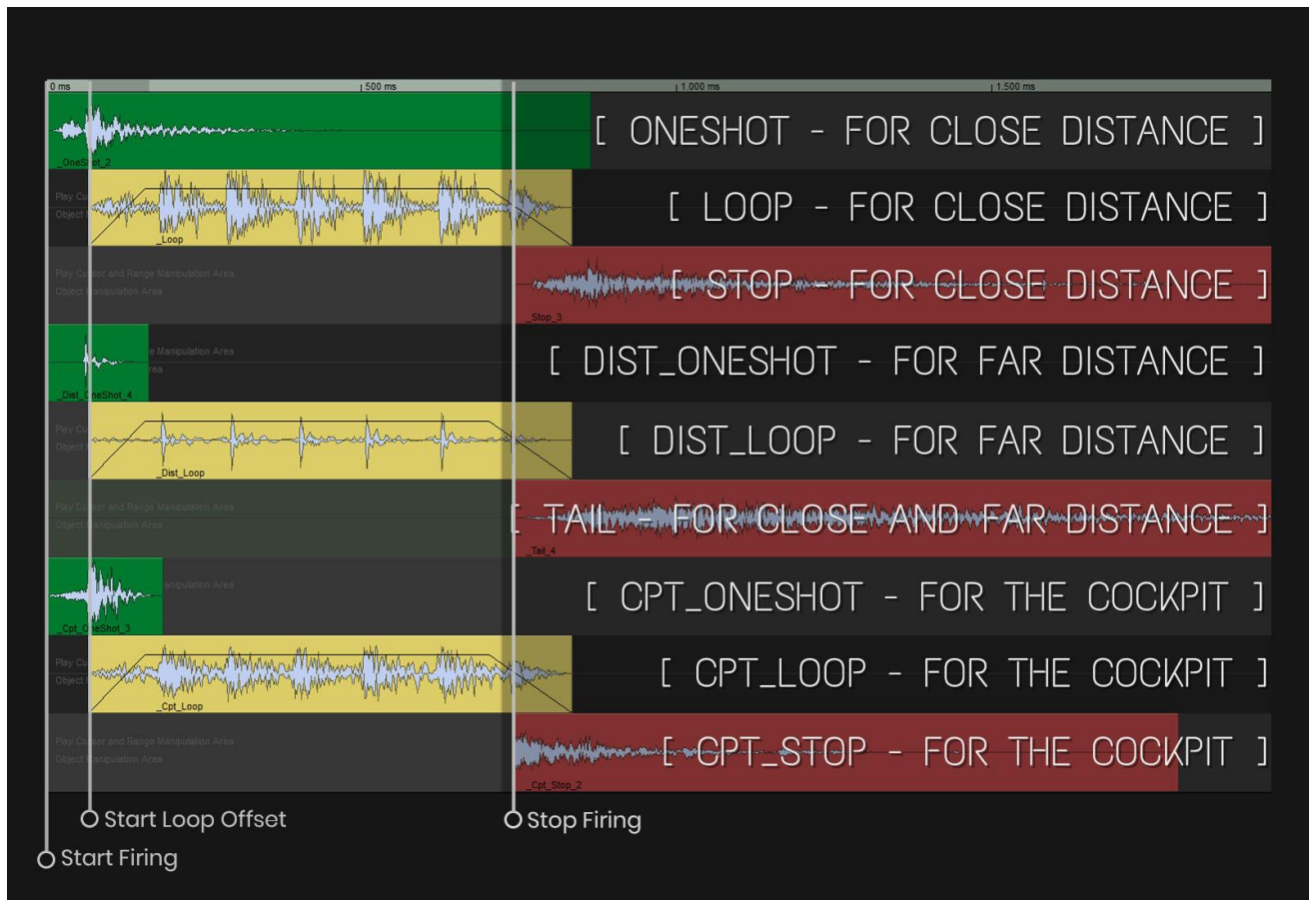
randomly selected position in the sample from the following list:

{ 0.0, 1.508, 3.026, 4.532, 5.87 } (in seconds). Thus, the sound of gunfire

will always sound different.

At the end of firing, stop playing all '_Loop' sounds and start randomly selected '_Stop' sounds along with the '_Tail' sound.

Look at our explanatory picture:



'SmokeGrenadeLauncher' sounds:

Play 'SmokeGrenadeLauncher' and 'SmokeGrenadeLauncher_Cpt' sounds.

If you notice any errors or have suggestions for improvements, please let us know.