

Documentation on StegMeros Defender (v114)



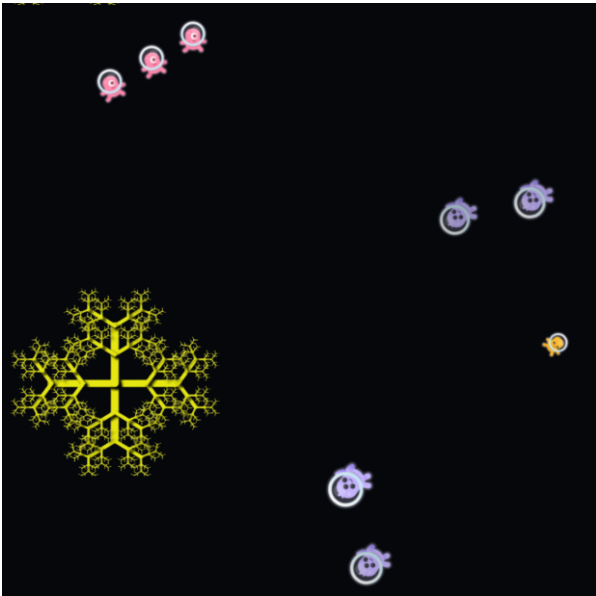
Splash Screen

This is the splash screen. The moving blue triangles are actually a javascript for a simple swarm to provide animation. The yellow triangles represent enemies with the teal color squares being alien walls that have been created. The blue squares are the colonies.

The Tiles and Player

I will write a bit more about this later. But this game is in javascript using PIXI.js (<https://pixijs.com/>) . In PIXI you can have sprites (<https://pixijs.com/8.x/guides/components/scene-objects/sprite>). I picked simple geometric shapes because I needed to get the coding correctly setup and optimized. The tiles, player, enemies can be

swapped out with graphics. Here's an example using Kenny.nl character set. Pink are aliens, the fractal is from another project, the player is yellow and the colonies are purple.



PIXI is used because it can handle 5000+ particles but that's a long discussion in another blog.

Top Level Configuration

This is the main configuration entrance. You pick what level to configure and then you can edit the level and the parameters.

STEGMEROS DEFENDER

Production tool: This ADMIN takes the output from the MAP utility which is used to set obstacles and weapons. If no map then default random and all weapons. This utility allows you to set the map, tiles, win/lose conditions, LoS pixel, waves, attacking swarm parameters, and Music 1/2/3 audio. Results exported to game

Level 1Level 2Level 3

Configure Level 3 ▾

Edit Level Parameters

Introduction Screen

Controls Screen

Load 3-Level Configuration

Save 3-Level Configuration

Load Map File

Apply Map to All Levels

Level 3: Level 3 - The Journey

Load Wall Tile PNG

Apply Tile to All Levels

MUSIC

Generic Music 1 / Music 2 / Music 3 slots. The loaded MP3 filename identifies the actual music in each slot.

	Default volume (0-1)	Music 1 max colonies	Music 3 starts at colonies
☒ Music default ON	0.35	50	100
Music 1	Music 1 - La Follia Var 5.mp3		Load MP3 Preview
Music 2	Music 2 - La Follia Var 7.mp3		Load MP3 Preview
Music 3	Music 3 - La Follia Var 14.mp3		Load MP3 Preview

Music 1: 0-50 colonies | Music 2: 51-99 | Music 3: 100+

BALANCE TEST DATA

Admin only. Runs unattended and records the configured topology, strategy, 185-second snapshot, early colony extinction, timeout, or win.

☒ Collect balance-test data

Snapshot at

185

gameplay seconds

Load the map utility JSON that you created to the level or to all levels.

- Change the tile (default is the teal one) to other tiles. These are 100x100 pixel tiles.
- Once you change configuration you can export it the JSON file.
- The Music can be whatever mp3 you decide.
- The Balance Test Data creates an excel with the game stats. Its' cumulative unless you restart the count.

Select Configure Level 3

Level 3 Text

Player-facing title and description are editable here and remain separate from gameplay parameters.

Level title (level number is added automatically)

Level 3 - The Journey

Level description

Civilizations begin in a confined cradle, learn to reach outward, travel farther and faster, and eventually confront their place in the larger fate of the universe.
Inspired by Liu Cixin, Death's End.

Level 3 Parameters

Initial enemies	Colony seeds	Colony growth interval (ms)	Movement profile
1000	1	265	CONSTRAINED
Random obstacle count	Random obstacle seed	Time limit (seconds)	
105	303	1200	
Win condition	Win when active colonies >=		
ACTIVE_COLONIES >=	100		
Lose condition	Lose when active colonies <= (arms after first above target)		
NO_COLONIES (0)	0		

Movement Transitions — Conditional Test

After minimum time, all enabled colony/enemy conditions must be true. Maximum time forces the next mode. A* still requires its existing qualifying colony group.

ENERGETIC WANDER → STREAMING

Minimum time (sec)	Maximum time (sec)	
5	20	
Colonies >= (0 = off)	Enemies >= (0 = off)	Enemies <= (0 = off)
0	0	0

You can change the title and the description in the text boxes to match your scenario. The most important configuration is the Colony growth rate and the win condition. Stegmeros is basically a predator – prey game and depending on how quickly the colonies grow will determine if they can out survive the attack of the enemies. If the equations are balance then the game hits an equilibrium where the play needs to do little very little to win. The win condition sets the endpoint for the game.

Level 3 Parameters:

The movement profile is set to CONSTRAINED. This means that path finding will be of little use so the strategy is to find and send the enemies to the colony location. The 2 modalities are Wander and Streaming and you can set the time and conditions.

The Line of Sight (LoS) only applies to SPARSE mode because in this case there's path finding involved. We will get to that example.

Colony LOS Hunting — SPARSE Modes
Direct visual colony acquisition only; no A*. Range 0 disables the LOS hunt for that mode. Sampling remains once per second and the established seek/nudge strengths are unchanged.

TIGHT colony LOS range (px, 0 = OFF)

LARGER colony LOS range (px, 0 = OFF)

Enemy Emitter

☒ Emitter enabled ☒ Use map S spawn

Spawn radius Maximum active enemies

Fallback X Fallback Y

Emitter Waves
Each wave is independent and fires once when its own colony condition is true. Wave order does not block another wave. Trigger value 0 = OFF.

Wave 1						Delete Wave
Colony condition	Trigger value (0 = OFF)	Total enemies	Enemies per burst			
COLONIES >=	0	1000	10			
Burst interval (ms)	Start delay after trigger (ms)					
100	0					

+ Add Wave

Apply Level Changes Save Level Parameters CSV Reset Level Text + Parameters

Enemy Emitter determines the flow of enemies. Enemies spawn location is included on the map. If the map utility is not used then the X, Y coordinates can be used. The emitter has a condition with a total – 1000 in this case with 10 enemies per burst of 100ms bursts.

You can add and delete waves and how many enemies they contribute when triggered.

Very important! Save you changes with “Apply Level Changes”.

Music and Stats

MUSIC

Generic Music 1 / Music 2 / Music 3 slots. The loaded MP3 filename identifies the actual music in each slot.

☒ Music default ON

Default volume (0-1)
0.35

Music 1 max colonies
50

Music 3 starts at colonies
100

Music 1

Music 1 - La Follia Var 5.mp3

Load MP3

Preview

Music 2

Music 2 - La Follia Var 7.mp3

Load MP3

Preview

Music 3

Music 3 - La Follia Var 14.mp3

Load MP3

Preview

Music 1: 0-50 colonies | Music 2: 51-99 | Music 3: 100+

BALANCE TEST DATA

Admin only. Runs unattended and records the configured topology, strategy, 185-second snapshot, early colony extinction, timeout, or win.

☒ Collect balance-test data

Snapshot at 185

gameplay seconds

Download Test CSV

Clear Test Data

Collection ON | 33 completed runs

Random Map Active: NO

Create Final Stegmeros Defender Game

You can load any mp3 music you like and preview. I picked a reduced version of Vivaldi La Folia pieces. There are 19 or so of them and these three (5,7,14) were my favorites.

Balance test data section. This collects reproduction and colony death rates and the strategy used at that time. Very useful for tuning the game. A very useful debug key is "=", you'll see it below.

Create Final StegMeros Defender Game – produces a version without all the admin setup so it can be played as a standalone game.

Game Test Run

Here's the game produced with this settings. This is with that “=” key pressed. Where the arrow is pointing you can see the transitions for STREAMING from wander to stream.



Level 2 Configuration

In this example let's look at level 2 configuration.

Level 1 Level 2 Level 3

Configure Level 2 Edit Level Parameters Introduction Screen Controls Screen

Load 3-Level Configuration Save 3-Level Configuration Load Map File

Apply Map to All Levels Level 2: Level 2 - Containment

Load Wall Tile PNG Apply Tile to All Levels

MUSIC

Generic Music 1 / Music 2 / Music 3 slots. The loaded MP3 filename identifies the actual music in each slot.

☒ Music default ON

Default volume (0-1) 0.35 Music 1 max colonies 50 Music 3 starts at colonies 100

Music 1 Music 1 - La Follia Var 5.mp3 Load MP3 Preview

Music 2 Music 2 - La Follia Var 7.mp3 Load MP3 Preview

Music 3 Music 3 - La Follia Var 14.mp3 Load MP3 Preview

Music 1: 0-50 colonies | Music 2: 51-99 | Music 3: 100+

BALANCE TEST DATA

Admin only. Runs unattended and records the configured topology, strategy, 185-second snapshot, early colony extinction, timeout, or win.

☒ Collect balance-test data Snapshot at 185 gameplay seconds

Download Test CSV Clear Test Data Recorded WIN at 65.0s | 36 completed runs

Random Map Active: NO Create Final Stegmeros Defender Game

This overview setup screen is the same for all levels. You can see here I've run this 36 times and collected balance test data.

Level 2 Details – Sparse Map

Here we can see it the level starts with 100 enemies and 20 Colonies, growth rate of 260ms (about $\frac{1}{4}$ of a second) colony. The movement profile is "SPARSE". What this means is that the field of obstacles is sparse enough to change the colony swarming configuration. A [swarm](#) has:

- Alignment
- Cohesion
- Separation

Changing these determines whether the enemy is just a tight pack or a loose pack. The enemy size will determine tight group or large swarm. When the type is SPARSE this matters and you can set the parameters. For "CONSTRAINED" it really means that the obstacles are too tight for swarms to see each other so the parameter is a simpler – stream to a point or wander.

Level 1 Parameters

Initial enemies 100	Colony seeds 20	Colony growth interval (ms) 260	Movement profile SPARSE
Random obstacle count 0	Random obstacle seed 0	Time limit (seconds) 200	
Win condition ACTIVE_COLONIES >=		Win when active colonies >= 175	
Lose condition NO_COLONIES (0)		Lose when active colonies <= (arms after first above target) 0	

Movement Transitions — Conditional Test

After minimum time, all enabled colony/enemy conditions must be true. Maximum time forces the next mode. A* still requires its existing qualifying colony group.

WANDER → TIGHT SMALL GROUPS

Minimum time (sec) 5	Maximum time (sec) 20		
Colonies >= (0 = off) 0	Enemies >= (0 = off) 0	Enemies <= (0 = off) 0	

TIGHT SMALL GROUPS → LARGER GROUPS

Minimum time (sec) 10	Maximum time (sec) 30		
Colonies >= (0 = off) 0	Enemies >= (0 = off) 0	Enemies <= (0 = off) 0	

LARGER GROUPS → ADVANCED A* LEADER

Minimum time (sec) 10	Maximum time (sec) 30		
Colonies >= (0 = off) 0	Enemies >= (0 = off) 0	Enemies <= (0 = off) 0	

ADVANCED A* LEADER → WANDER

Minimum time (sec) 10	Maximum time (sec) 40		
Colonies >= (0 = off) 0	Enemies >= (0 = off) 0	Enemies <= (0 = off) 0	

Colony LOS Hunting — SPARSE Modes

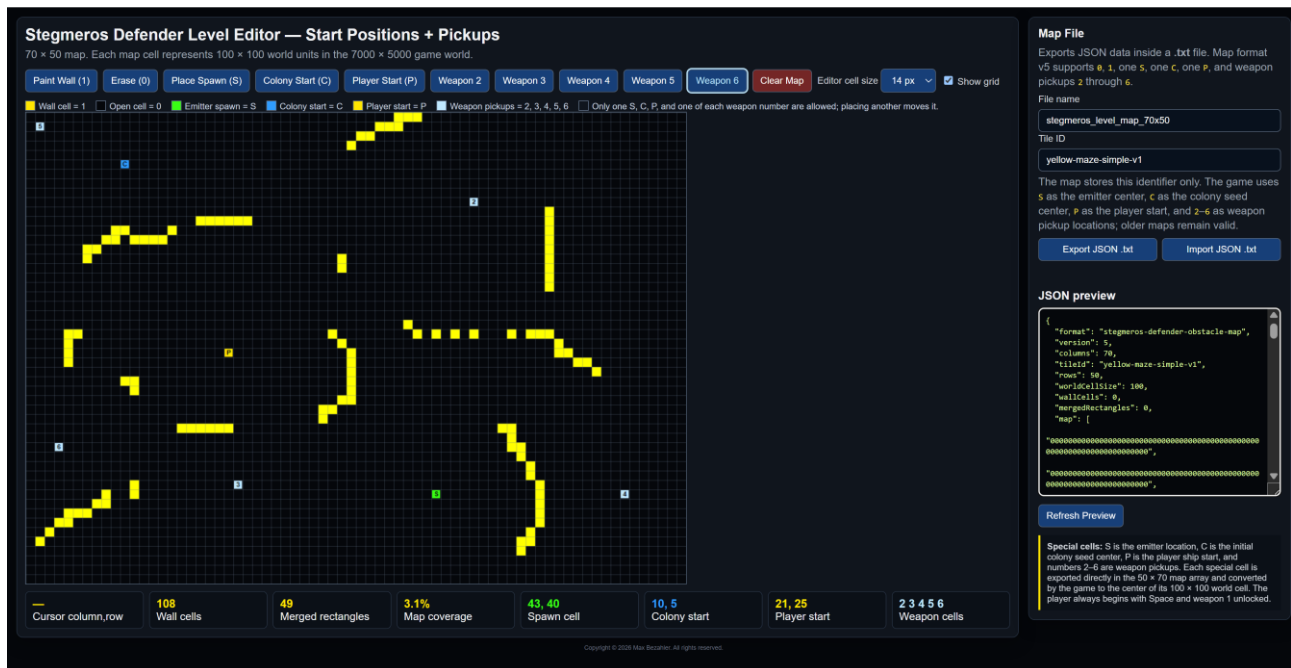
Direct visual colony acquisition only; no A*. Range 0 disables the LOS hunt for that mode. Sampling remains once per second and the established seek/nudge strengths are unchanged.

TIGHT colony LOS range (px, 0 = OFF) 300	LARGER colony LOS range (px, 0 = OFF) 300
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So above you can set how long the swarm stays in a configuration based on time (mostly what I use) or via the colony or enemy parameters. This shows a transition from Tight group – to – larger groups – to Advanced A* (read as [A*](#)). A* is actual path finding and will take a swarm and target a specific location. A* because it's guided is often the most lethal swarm strategy. You can also adjust the Line of Sight (LOS) for these swarms. This relies on [Bresenham's](#) algorithm. Making the pixel (px) range will make the attackers more aggressive.

The enemy emitter was discussed above. A very good gaming algorithm site is [Red Blob](#) which is very interactive with clear examples.

MAP Utility



The Map allows you to:

- Add walls – this works like paint and you can move the cursor around to add and right click to remove.
- Spawn location – only one in this version. This location can be changed in the ADMIN version.
- Colony start. In the ADMIN version you can increase this number
- Player start
- Weapons 1- 6 . These appear as digital numbers in the game and all the player has to do is go near to pick it up.
- Map File name – this can be changed. The default is shown here.
- JSON preview – really used during development.
- Export your map. IN the ADMIN version you can import the map and apply it to all levels or a specific level. In the ADMIN version the save configuration actually exports the entire map as well as config parameters.
- Import your map. Pull it into this editor.
- The yellow tiles are 100x100 and just used for clarity. The ADMIN area you can change the tiles.

