
Welcome To Laser Defender

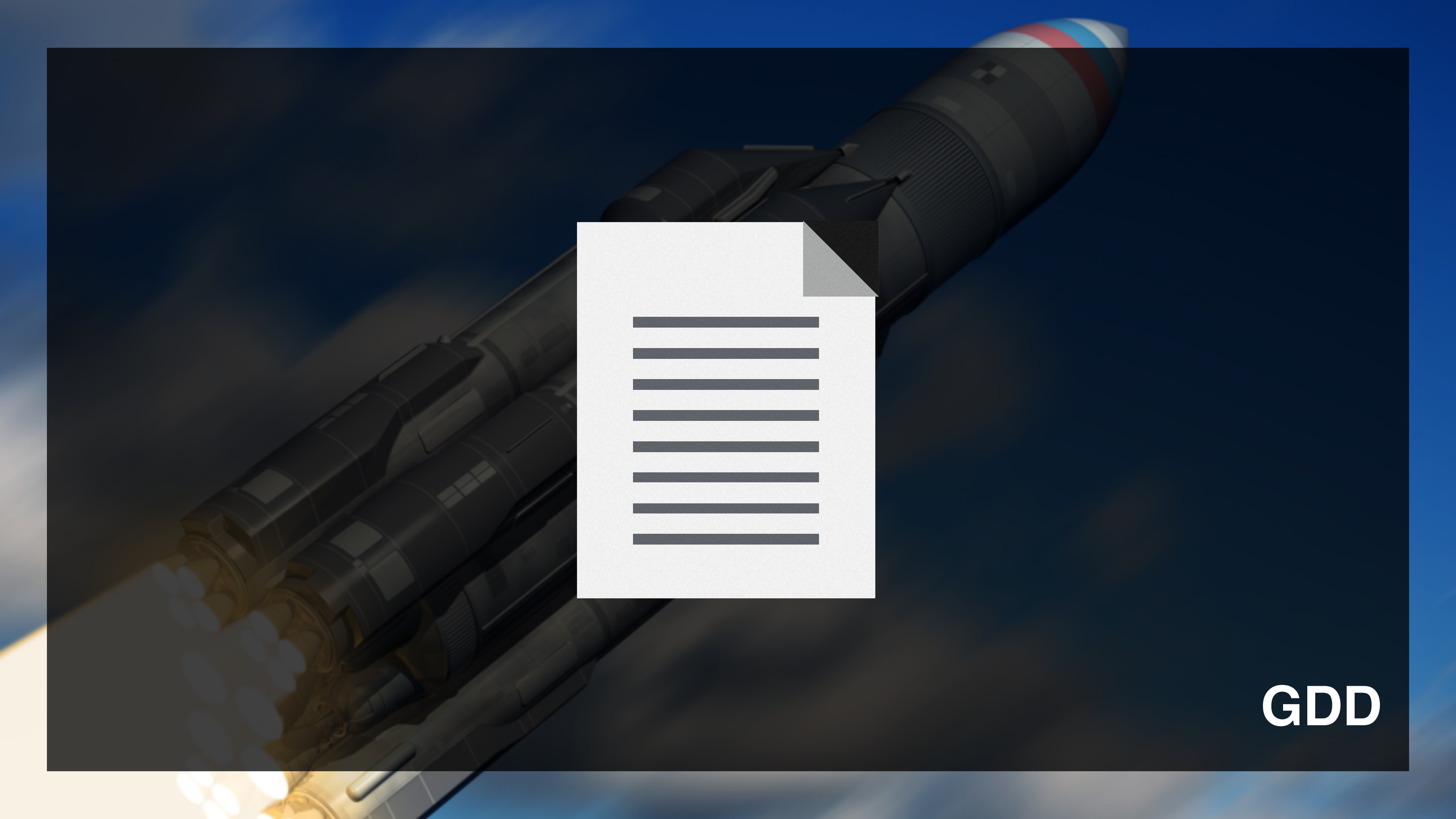
This Section is Work in Progress

We’re working hard to make this section available as quickly as we can. Hope you enjoy the preview :-)

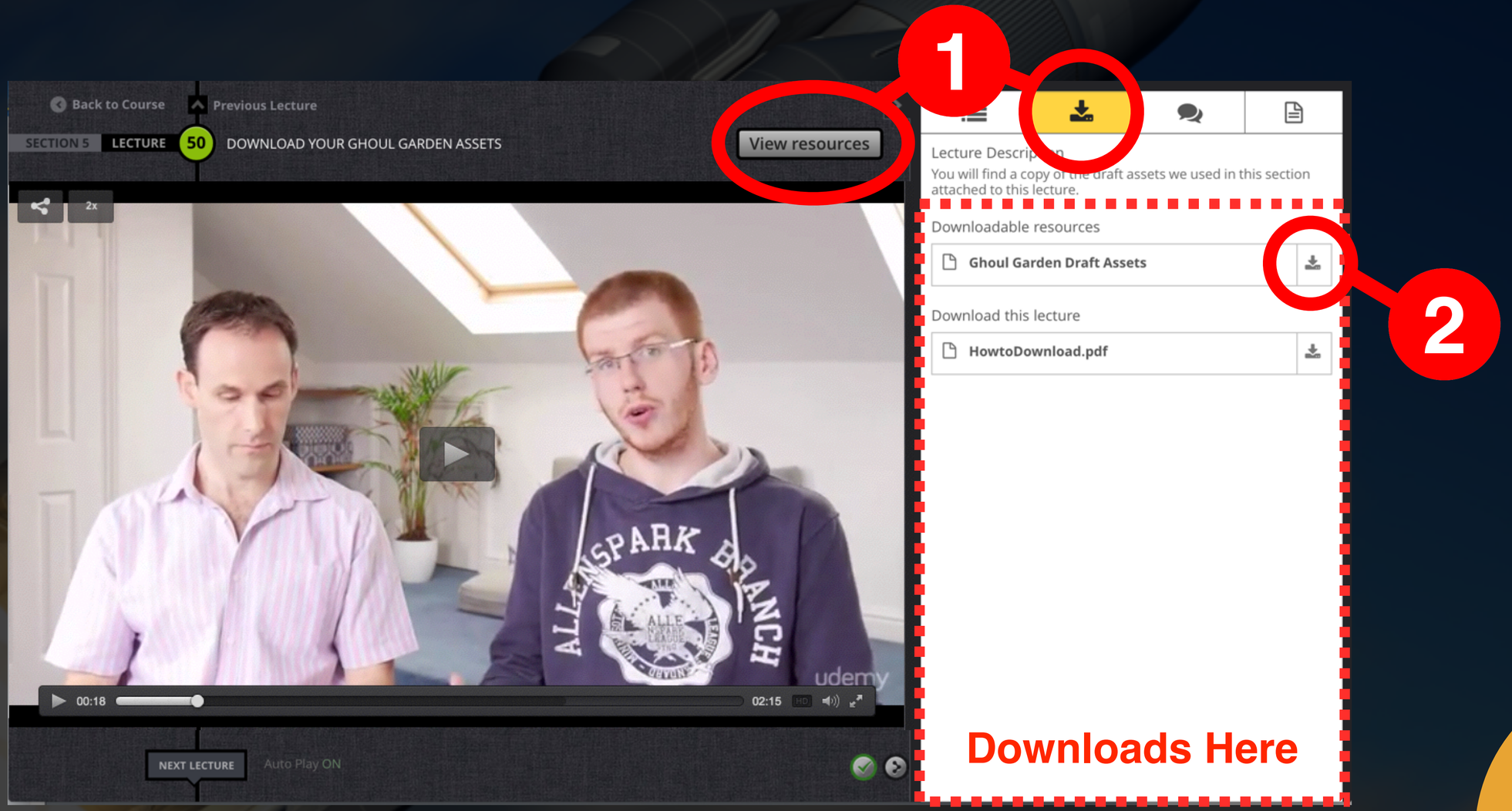
We’ll be adding videos as we make them in the coming days.

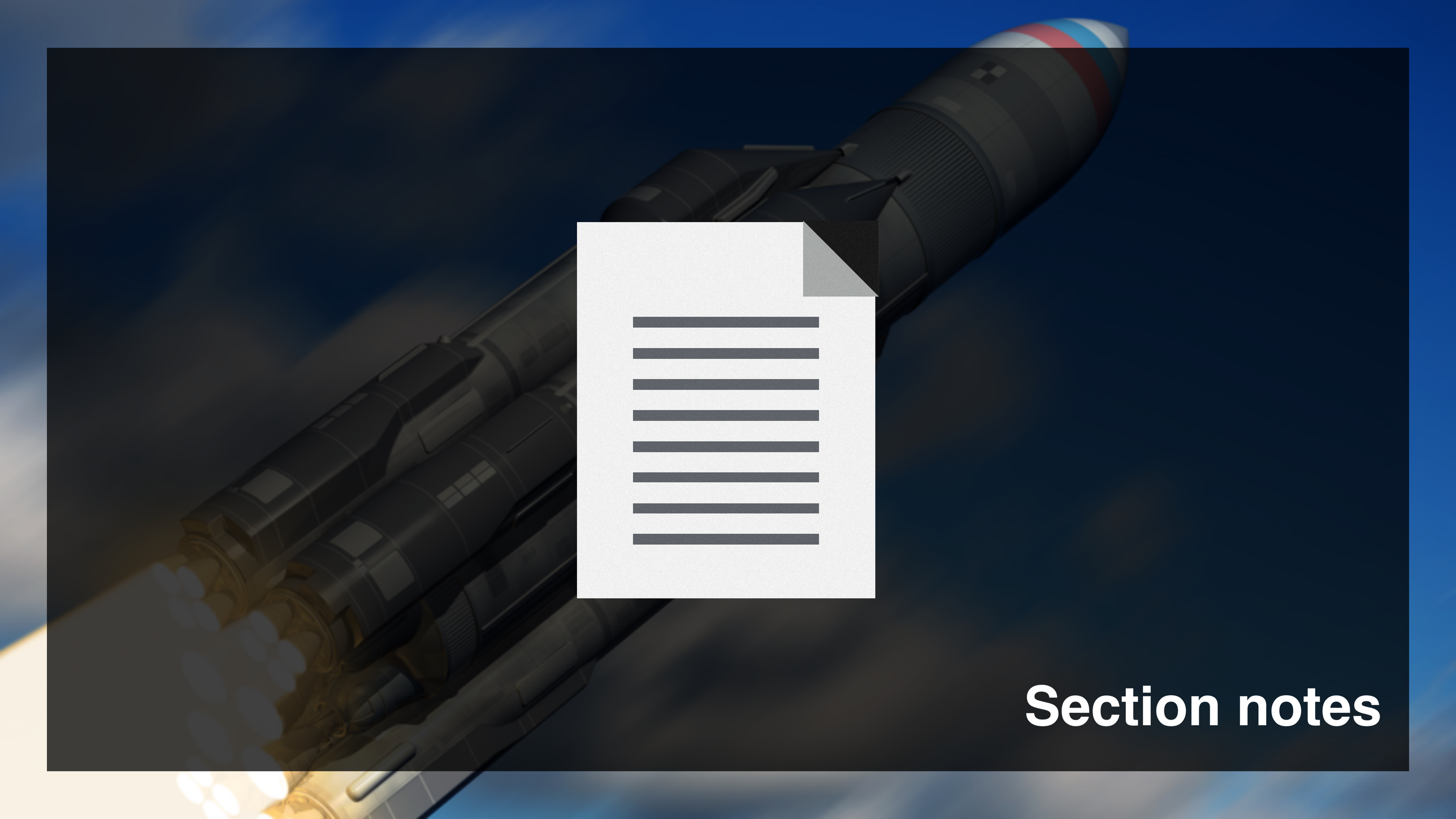
What Laser Defender Teaches

- Animation basics
- Using Trigger colliders
- Layers and Sorting Layers
- Introduction to Particle Systems

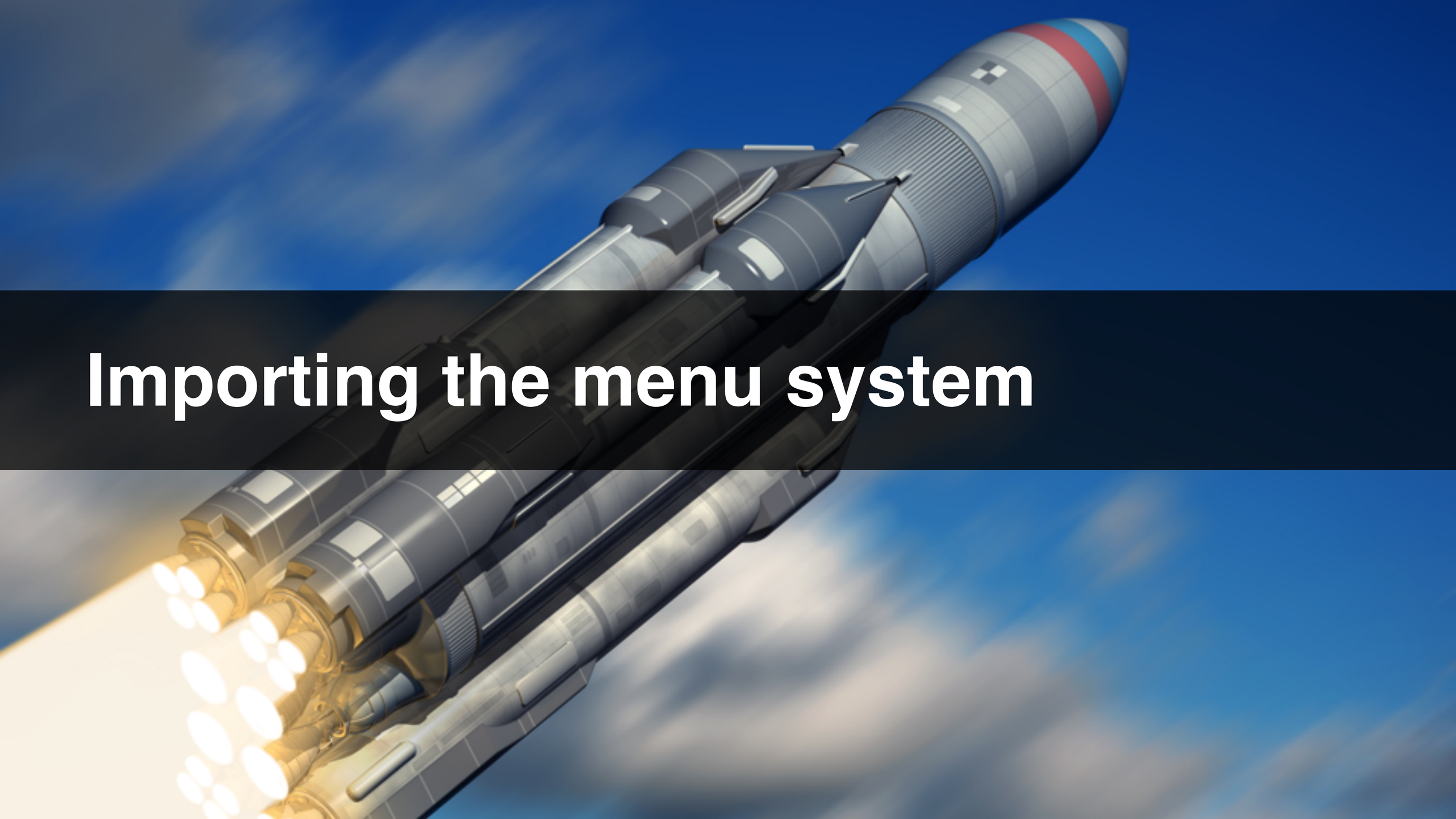

GDD

Your Laser Defender Assets





Section notes



Importing the menu system

Importing the menu system

- Open our previous game and import the menu system
- Create a unity package
- Import package into Laser Defender
- Alternatively, we can use the unitypackage from the section bundle at the beginning of this section

Import a Menu System

- Create a unity package from your previous game (or use the one provided in the asset pack)
- Import it into Laser Defender

Importing the menu system

- Imported our menus from a previous game or from the bundle
- We added a blank scene to begin
- Ready to go!

A Starship we can control

A Starship we can control

- Find a suitable sprite asset
- Import into our game
- Create a Player Controller Script to move it
- Restrict the movement to the playspace

Finding a suitable asset

- Found on http://opengameart.org
- We use Kenney's (http://www.Kenney.nl) Public Domain sprite assets:

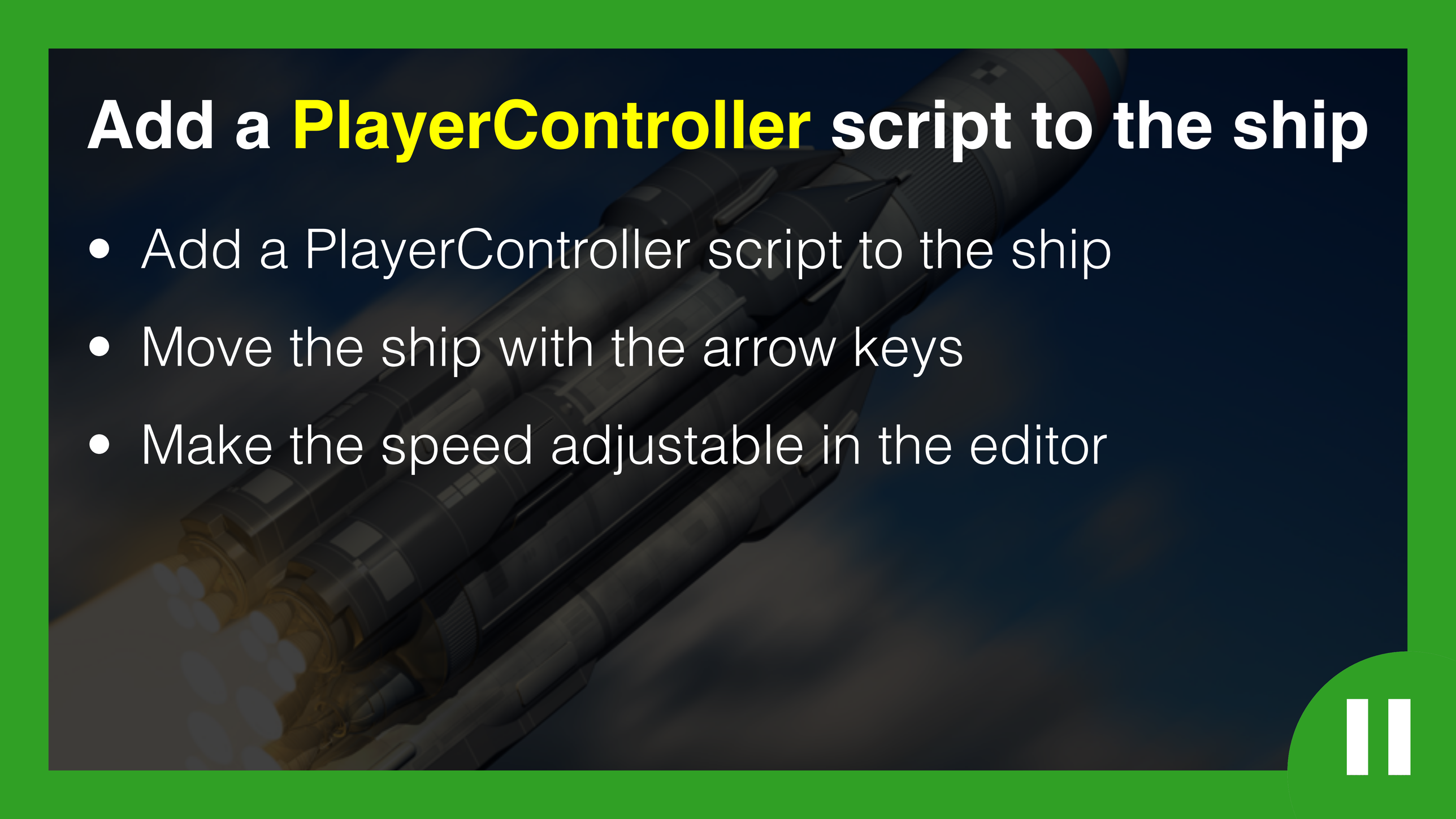
  http://opengameart.org/content/space-shooter-redux

Importing the sprite into our game

- Add it to Unity’s assets
- Change the mode to sprite (2D and UI)
- drag it into our scene

Add a PlayerController script to the ship

- Add a PlayerController script to the ship
- Move the ship with the arrow keys
- Make the speed adjustable in the editor



The PlayerController script

- Uses `Input.getKey()` and `transform.position`
- Make sure movement is independent of framerate using `Time.deltaTime`

Restricting the Spaceship’s position

Restricting the Spaceship’s position

- We don’t want the spaceship to go outside the playspace
- We will check the position when moving and restrict it to something sensible

Restricting the Position

- Use **Mathf.clamp()** to restrict movement
- Use **Camera.ViewportToWorldPoint()** to work out the boundaries of the playspace

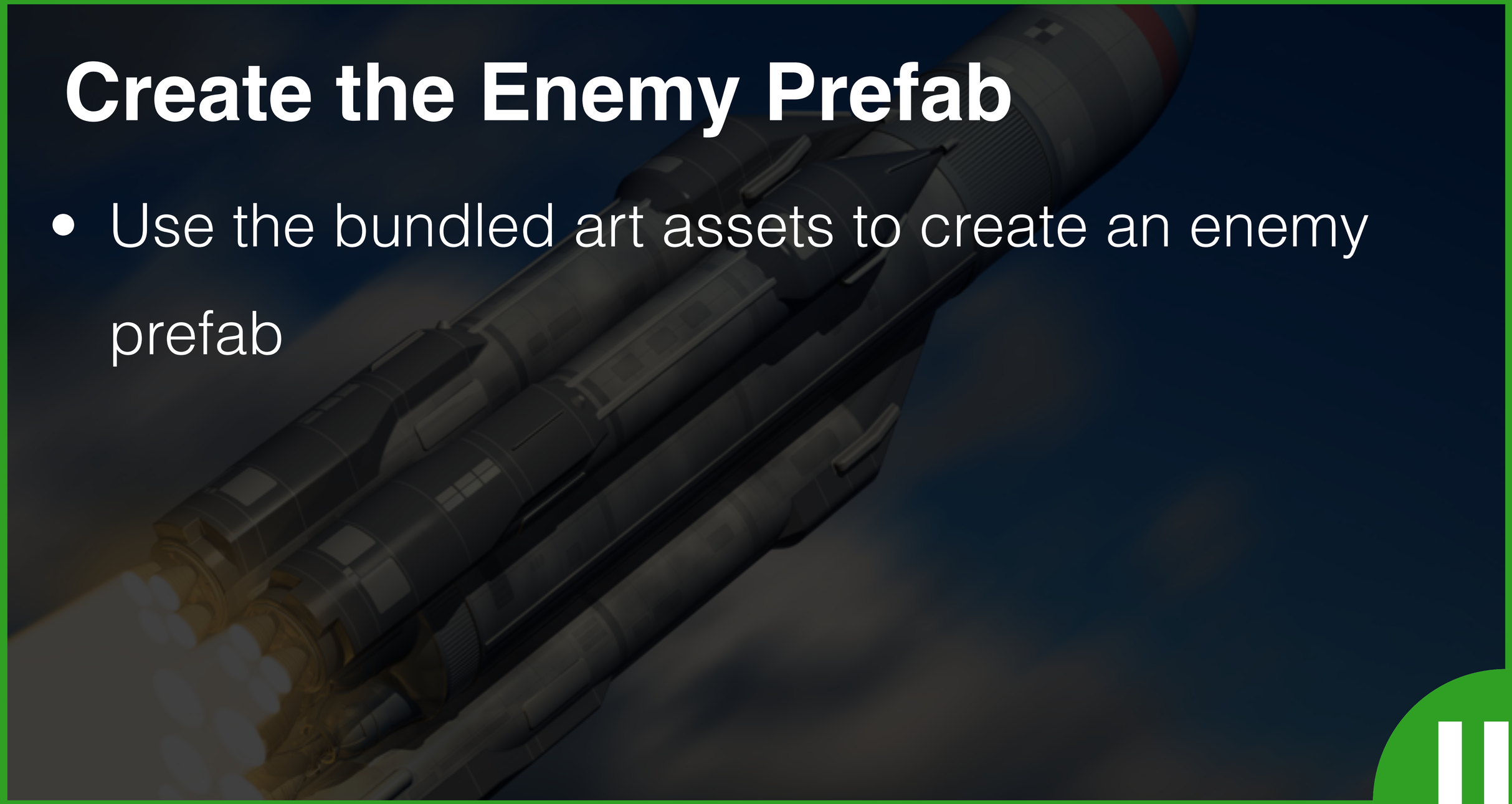
Creating the enemies

Creating the enemies

- Creating the enemy prefab
- Create an EnemySpawner that will generate enemies at runtime
- Make the EnemySpawner generate a single enemy on start

Create the Enemy Prefab

- Use the bundled art assets to create an enemy prefab



Building the spawner I

- Spawner is an empty GameObject with a script attached to it.
- The script has a reference to the Enemy prefab
- The Start Method calls `Instantiate()` to create an enemy

Building the spawner II

- We child the new Enemy to an EnemyFormation
- This keeps our scene hierarchy tidy and helps us find what we want
- The Spawner script will need a reference to that object too.

Creating the enemies

- Creating the enemy prefab
- Create an EnemySpawner that will generate enemies at runtime
- Make the EnemySpawner generate a single enemy on start

Creating Enemy Positions

Creating Enemy Positions

- Create a position within the EnemyFormation
- Use `OnDrawGizmos()` to show the position
- Turn the position into a prefab
- Change the spawning script to keep track of positions

Create the Position

- Child an empty game object to EnemyFormation
- Add a script and use `OnDrawGizmos()` to show the position while editing

Create your formation

- Turn the position into a prefab
- Add several positions from their prefab to the EnemyFormation
- Be creative about the formation

Spawning multiple enemies

- Loop over every child object
- Grab their transform
- Spawn an enemy on top of every position

Creating Enemy Positions

- Create a position within the EnemyFormation
- Use `OnDrawGizmos()` to show the position
- Turn the position into a prefab
- Change the EnemySpawner script to spawn an enemy on every position

Moving the enemy formation

Moving the enemy formation

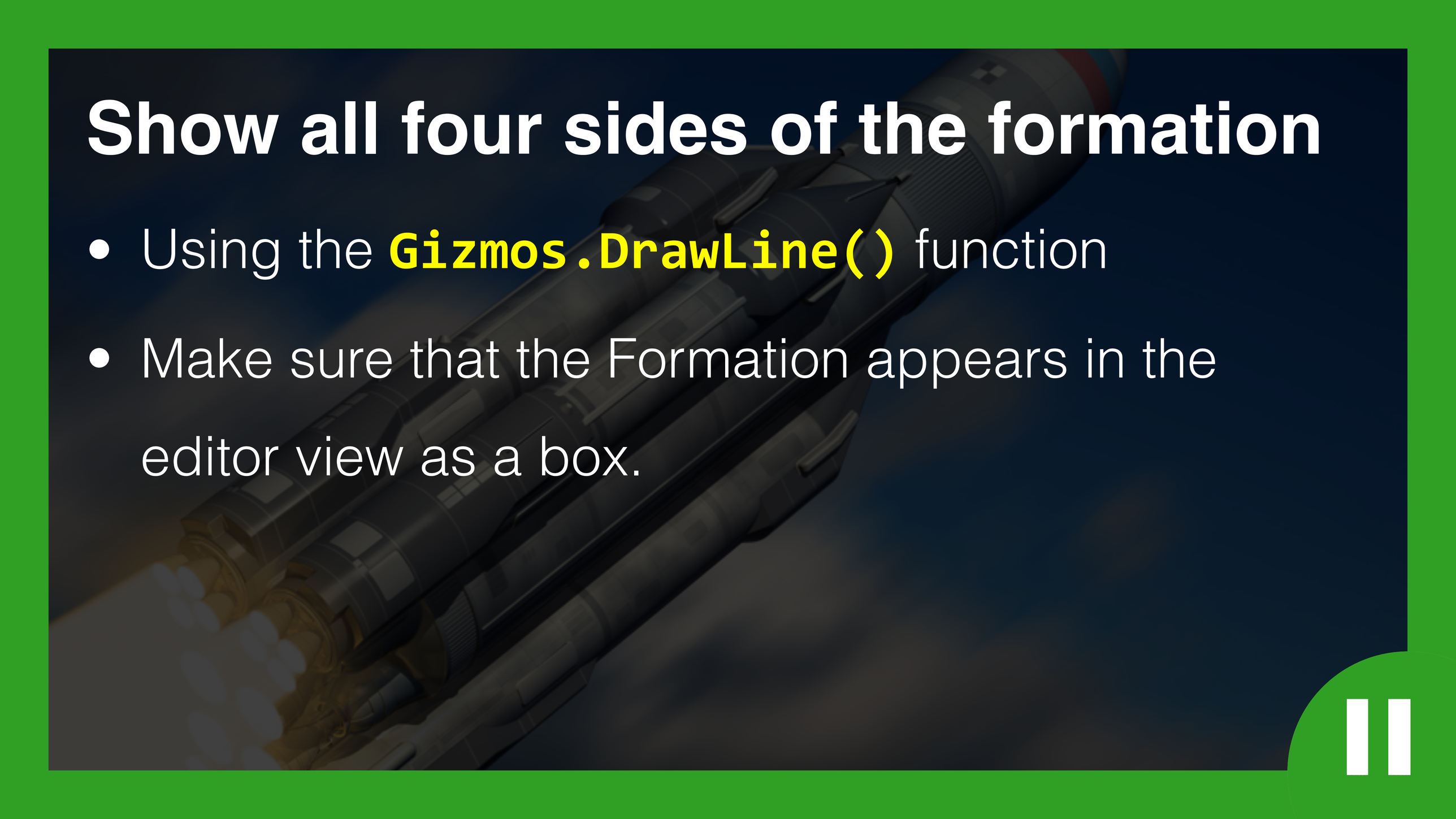
- Add a Gizmo to show the formation while editing
- On the Enemy formation’s update, move it left or right to leave the player no space to hide
- Make sure that the formation doesn’t leave the bounds of the playspace

Showing the Formation in the Editor

- We can use Gizmos again
- We define the width and height of the Formation
- We draw lines around the boundary

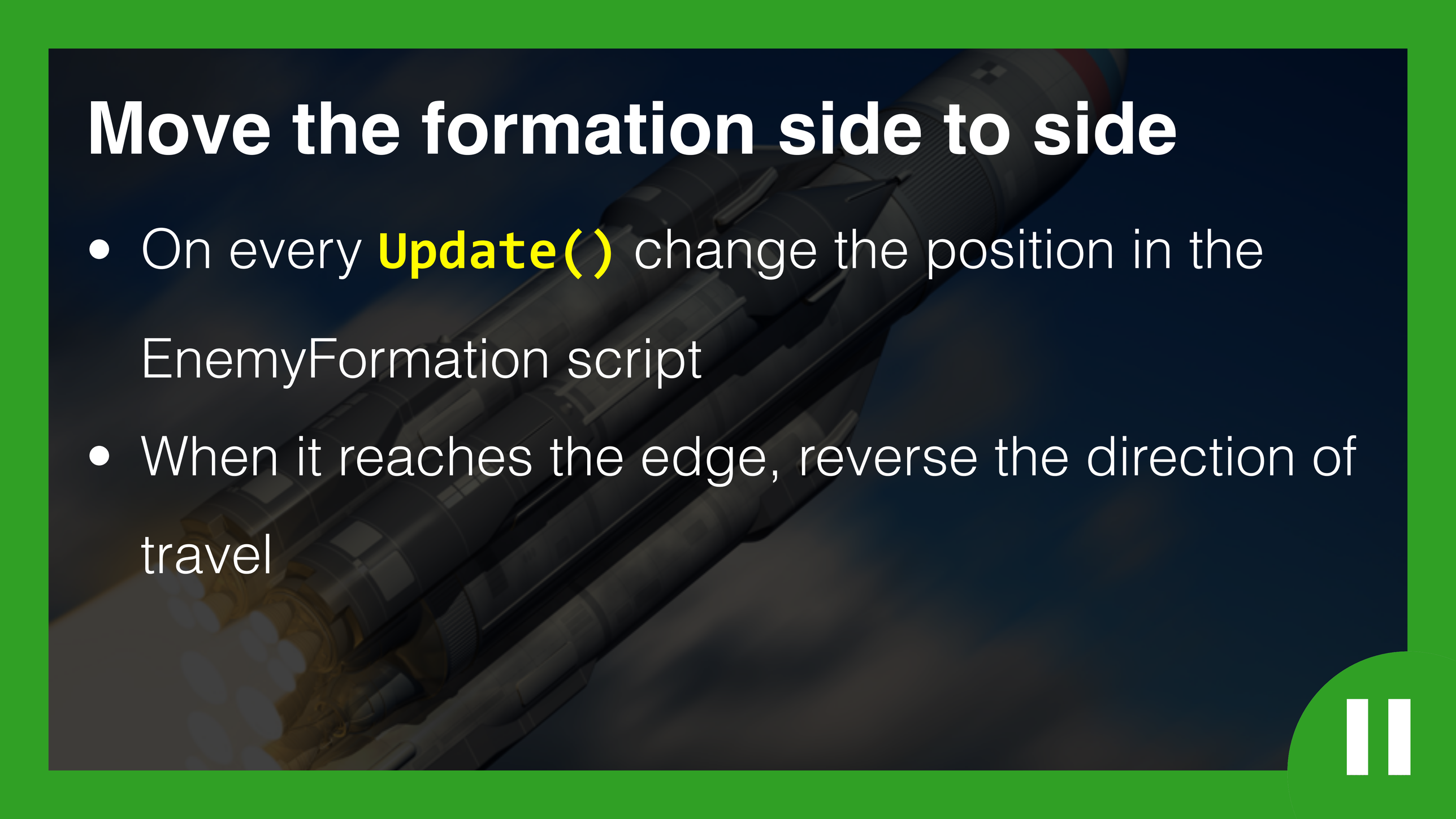
Show all four sides of the formation

- Using the `Gizmos.DrawLine()` function
- Make sure that the Formation appears in the editor view as a box.



Move the formation side to side

- On every `Update()` change the position in the EnemyFormation script
- When it reaches the edge, reverse the direction of travel



Moving the formation

- Use `transform.position` to move the formation
- We use `Time.deltaTime` to ensure the movement is smooth
- We multiply the x value by 1 or -1 to reverse the direction

Moving the enemy formation

- Add **Update()** to the EnemyFormation to move it side to side
- Add a Gizmo to show the formation while editing
- Make sure that the formation doesn’t leave the bounds of the playspace

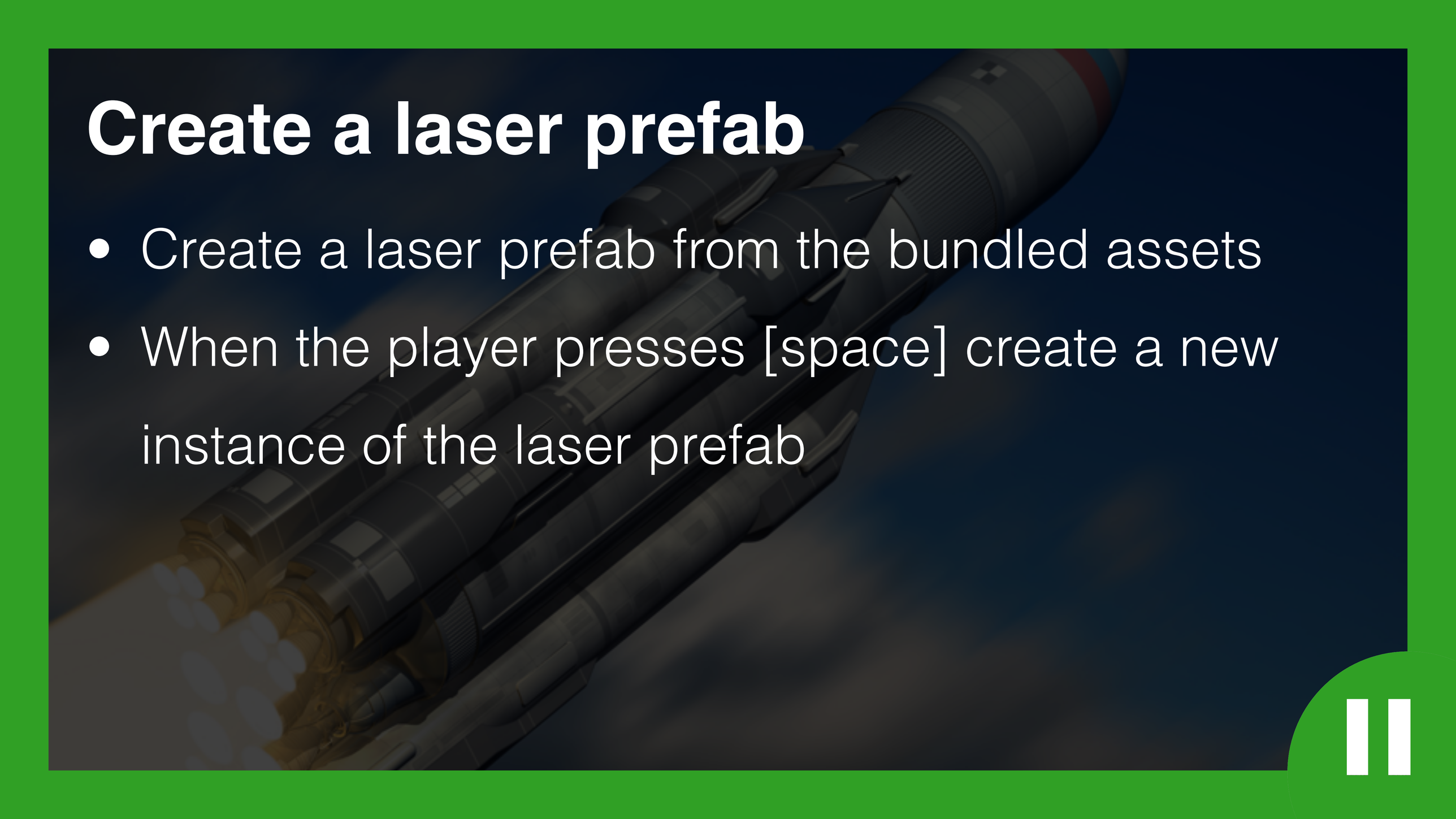
Spawning projectiles

Spawning Projectile

- Player object should spawns laser when [space] is pressed
- Create a laser prefab
- We use `Instantiate()` to create a new one
- We give the projectile velocity

Create a laser prefab

- Create a laser prefab from the bundled assets
- When the player presses [space] create a new instance of the laser prefab



Creating the laser prefab

- Add sprite, create prefab
- Add public field to Player and pass in the prefab
- When the space key is pressed, `Instantiate()` a new laser from its prefab

Making the laser shot move

- Add a Rigidbody2D to the laser prefab
- Fix the angle and remove drag and gravity
- From the player set **`laser.rigidbody.velocity`**
- As a bonus, offset alternative shots to make it look like the ship has two guns

Limiting the firing rate

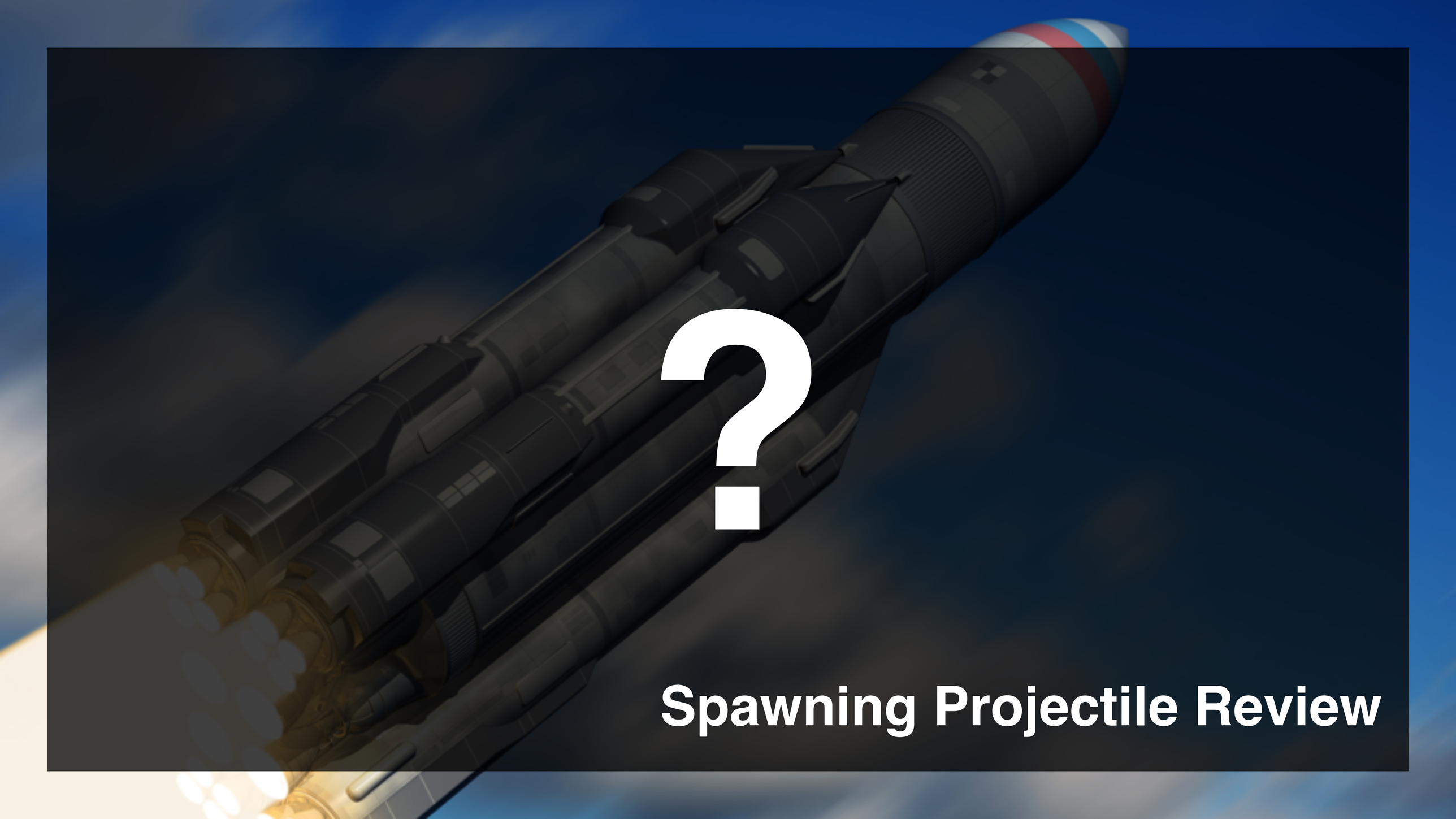
- Use **`GetKeyDown()`** and **`GetKeyUp()`** to call **`InvokeRepeating()`** and **`CancelInvoke()`**
- To avoid multi-shot bug, make sure that the initial delay is greater than 0.0 for **`InvokeRepeating()`**

Destroying the laser shots

- Add a Trigger Collider outside of the playspace
- Attach a Shredder script that destroys all the objects that enter the trigger
- Add a BoxCollider2D to the laser prefab

Spawning Projectile

- Player object should spawns laser when [space] is pressed
- Create a laser prefab
- We use `Instantiate()` to create a new one
- We give the projectile velocity



Spawning Projectile Review

Shooting enemies

Shooting Enemies

- Enemies will respond to the projectile hitting them.
- We use *Kinematic Rigidbody Triggers* for the enemies
- On trigger, enemy takes damage according to projectile component

Defining the projectile behaviour

- Create a **Projectile** script that has a public **damage** field
- Add the script as a component of our lasers

Detect laser collisions

- Log a message when a projectile hits an enemy.
- Bonus points if you can figure out how to log messages **only** when hit with projectiles

Hint: `gameObject.GetComponent<Projectile>()` will return the Projectile component, if it exists

Getting the damage from the lasers

- We use `OnTriggerEnter2D()` to detect collisions
- We check that the thing we bumped into has a Projectile component.
- If it does, we damage ourselves and call the `Hit()` method of the projectile

Shooting Enemies

- Enemies will respond to the projectile hitting them.
- We use *Kinematic Rigidbody Triggers* for the enemies
- On trigger, enemy takes damage according to projectile component

Enemies shooting back

Enemies shooting back

- Enemies will randomly shoot back with a tuneable frequency

Make enemies shoot at the player

- In a similar way to the player shooting, make the enemies shoot at the player
- At first, shoot a projectile on every `Update()` call
- Bonus: Reduce the shooting frequency by using `Time.deltaTime` and `Random.value`
- When projectile hits the player, log out to console

Creating the enemy projectile

- Identical to player prefab
- Check that projectile has Rigidbody2D and Collider
- Also includes the Projectile script

Getting hit by the enemy

- Player will need a *Kinematic Rigidbody Trigger* and an **`OnTriggerEnter2D()`** method
- Still good idea to check for a Projectile component

Tuning the Frequency

- We calculate the probability of firing in a given frame and fire if appropriate
- Probability of firing depends on how long has elapsed and the intended frequency.

p(fire this frame) = time elapsed x frequency

- Use **Random.value** to fire given a probability

Enemies shooting back

- Enemies will randomly shoot back with a tuneable frequency

Controlling Collisions Using Layers

Controlling Collisions Using Layers

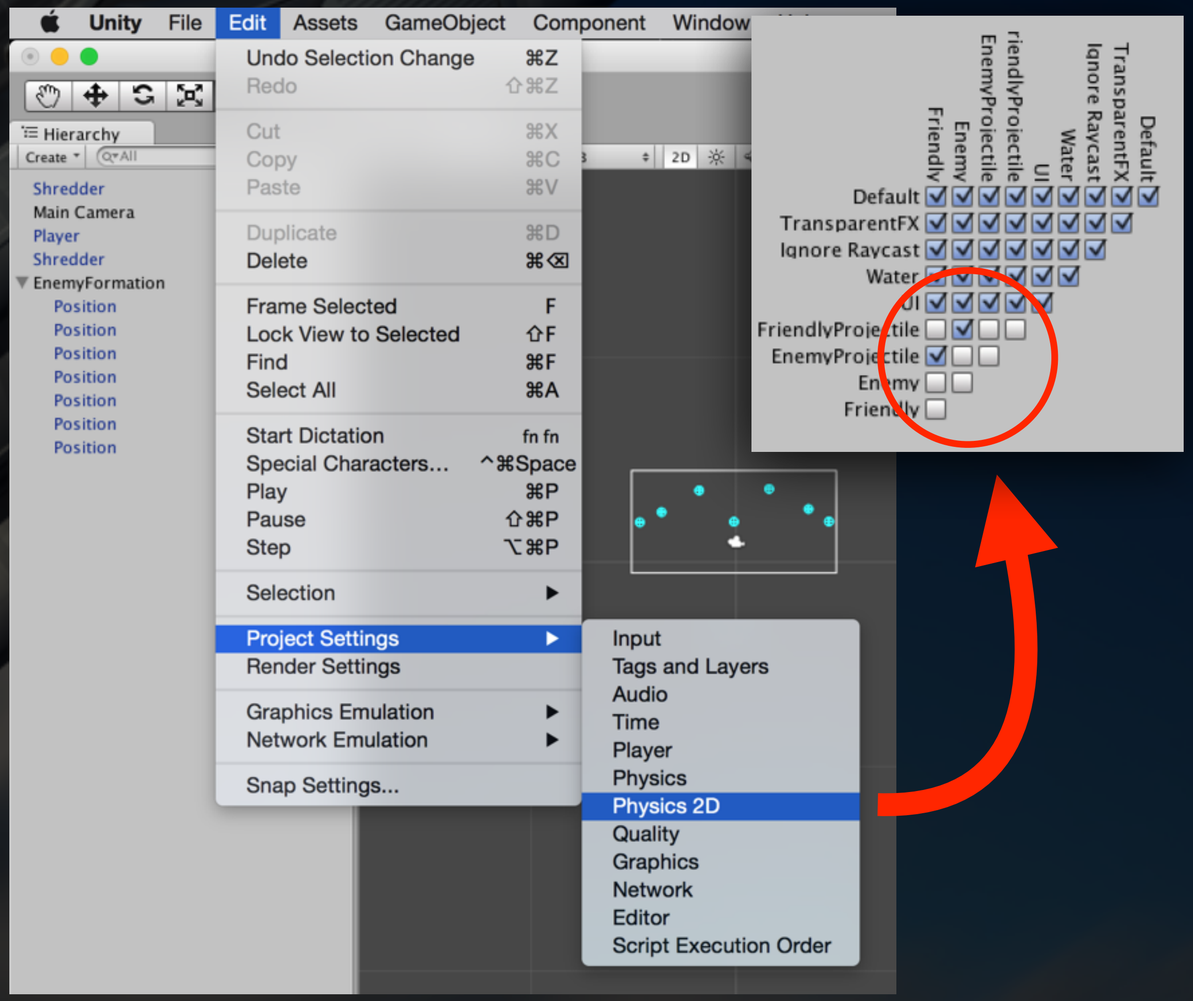
- Player shoots itself when firing!
- Lasers hit each other!
- We need the player's projectile not to collide with itself or the player
- We need the enemy projectiles to not collide with enemies or each other

Create and setup the layers

- Create the Enemies, Friendlies, EnemyProjectiles and FriendlyProjectiles layer
- Add the appropriate objects to them

Using layers to stop projectiles colliding

- Tag enemy projectiles prefab with ‘EnemyProjectile’ tag in inspector
- Set the FriendlyProjectile, Friendly and Enemy tags appropriately
- Go to **Edit > Project Settings > Physics 2D** and uncheck the collision box between things that shouldn’t collide




Detecting enemies have been destroyed

Detecting enemies have been destroyed

- We need to know when all enemies are dead
- We use the childCount property of a transform on the positions - an empty position is a dead enemy
- We re-spawn the enemies when that happens

Using `Transform.childCount`

- This lets us know if the enemy ship is still here
- Need to loop over every positions
- Keep logic in `AllMembersAreDead()` method

Re-spawn enemies

- When all enemies are dead, respawn a fresh batch of enemies.
- Extract the spawning code from the Start() method
- Don’t duplicate but call a new method instead

Re-spawning enemies

- Create new method **`PositionAvailable()`**
- Spawn enemies using **`Invoke()`** until false
- Enables a slight spawn delay between enemies for effect

Detecting enemies have been destroyed

- We need to know when all enemies are dead
- We use the childCount property of a transform on the positions - an empty position is a dead enemy
- We re-spawn the enemies when that happens

Understanding Transform Relationships

Position animation for a new enemy

Position Animation for a new enemy

- Enemies should animate in, rather than appear
- Create an Animator and Animation Controller
- Create states to represent arriving and flying
- Add the appropriate animation

Explore the animation package

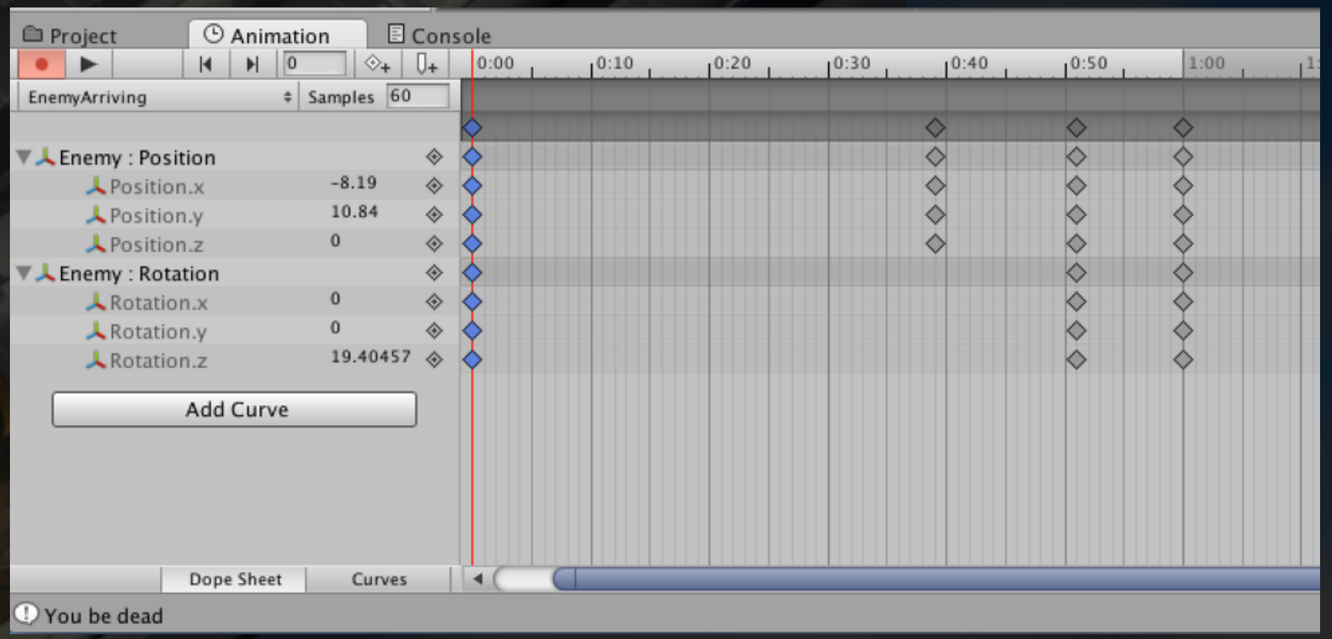
- See if you can make your own unique animation for the incoming enemy
- Why don’t you explore the other options for curves in the animator?

An introduction to Mecanim

- For the Enemy prefab, got to the **Inspector > Add Component** then search for **Animator**
- In the Animator, create states by right clicking in the workspace and selecting **New State > Empty**
- Create transitions between states by right-clicking a state and selecting **Make Transition**

Creating an animation

- Drag and drop an enemy into the scene
- **Window > Animator** to show the animation tool



Add the animation to a state

- Add your newly created EnemyArriving animation to the Arriving state in the inspector when in the animator tool
- Right click and select the EnemyArriving state as default.

Congrats, your enemies are animating

- Try to tweak the animation to be a little smoother
- See if you can create an idle or formation animation

Creating a starfield

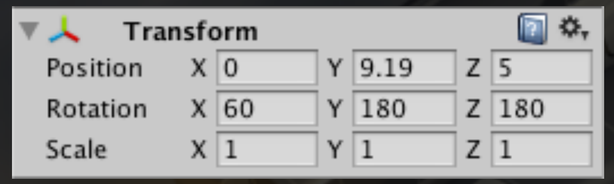
Creating a Starfield

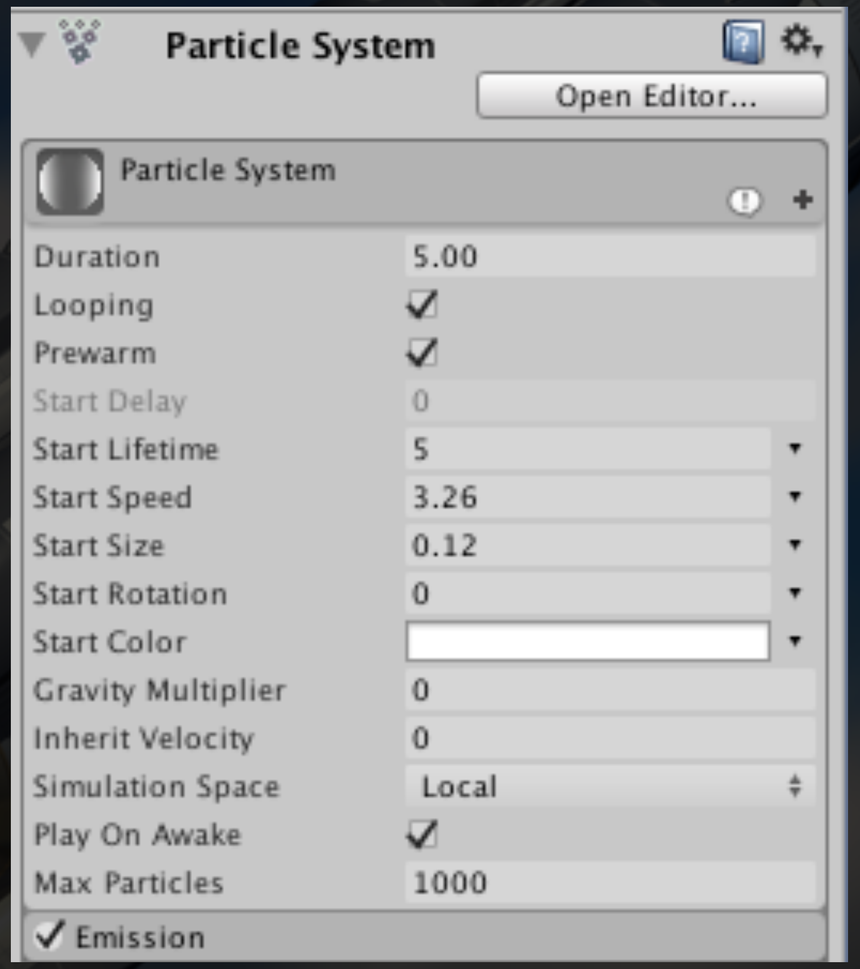
- The background looks a little barren
- Let’s add a starfield with parallax effect to give some sense of depth
- We can use a Particle System to do this.

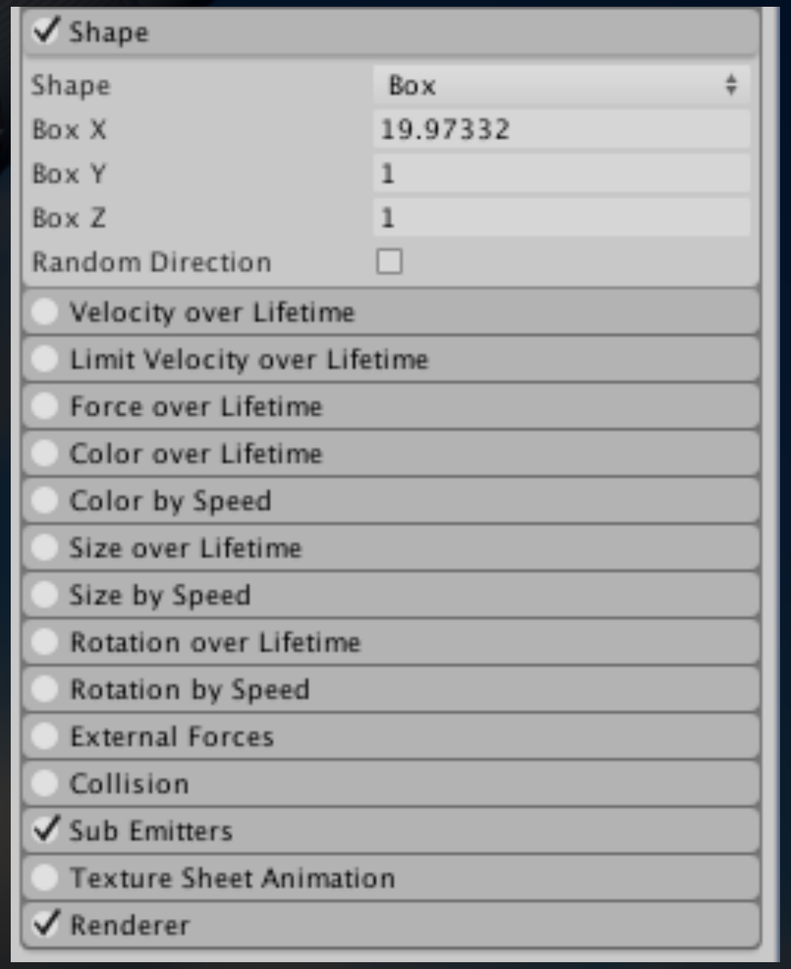
Adding our first particle effect

- Create a new Particle System Object in the hierarchy
- Position it so that the particles are moving down and towards the camera
- Tune the lifetime and size of the particles to make the effect look like stars

First Particle System Settings







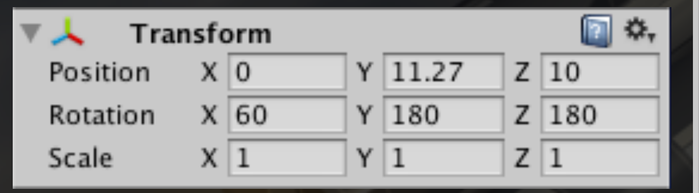
Explore Particle Effects

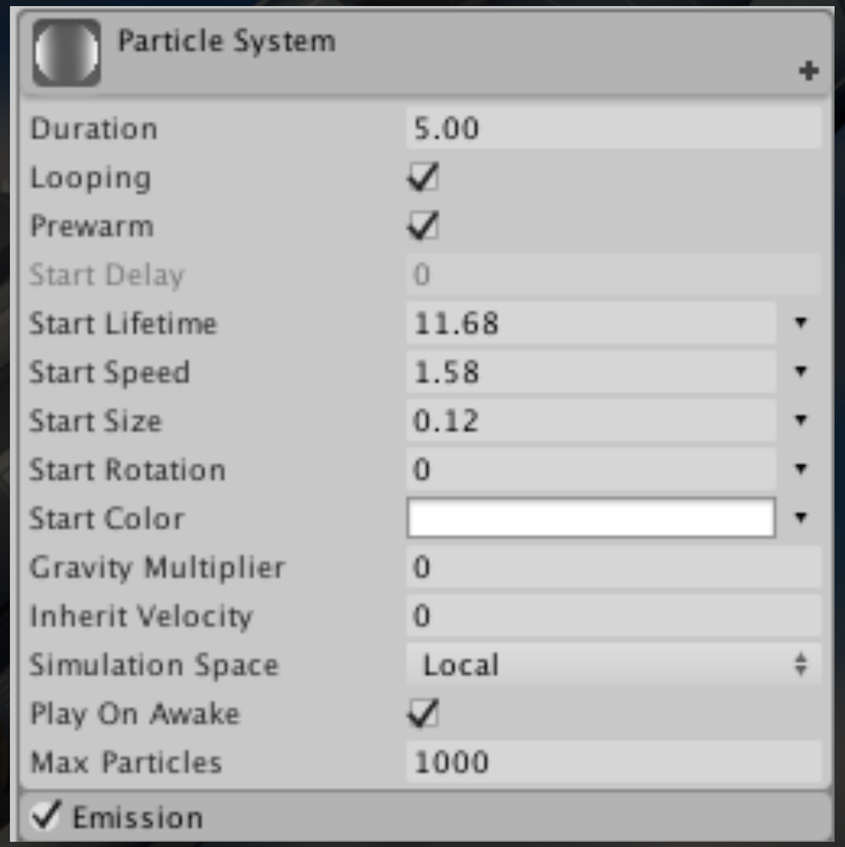
- Explore the various options of a particle effect
- See if you can create a smoke signal
- See if you can create a plasma torch
- See if you can create a thruster effect
- Combine with animation for awesomeness!

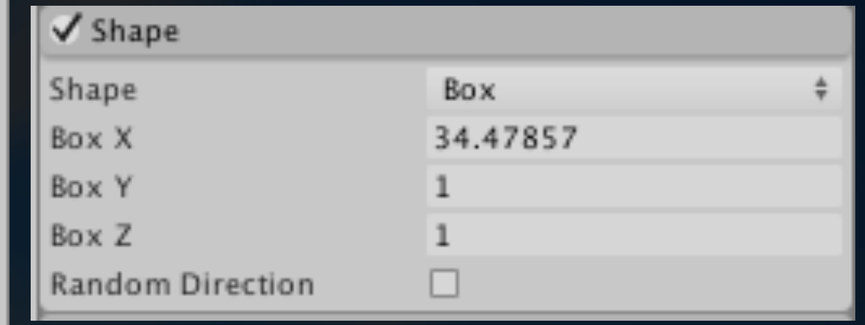
Parallax?

- As you move, objects in the distance seem to move less than those nearby
- Good technique to give a sense of depth artificially, even in 2D
- Relative speed of objects is important

Second Particle System Settings

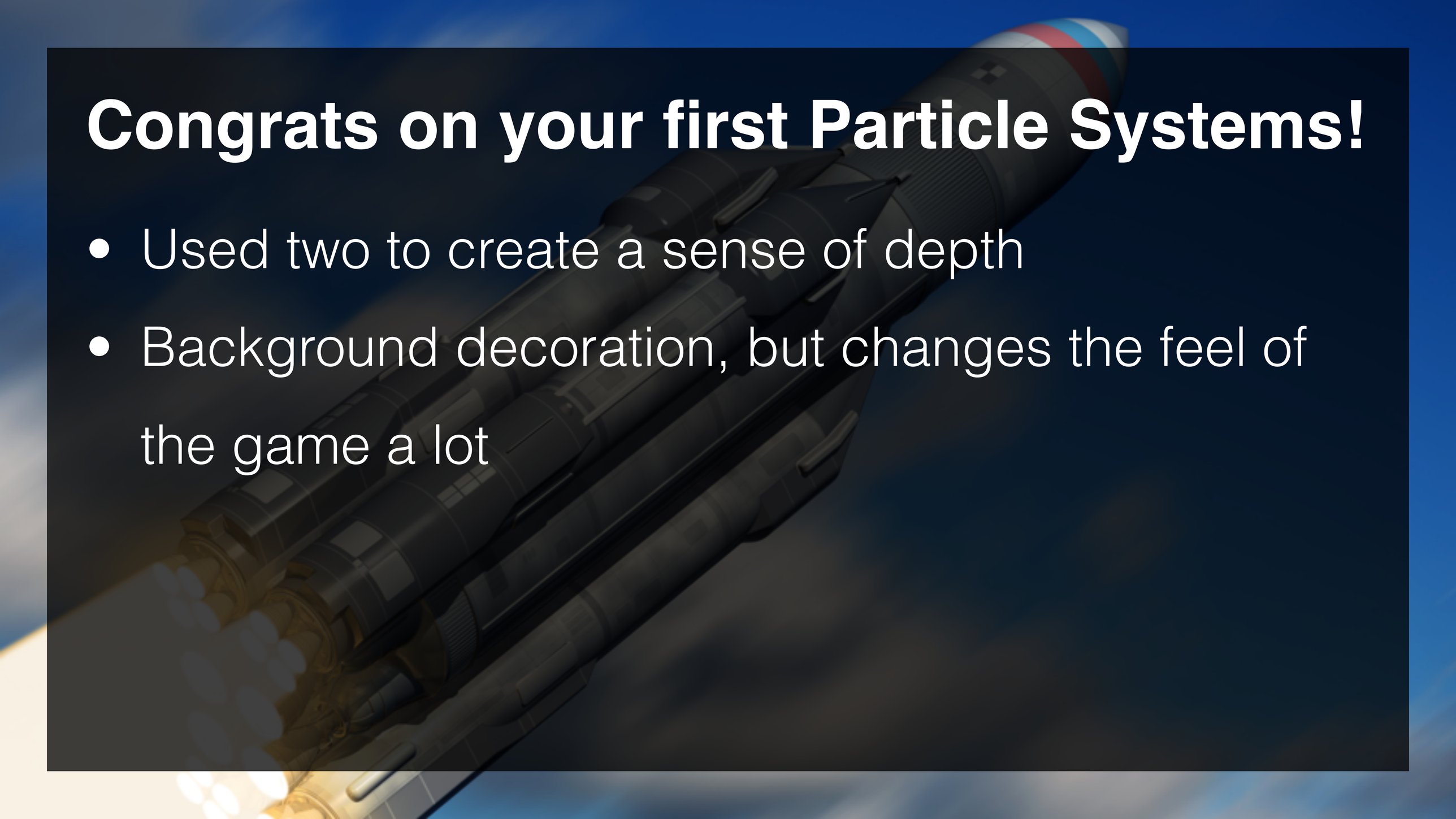






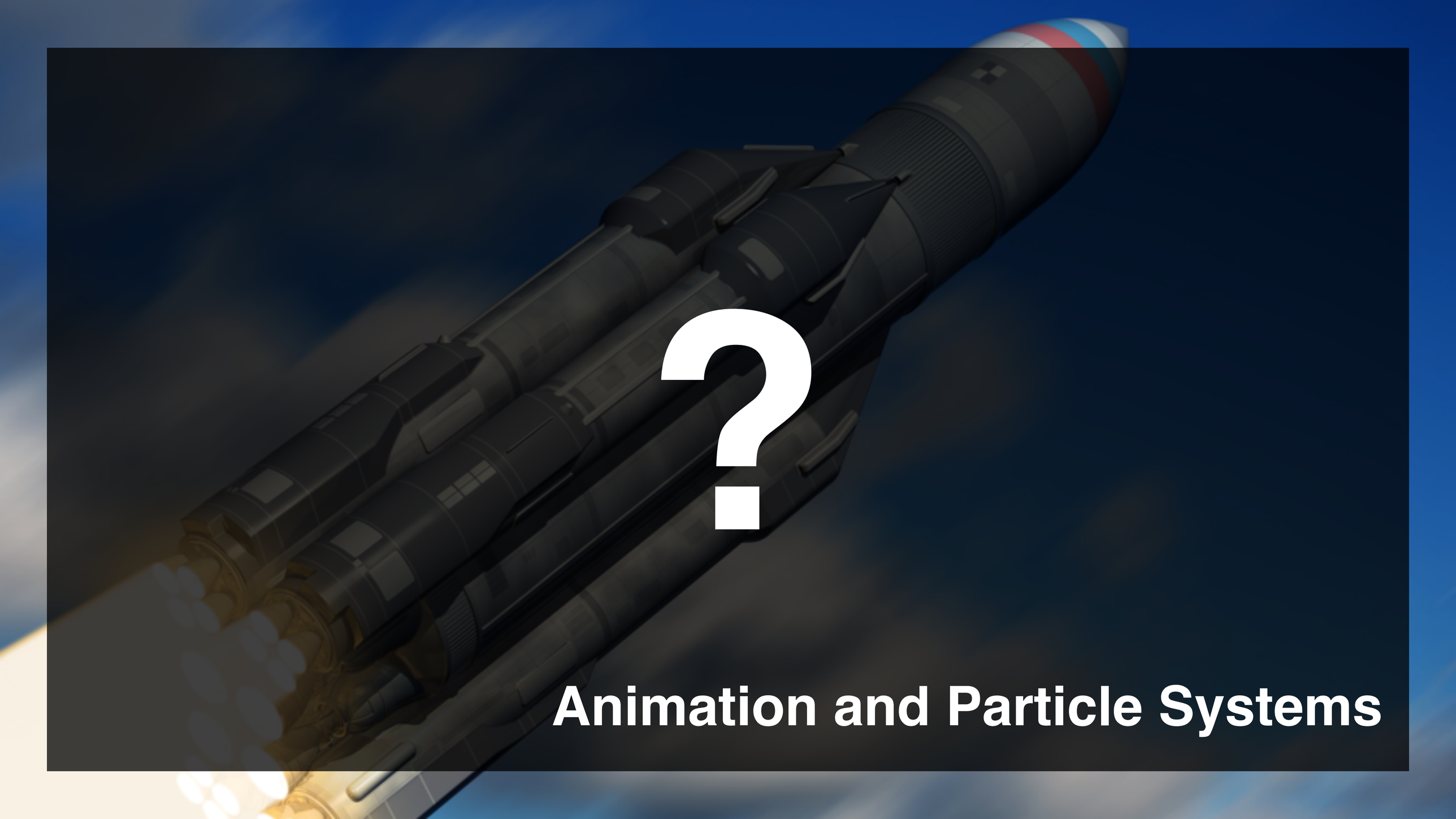
Play Tune Till Awesomeness

- Play around with the shape and properties of your particle system until it looks great



Congrats on your first Particle Systems!

- Used two to create a sense of depth
- Background decoration, but changes the feel of the game a lot



Animation and Particle Systems

Keeping Score

Keeping score

- Requires Some object to keep track of the scores
- We'll create a ScoreKeeper that we attach to the score
- When an Enemy dies, we'll call the ScoreKeeper

The ScoreKeeper

- Will track scores and update the UI (for now)
- Attached to the score Text UI element
- We can use the `GameObject.Find()` function to get the Score game Object and the `GetComponent()` method to get the ScoreKeeper from the EnemyController

Create the UI for the score

- Create a Score text visible to the player that will keep track of the score
- Make sure that it renders at the right place for the target resolution

Creating a Score UI

- Create a UI Canvas
- Add a text element
- Style it and use a font from http://dafont.com
- Make sure it renders at the right place by selecting the right anchor and placement

Create the ScoreKeeper Script

- Should be attached to the Score text
- Has two methods: `Score(int points)` and `Reset()`
- Will change the score Text whenever the score is updated.

The ScoreKeeper Script

- Attached to the Score UI
- We need to call it when the enemies die
- `GameObject.Find("Score").GetComponent<ScoreKeeper>()` can be used to recover the ScoreKeeper
- Add a public field in our enemy script to keep the value in points of an enemy
- Send the value from our enemies to our ScoreKeeper

Congrats, we’re now Keeping score

- Created an Object to keep the score
- Attached it to our UI element
- When an Enemy dies, we call it and send our points to the ScoreKeeper

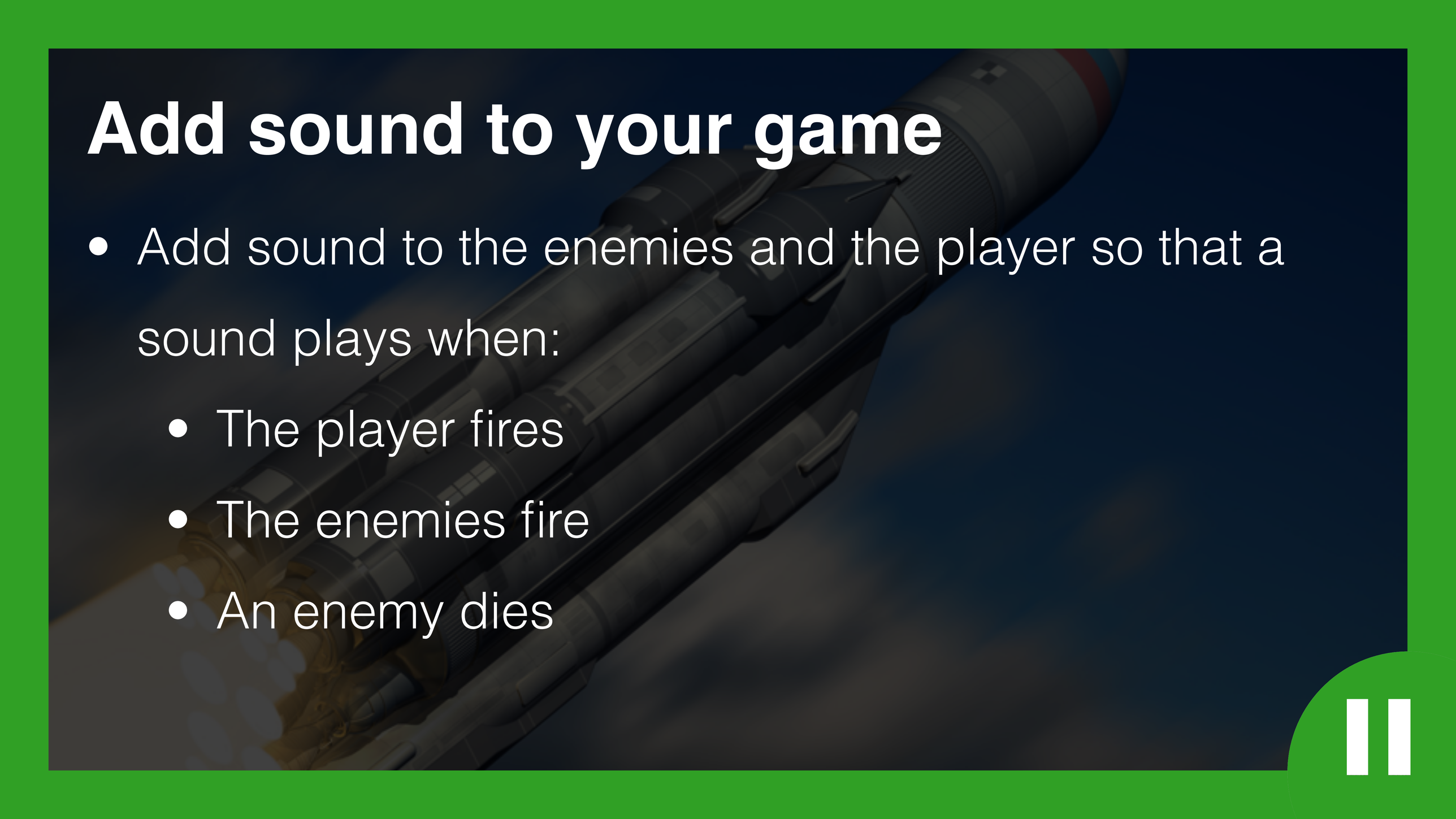
Sound effects for fun and profit

Sound Effects for fun and profit

- Will make a huge difference to our game
- Easy enough to do
- We'll look at playing sounds independently of an object, so that we can play a death sound for the enemies

Add sound to your game

- Add sound to the enemies and the player so that a sound plays when:
  - The player fires
  - The enemies fire
  - An enemy dies



Adding sound to the game

- Modify scripts to plays sounds using `AudioSource.PlayClipAtPoint()`
- Add sound assets to unity
- Connect clips to scripts
- We now have sound!

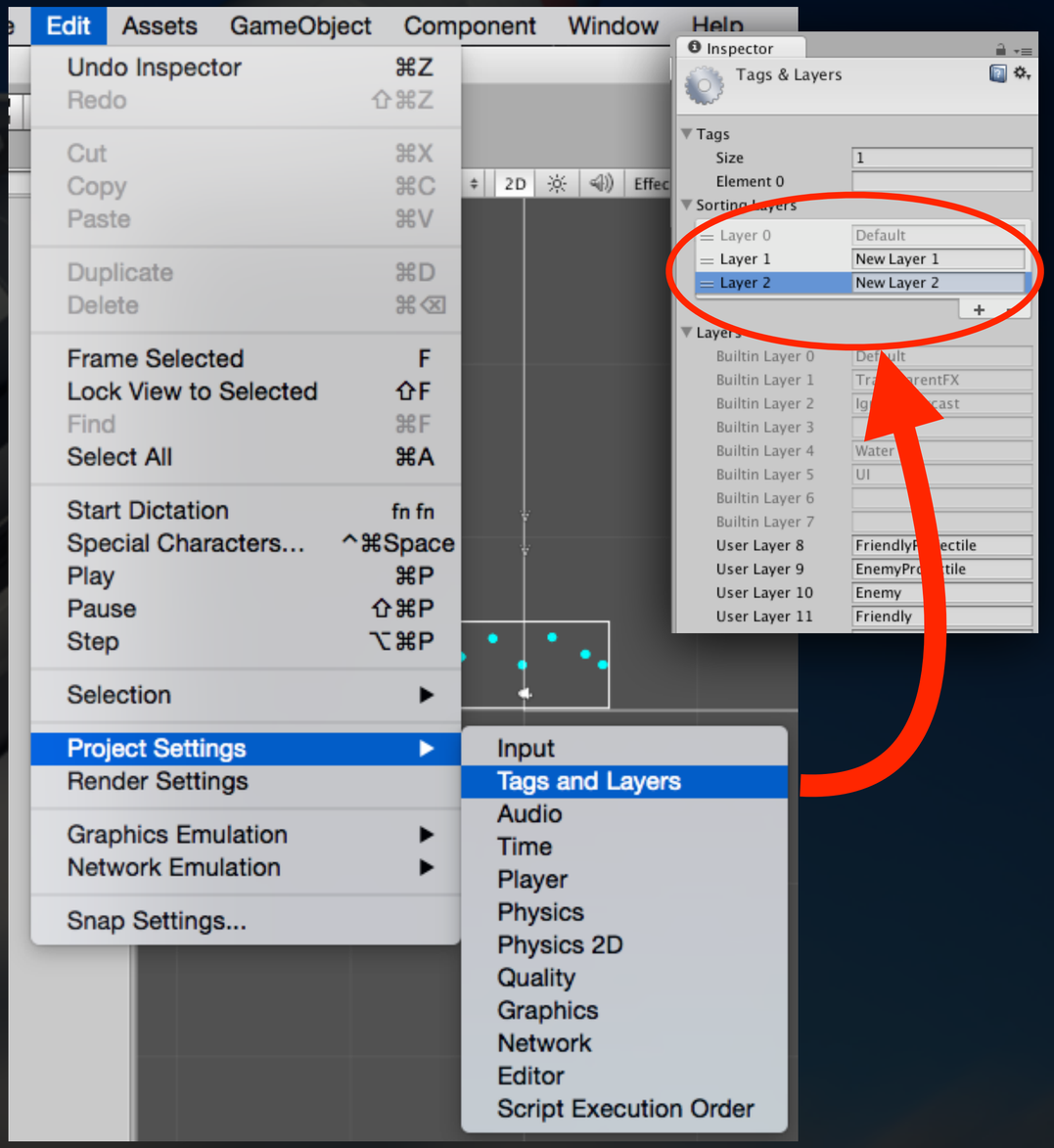
Sprites rendering order

Sprite Rendering Order

- Changes which sprites are drawn on top
- Lets missiles from the player be drawn below the ship when instantiated
- Not affected by z position

Sprites rendering

- Could be controlled with distance from camera
- Powerful and flexible to control with layers
- We use layers to make our game look better by drawing projectiles below their guns

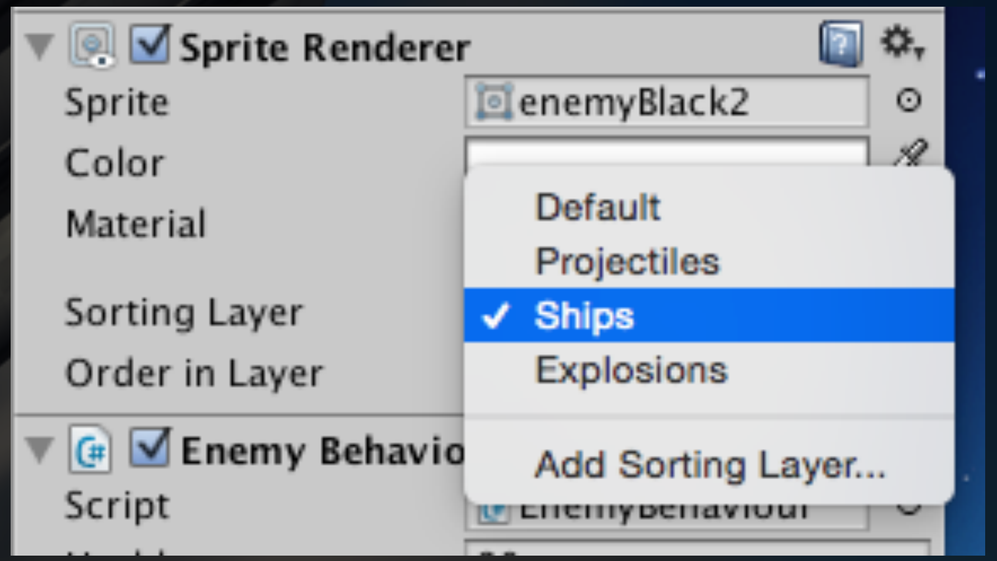


Create Appropriate Sorting Layers

- So that:
  - Player Projectiles render below the Player
  - Enemy Projectiles render below the Enemies
  - Player Projectiles render above the Enemies
- Make sure you change the Sprite Renderers to have the right sorting layers.

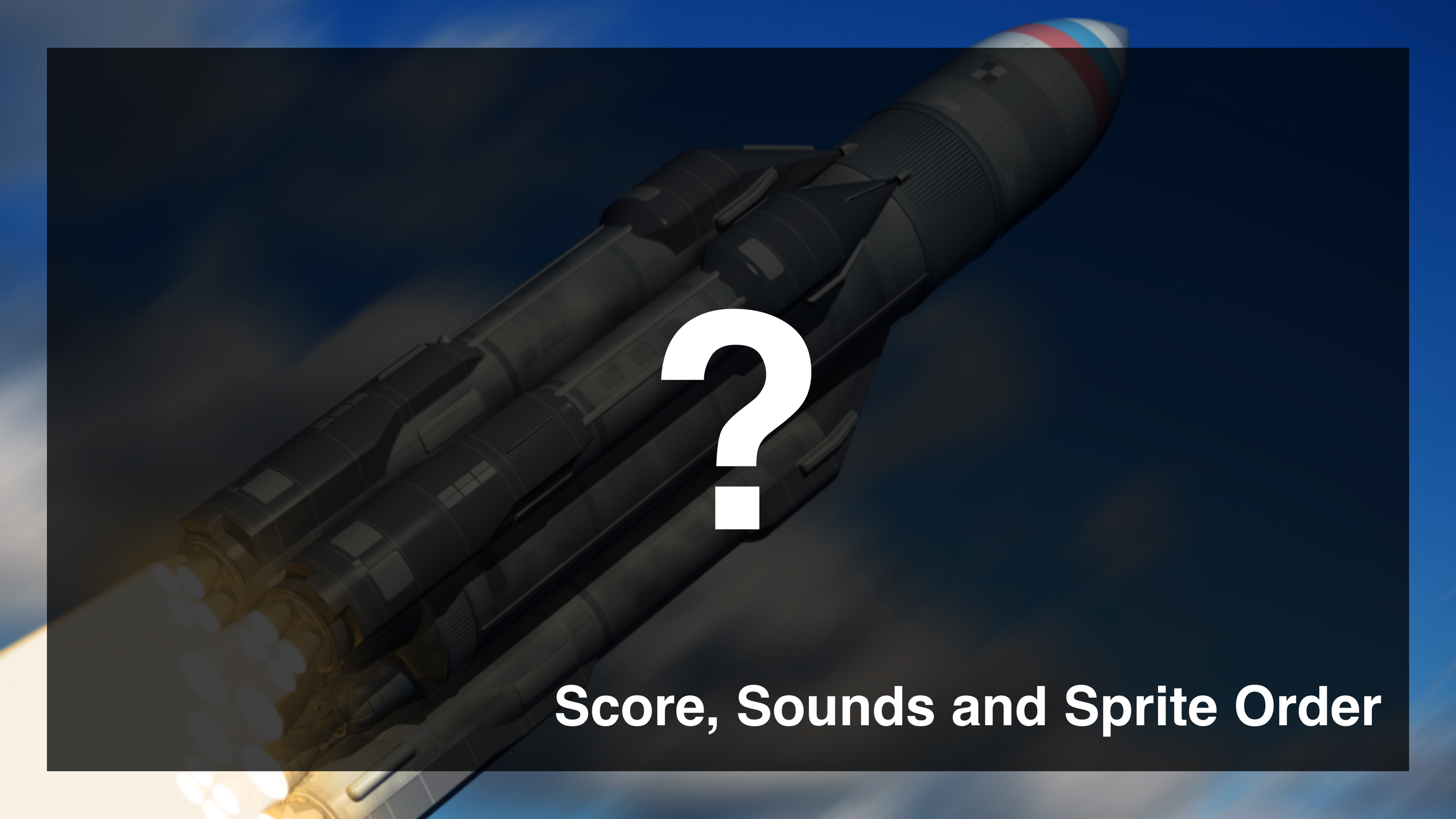
Change the Render layer for a Sprite

- The Sorting Layer for a sprite can be changed in the inspector



Laser Defender, now with layers

- We changed the way sprites were rendered by using sorting layers
- Lets us draw sprites on top of each other independently of distance from camera
- Completely **separate an independent** from normal Layers, which are used for physics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Score, Sounds and Sprite Order

Polishing the menu system I

Polishing the menu system I

- Replacing the menu style
- Passing the score to the ends

Change the style of the menu system

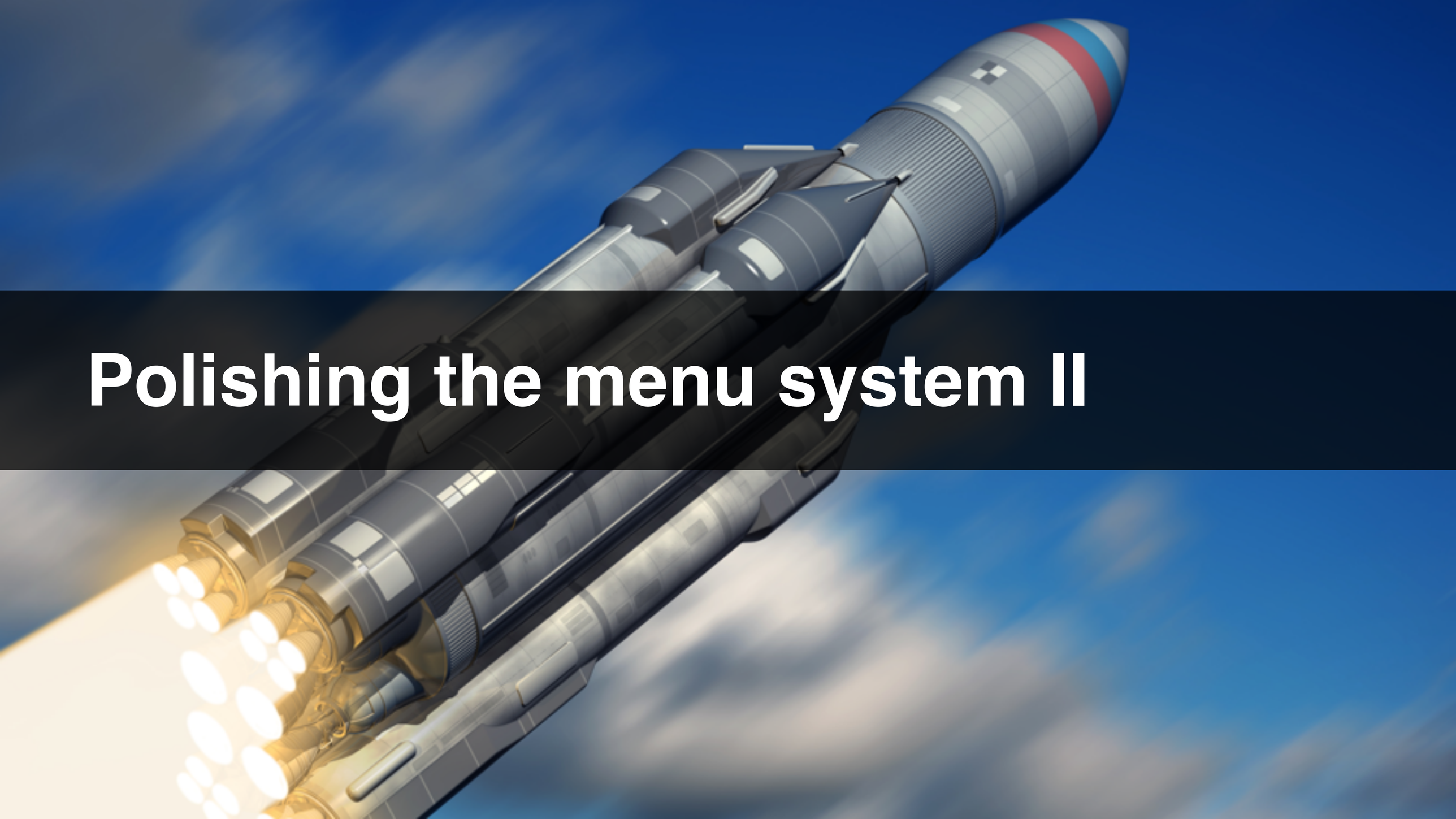
- Use a custom Font & colours
- Make sure to change the hover colours to match

Pass the score to the final scene

- Change the ScoreKeeper to static methods.
- Display the score in the end Scene.
- Make sure we call **ScoreKeeper.Reset()**

Polishing the menu system I

- Replacing the menu style
- Passing the score to the end scene



Polishing the menu system II

Polishing the menu system II

- Adding our own music to the game
- Adding a background starfield

Adding atmospheric music

- Found on http://opengameart.org
- We use Clearside's (http://clearsidemusic.com)

  music: http://opengameart.org/users/clearside

  licensed under Creative Commons

Changing the music on scene load

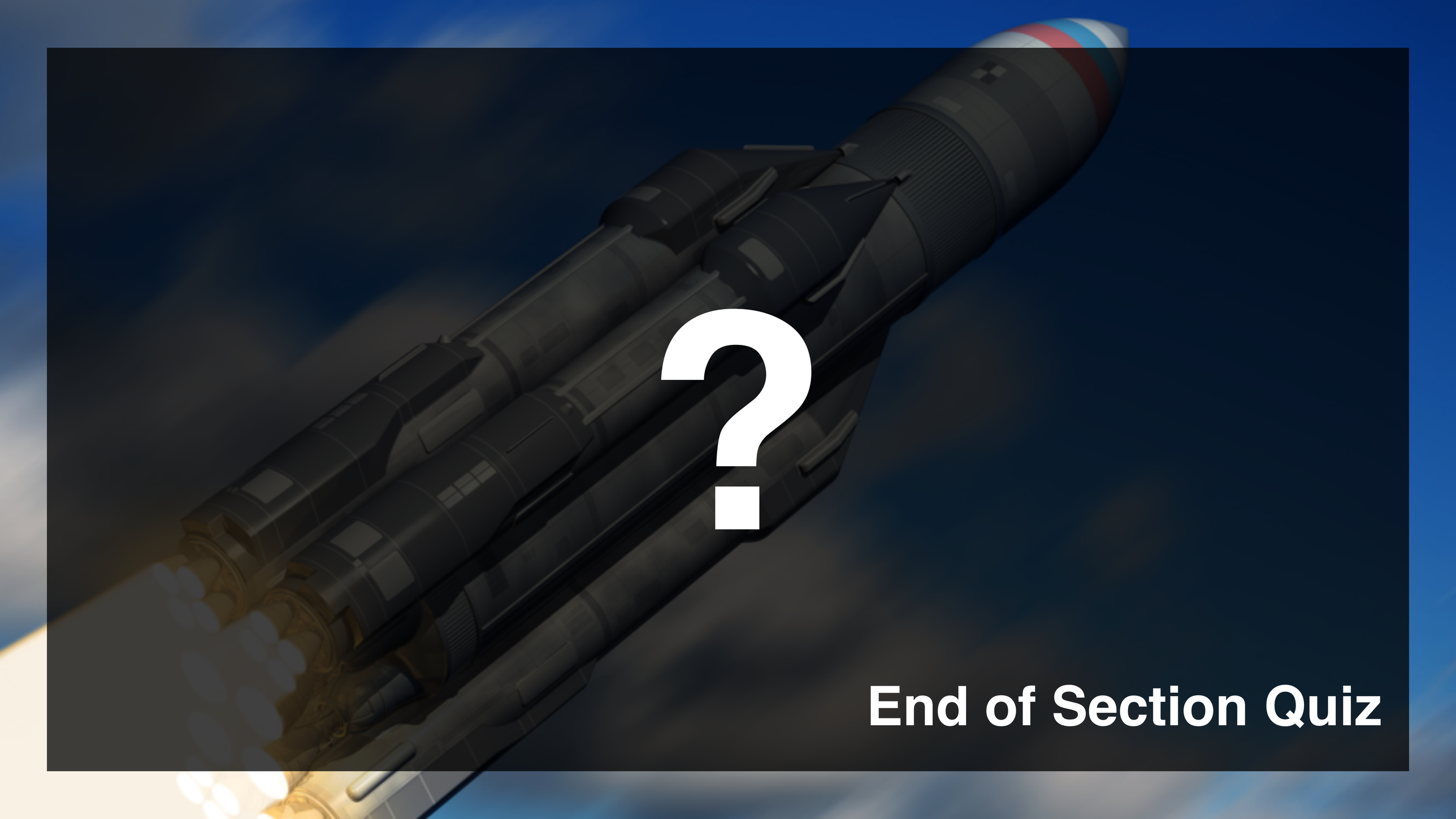
- Want different music on menu and scene
- Add music to music player, then use `OnLevelWasLoaded()` to check when it's appropriate to play which music track

Add a starfield effect to the menu

- Use Particle Systems to give the impression the player is flying through space in the main menu
- Quick and easy option is to copy the Particle System from the Game scene

Menu System Ready to go Chief!

- We now have a musical menu :)
- We’re showing off some particle effects as soon as the game is loaded
- Nice priming for the game itself



End of Section Quiz

Improving the player animation

Improving the player animation

- Use triggers for the animator
- Give player visual feedback on their key presses
- Create a better Idle animation

improving the enemy animations

Improving the enemy animations

- Enemies in formation should not be static
- Add firing animation to warn the player
- Enable thrusters when arriving
- Disable firing until in formation
- Add an animation to the formation to make it more exciting

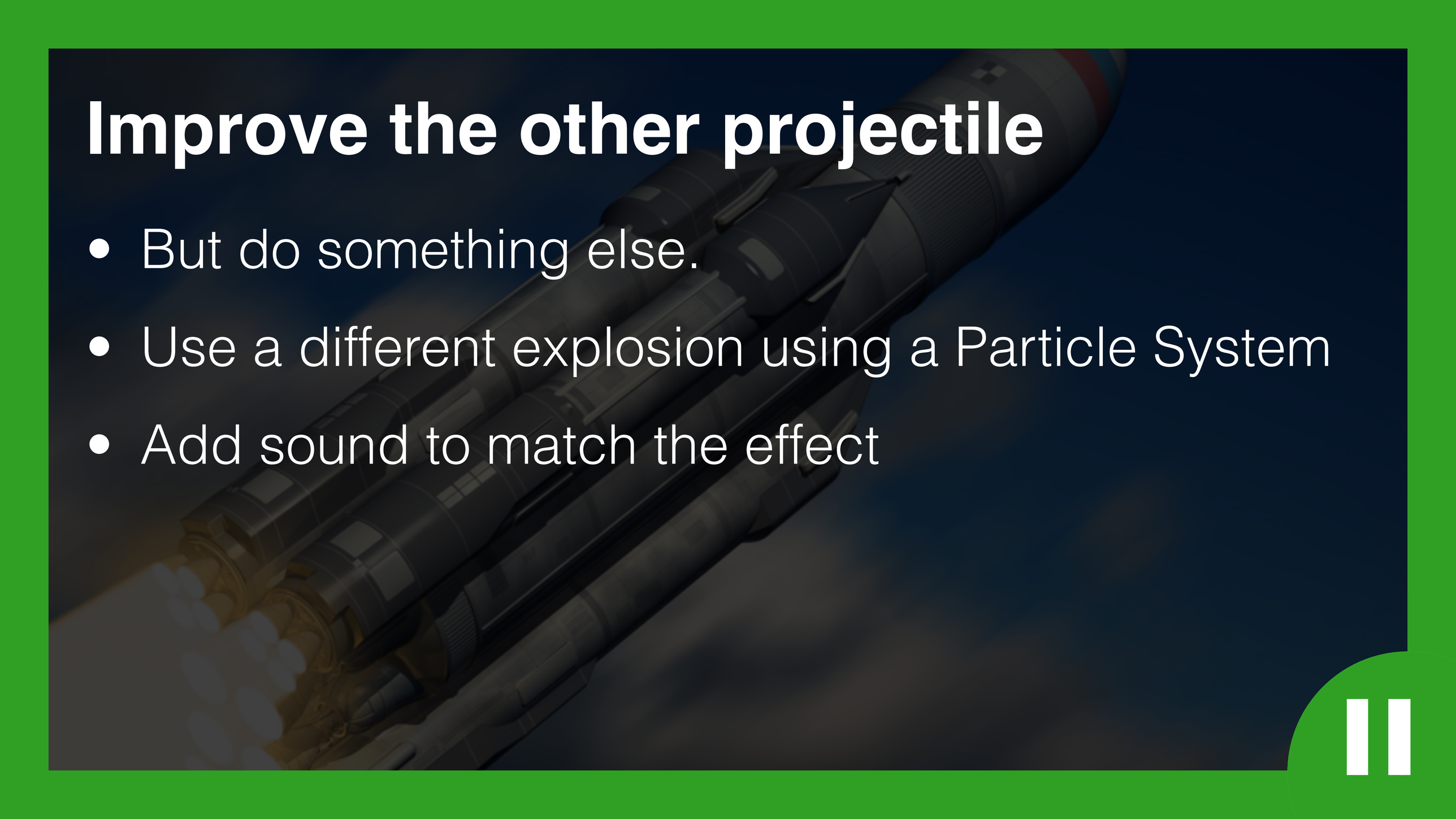
Improving the projectile animations

Improving the projectile animations

- Explosions agains ships look nicer
- Create an explosion prefab and instantiate before projectile death
- Add to right layer so it renders above ships

Improve the other projectile

- But do something else.
- Use a different explosion using a Particle System
- Add sound to match the effect

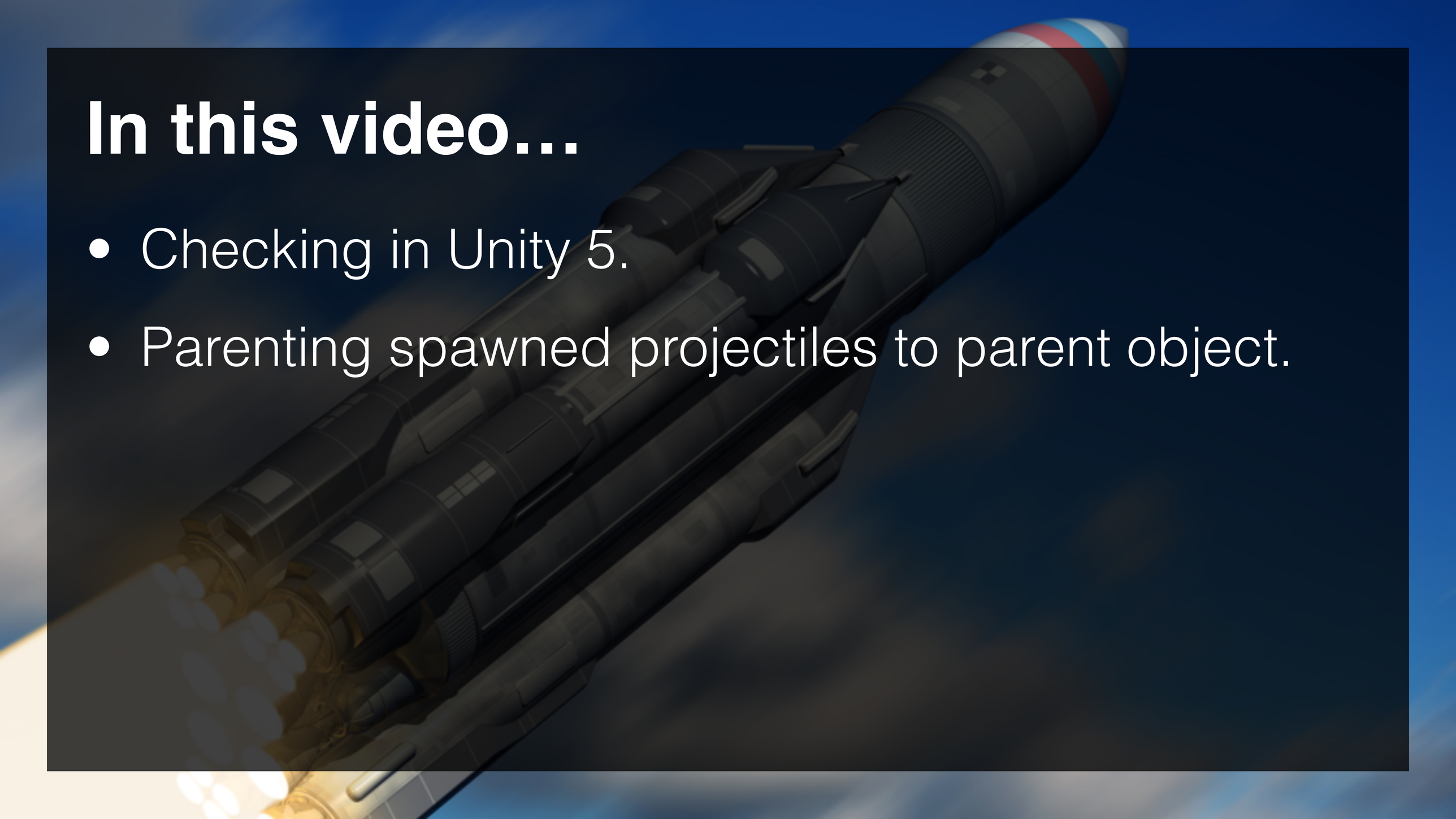



Make it yours and share

Make it yours and Share

- Make it yours!
- Add different enemy types
- We use a fraction of the sprites bundled - Use more
- Add asteroids that hurt enemies and player alike
- Let the player take a few hits and change the sprite to show the damage, ditto for enemies
- Add loot drop from dead enemies - Health pickups?

Unity 5 & Tweaks



In this video…

- Checking in Unity 5.
- Parenting spawned projectiles to parent object.

Recap & What's Next

Recap & What's Next

- New in your toolkit
  - Trigger Colliders
  - Sprite Animations
  - Particle Systems
  - Physics Layers
  - Sorting Layers