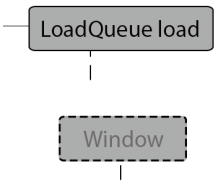
Design Document

Revised: 5 April 2017

Introduction

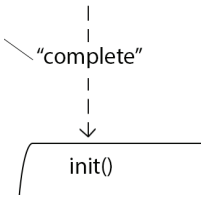
This document contains a series of diagrams illustrating game flow for Rocket Lander!. Rocket Lander! is a JavaScript game that utilizes the CreateJS library. The game code is made up of objects, functions, and events. Each component type is represented graphically.

- Objects are greyed squares. Solid line and black text represent the initialization of the object. Dashed line and greyed text represent a reference to the existing object.



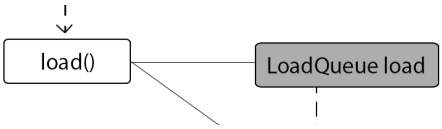
- Functions are white squares. Functions can contain properties, nested functions, or function calls.

- Event names are given in “quotation marks”.



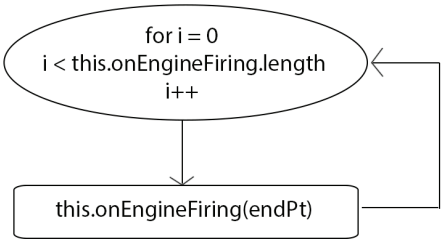
- Dashed lines represent the relationship between an object and a function called in the case of an event. (i.e. “complete” event triggers init())

- Solid lines represent a relationship between components.

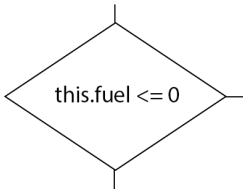


For example, the load() function initializes the LoadQueue queue object, and sets up the function init() to trigger when the LoadQueue event “complete” occurs.

- Oval shapes represent loop statements.



- Diamond shapes represent decision statements.



- Circles with numerical values are considered keys, and lead to a separate diagram that provides more information for the keyed item. Numerical values correpond to the page numbers listed on the lower righthand pages of this document.

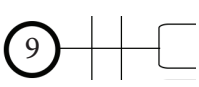


Diagram 1: Game Loading

The game's load() function is triggered by the "onload" event of the HTML <body> Element. It initializes a LoadQueue object, which loads all images needed for the game.

Upon completion of this loading, init() function is called. This function initializes all of the global game objects, sets the user controls, and starts the game.

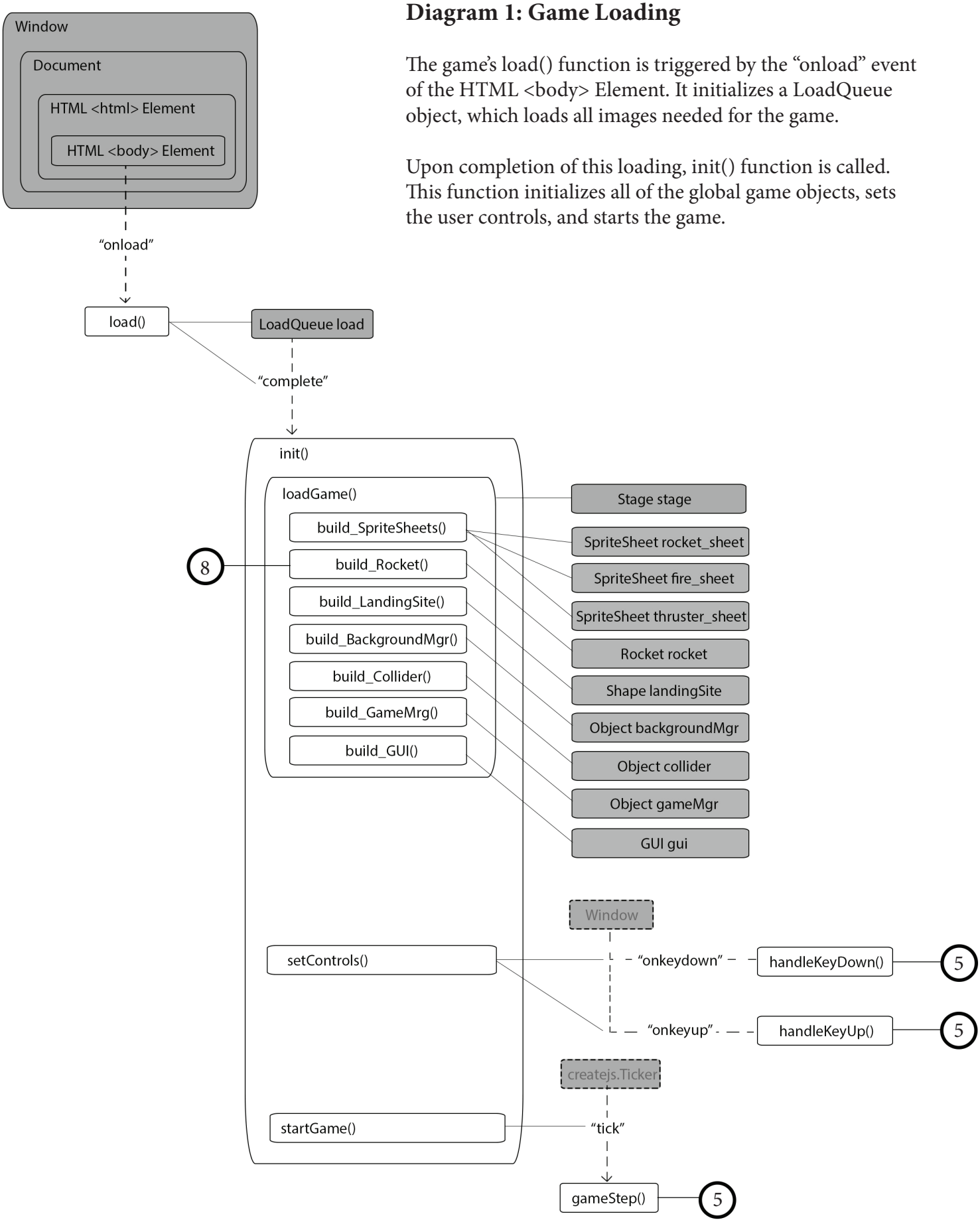


Diagram 2: handleKeyDown(e)

When window detects “onkeydown” event, it triggers handleKeyDown(e). Depending on the key pressed, different functions are called.

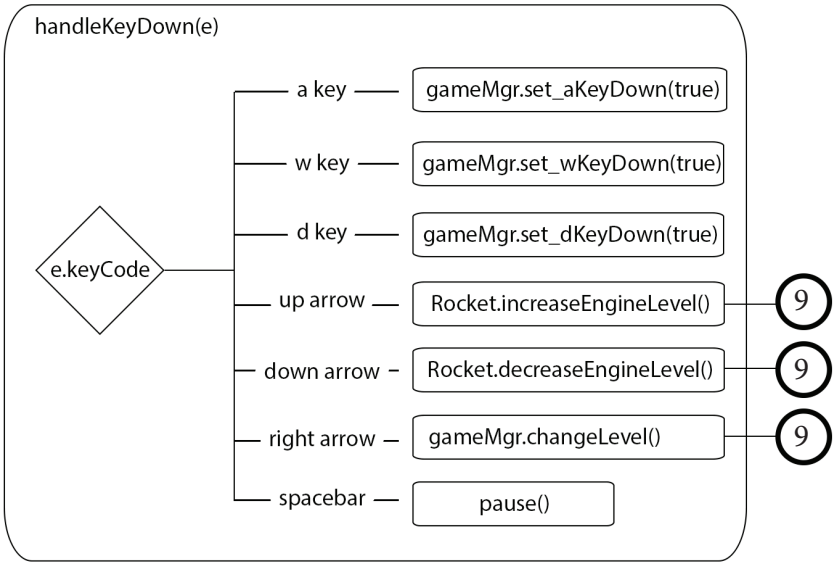


Diagram 3: handleKeyUp(e)

When window detects “onkeyup” event, it triggers handleKeyUp(e). Depending on the key pressed, different functions are called.

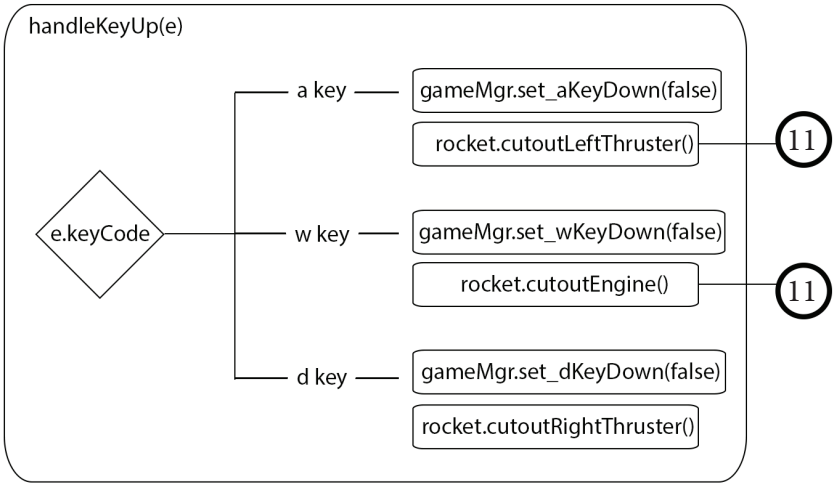


Diagram 4: gameStep()

This global function checks whether createjs.Ticker is paused. If it is not paused, updates the game manager and stage.

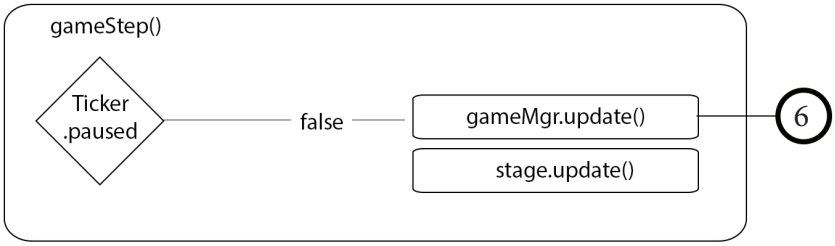


Diagram 5: gameMgr.update()

Game manager has a property gameover. If this internal property is not false, game manager checks other properties. Each of these other properties trigger specific rocket functions. These functions need to occur once every gameStep (other rocket functions can be called once when “onkeydown” event is triggered). Game manager then performs update for rocket, collider, and gui. Finally, game manager renders the rocket.

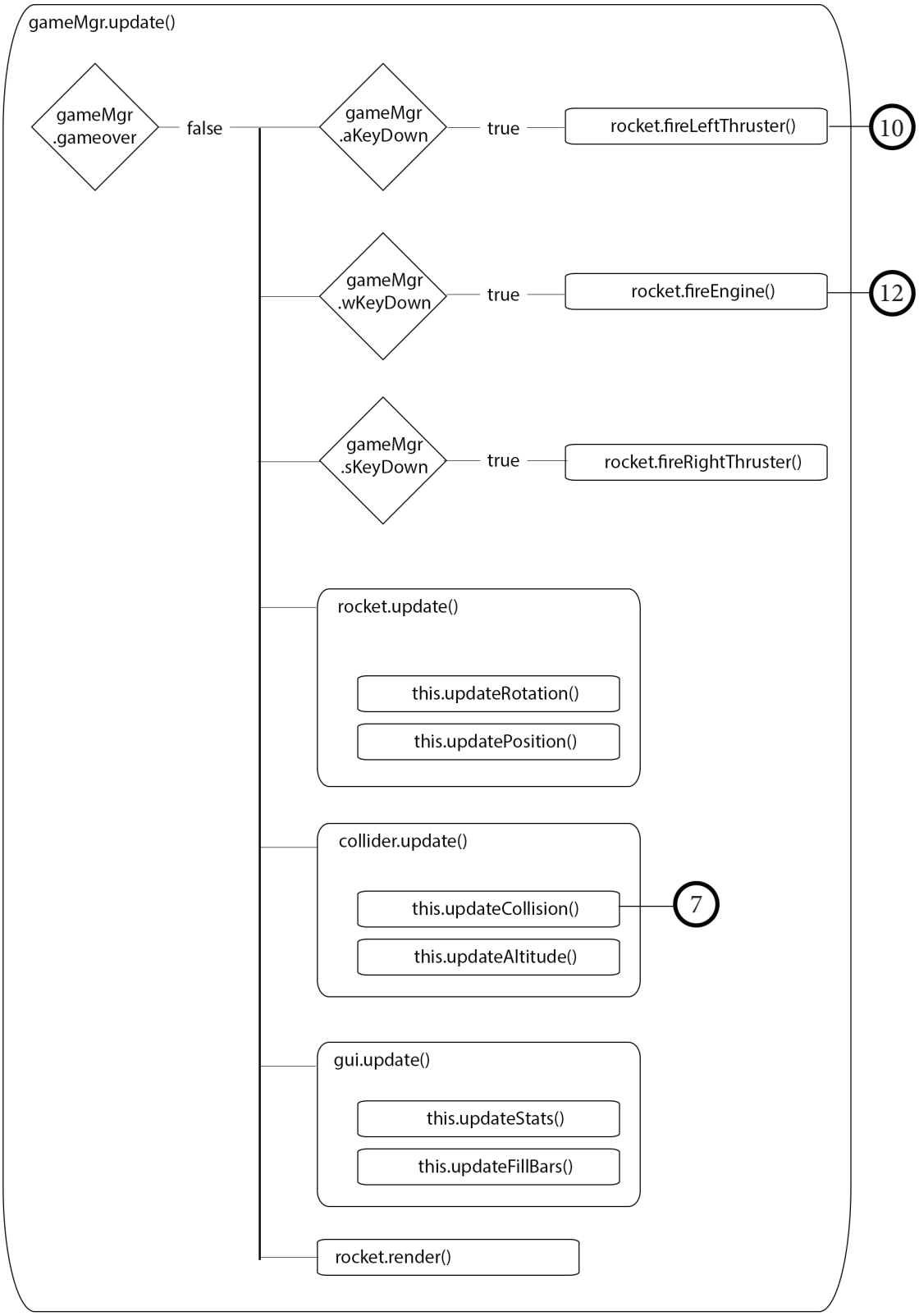


Diagram 6: collider.updateCollision()

Collider keeps track of the altitudes of rocket and landingSite objects, and triggers actions when a collision between them occurs. If bottom of the rocket's landing legs and the top of the landingSite are in the same horizontal plane, y-range is good. If the y-range is good, other parameters are checked. If rocket is landing over the landingSite, x-range is good. If the rocket's rotation, horizontal speed, and vertical speed are within a specified range, the collider can proceed with a landing event. Otherwise, the collider proceeds with a crash event.

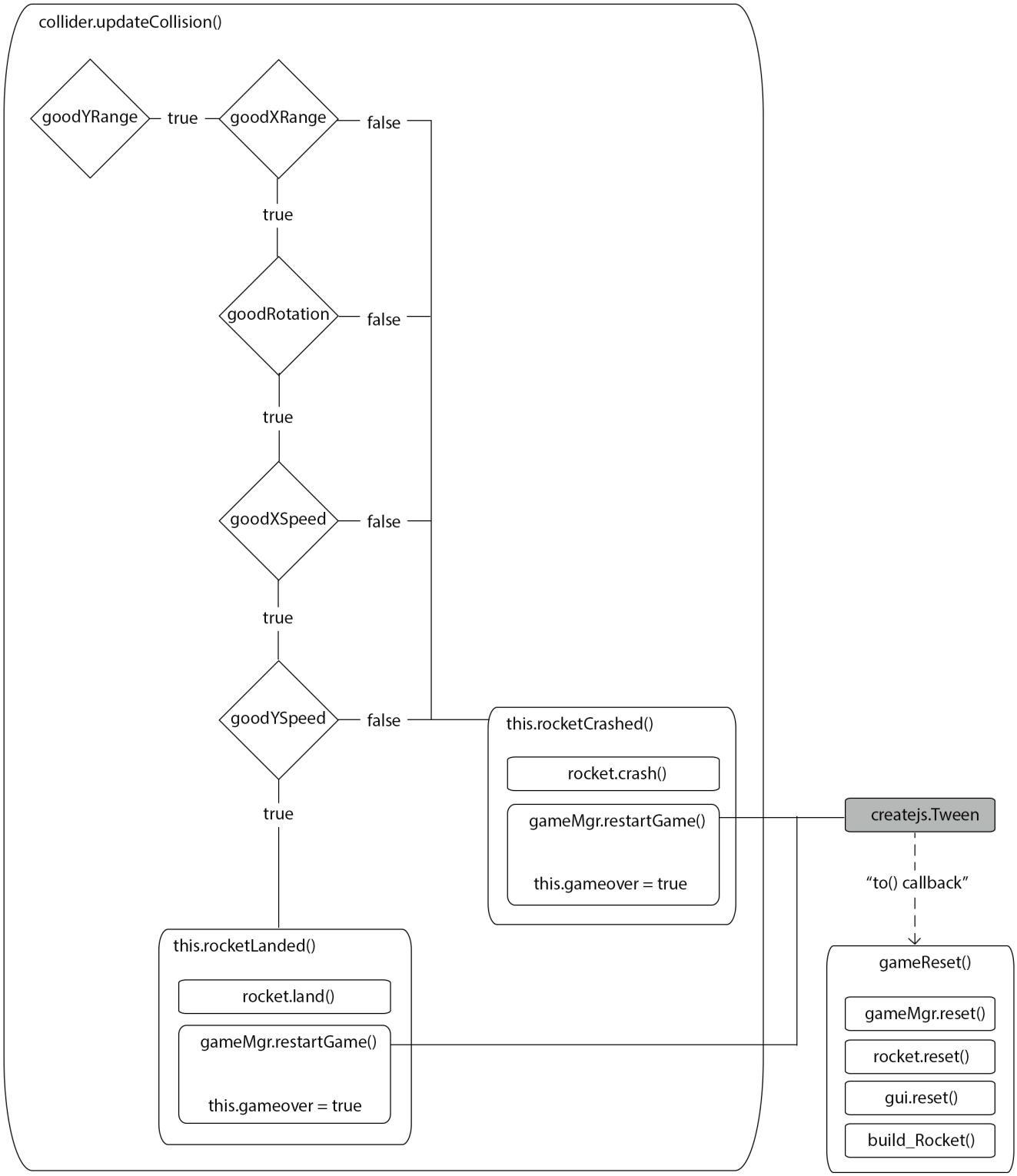


Diagram 7: build_Rocket()

This function will initialize the global rocket object and position it on the stage.

First, function calculates a random horizontal position and random angle for the rocket (the rocket begins in the same vertical position every attempt - out of view). Then if the rocket has already been initialized (in the case of a second landing attempt), the rocket is repositioned.

If the rocket has not yet been initialized, function calls the rocket constructor. Then functions are added to the rocket's event listeners, to be called for specific events that occur in the rocket. Then the rocket is positioned.

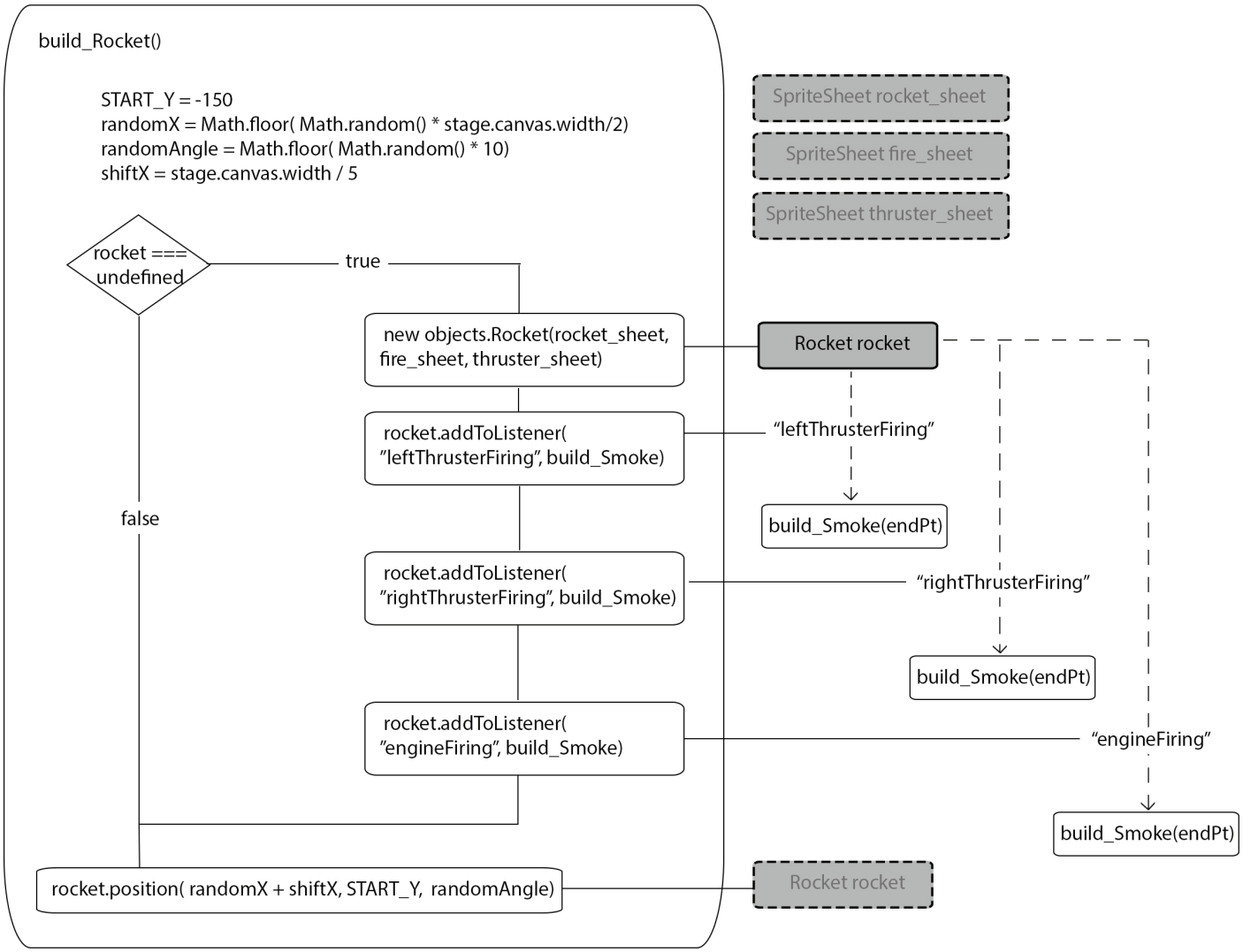


Diagram 8: gameMgr.changeLevel()

Function toggles between the levels of the game using modular arithmetic. Then calls a function of background manager, gui, and landingSite.

Background manager has function to choose which background images to show.

GUI has function to choose which text to display (and in what color), depending on the level.

Landing Site stores a reference to a graphics command object for the drawRect() command, and redraw() changes the shape of the landing site based on the level.

Fnally global function gameReset() is called.

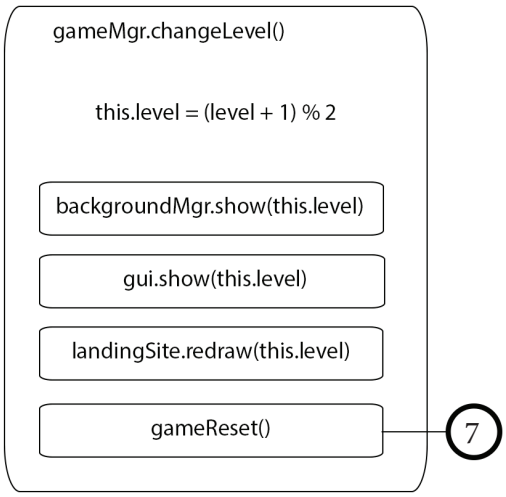


Diagram 9: rocket.increaseEngineLevel()

This function lowers the rocket's engine level property within established range.

Engine level plays a key role in rocket animations and movement.

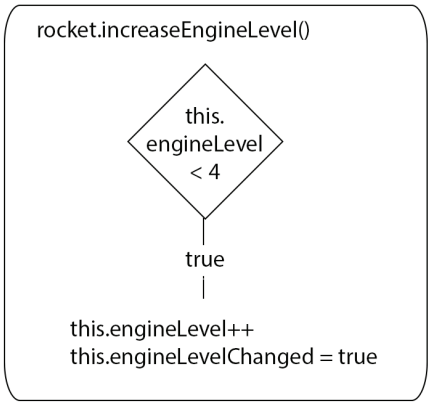


Diagram 10: rocket.decreaseEngineLevel()

This function raises the rocket's engine level property within established range.

Engine level plays a key role in rocket animations and movement.

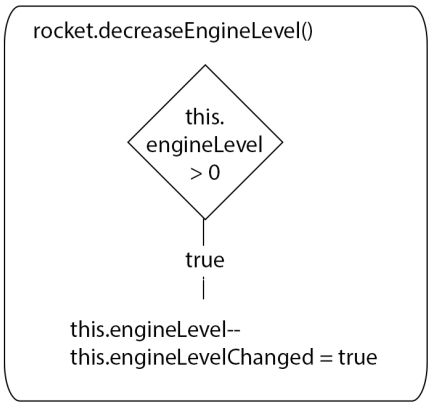


Diagram 11: rocket.fireLeftThruster()

Function checks whether this thruster is already firing and whether there is monopropellant (thruster fuel) remaining. It updates animations and torque values accordingly. Then it calls all functions that were stored in the event listener for this event. Called functions are sent a parameter representing the end point of the tip of the thruster animation.

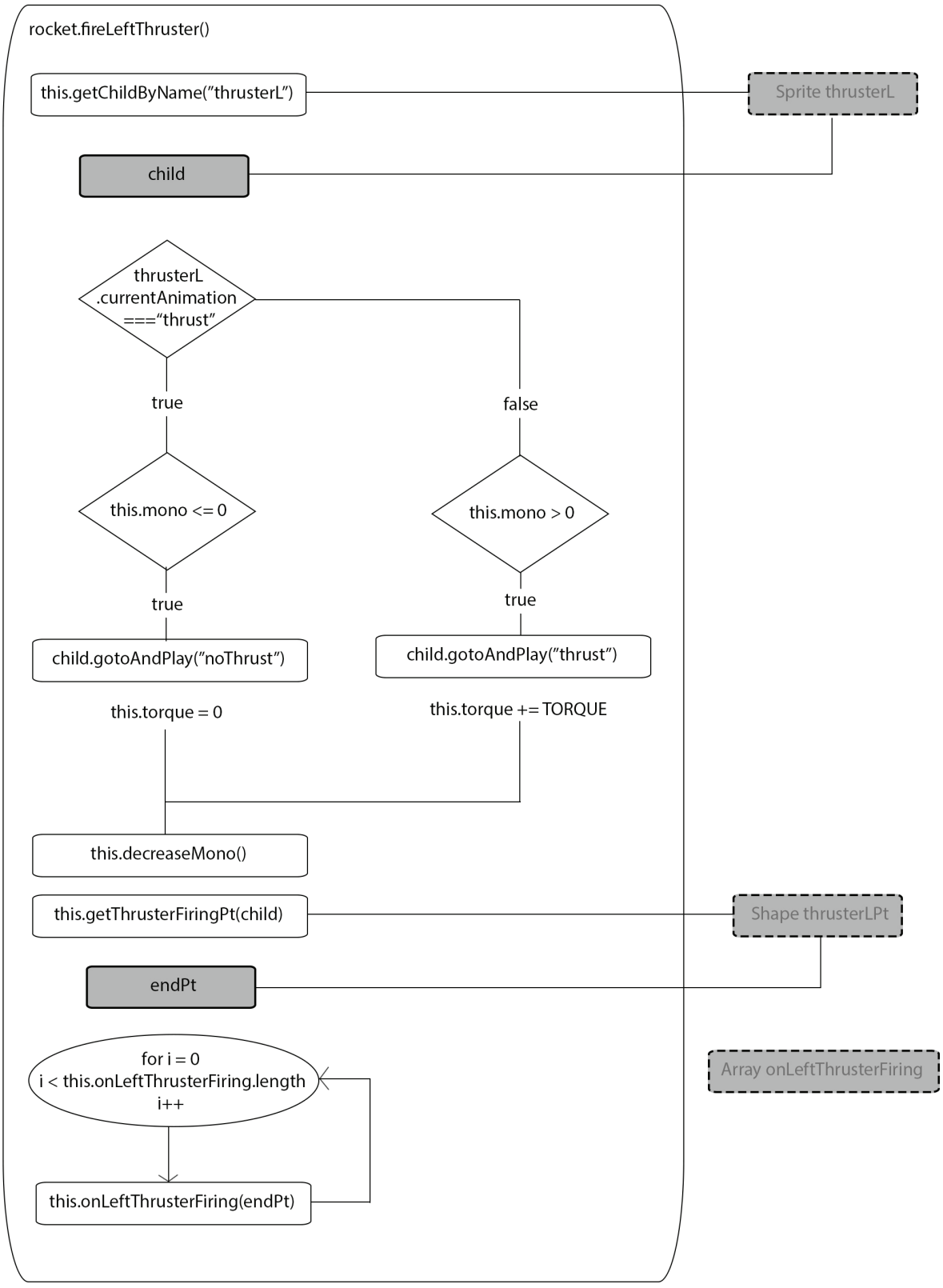


Diagram 12: rocket.cutoutLeftThruster()

Function checks whether this thruster has firing animation. If it does, it changes the animation and torque values.

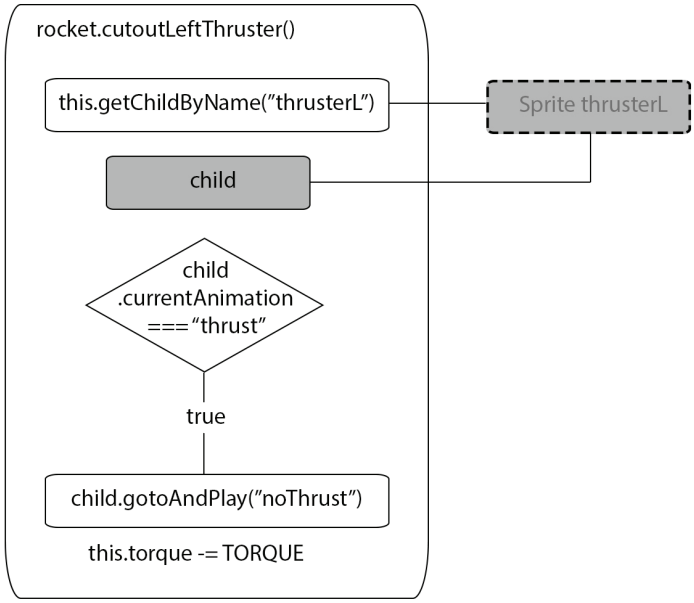
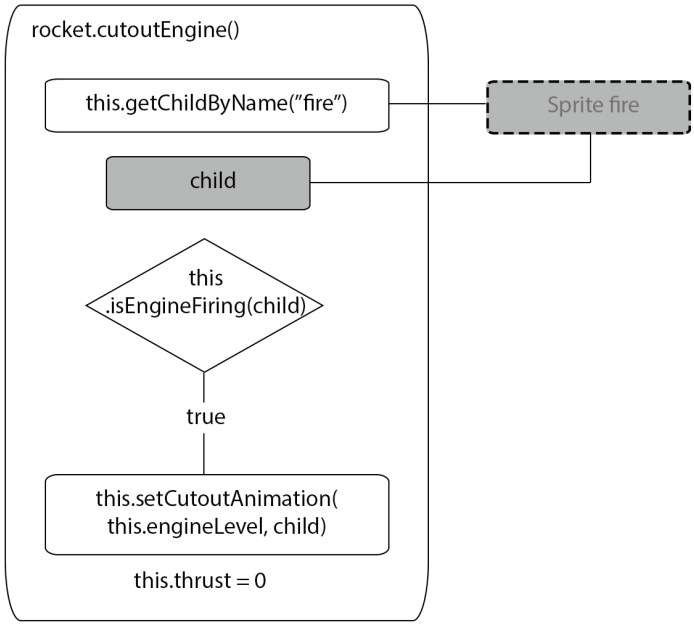


Diagram 13: rocket.cutoutEngine()

Function checks whether engine has a firing animation. If it does, it changes the animation and thrust values.



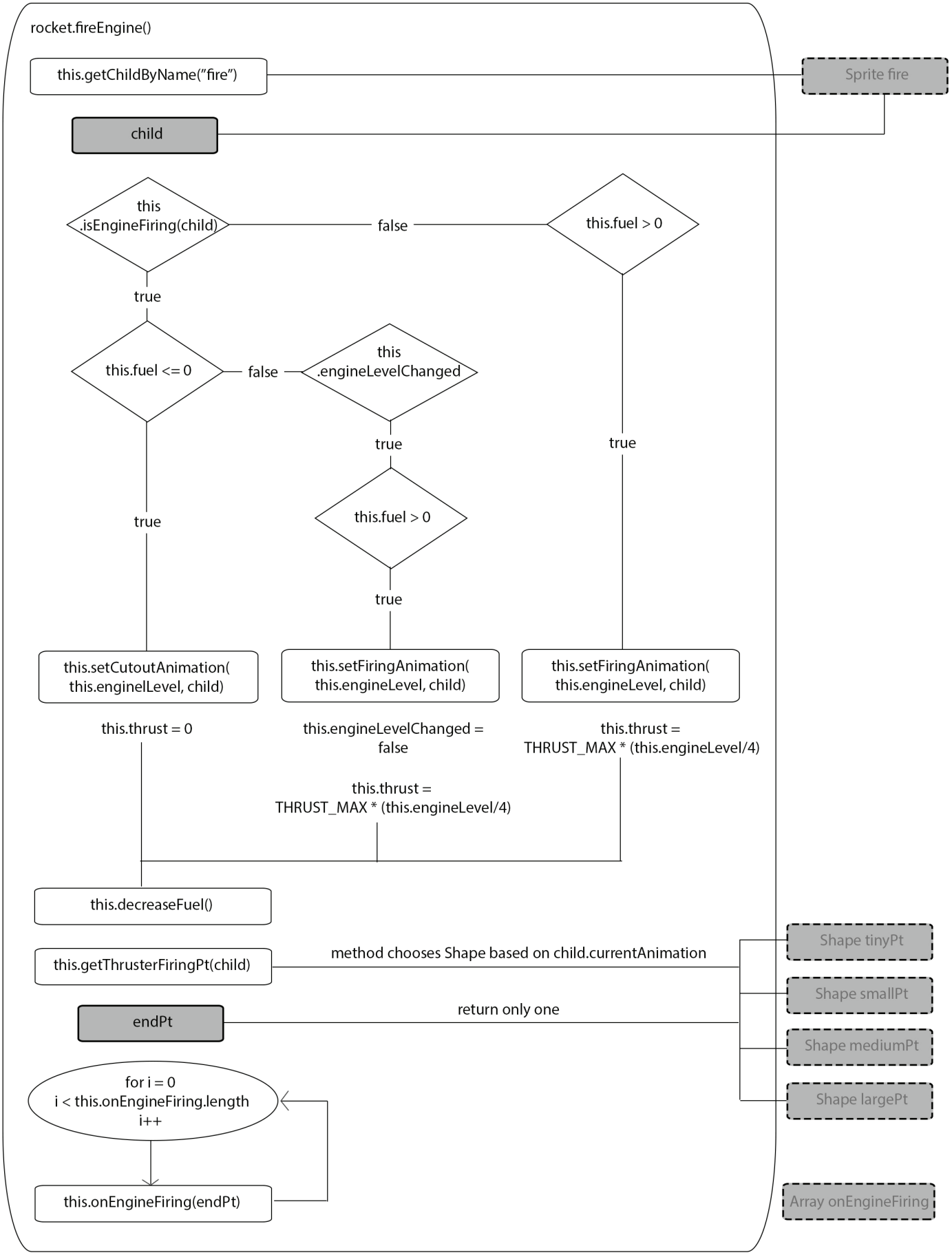

rocket.fireEngine()
this.getChildByName("fire")
Sprite fire
child
this .isEngineFiring(child)
false
this.fuel > 0
true
this.fuel <= 0
false
this .engineLevelChanged
true
true
true
this.fuel > 0
true
this.setCutoutAnimation(this.enginelLevel, child)
this.setFiringAnimation(this.engineLevel, child)
this.setFiringAnimation(this.engineLevel, child)
this.thrust = 0
this.engineLevelChanged = false
this.thrust = THRUST_MAX * (this.engineLevel/4)
this.thrust = THRUST_MAX * (this.engineLevel/4)
this.decreaseFuel()
this.getThrusterFiringPt(child)
method chooses Shape based on child.currentAnimation
Shape tinyPt
Shape smallPt
Shape mediumPt
Shape largePt
endPt
return only one
for i = 0 i < this.onEngineFiring.length i++
this.onEngineFiring(endPt)
Array onEngineFiring

Diagram 14: rocket.fireEngine()

Function checks whether this thruster is already firing and whether there is fuel remaining. It also checks whether the engine level has changed if the engine was already firing. It updates animations and thrust values accordingly.

Function then determines the correct reference to the end point of the tip of the current engine firing animation.

Then it calls all functions that were stored in the event listener for this event. Called functions are sent a parameter representing the end point of the tip of the engine firing animation.

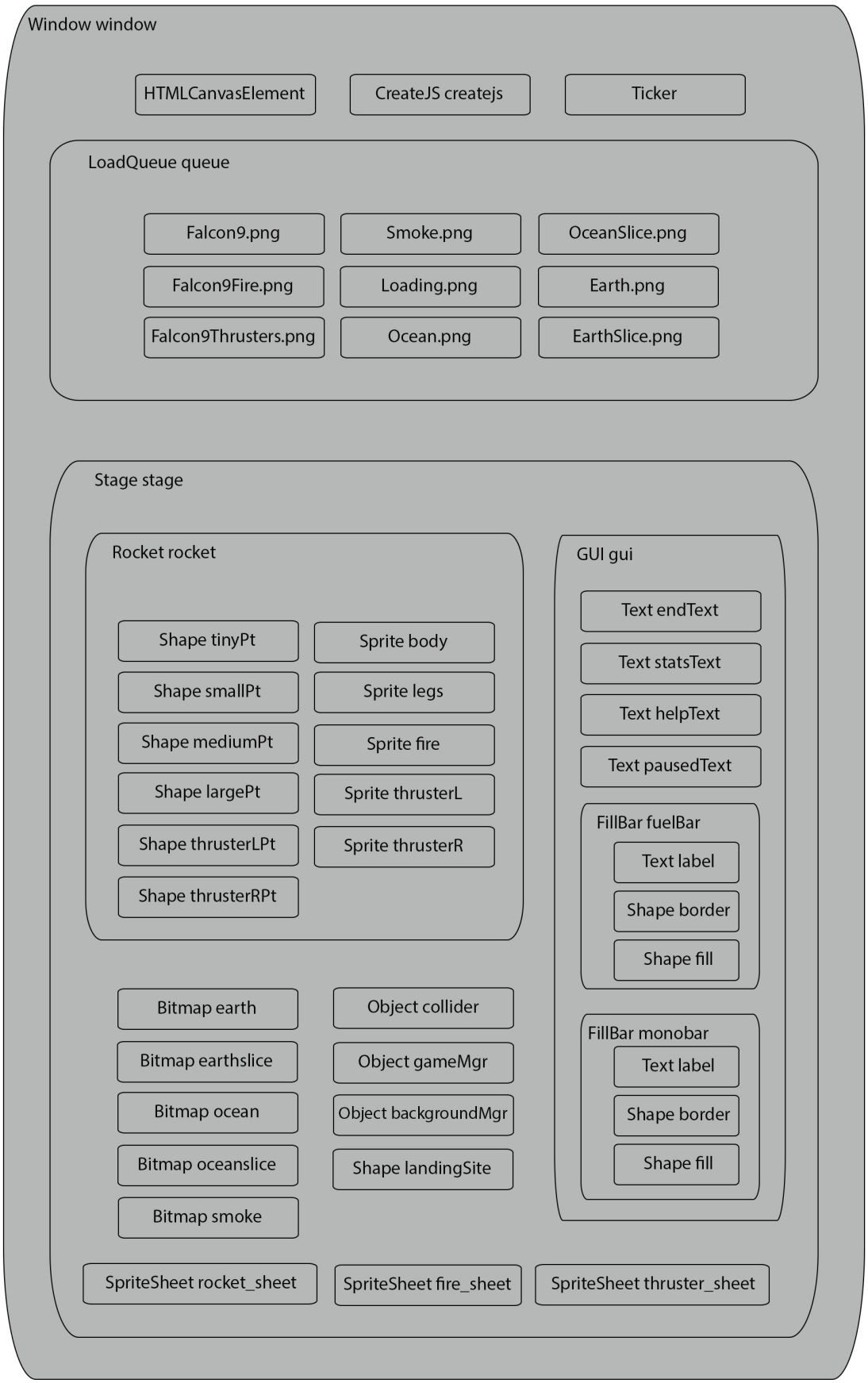

Window window
HTMLCanvasElement
CreateJS createjs
Ticker
LoadQueue queue
Falcon9.png
Smoke.png
OceanSlice.png
Falcon9Fire.png
Loading.png
Earth.png
Falcon9Thrusters.png
Ocean.png
EarthSlice.png
Stage stage
Rocket rocket
Shape tinyPt
Shape smallPt
Shape mediumPt
Shape largePt
Shape thrusterLPt
Shape thrusterRPt
Sprite body
Sprite legs
Sprite fire
Sprite thrusterL
Sprite thrusterR
GUI gui
Text endText
Text statsText
Text helpText
Text pausedText
FillBar fuelBar
Text label
Shape border
Shape fill
FillBar monobar
Text label
Shape border
Shape fill
Bitmap earth
Bitmap earthslice
Bitmap ocean
Bitmap oceanslice
Bitmap smoke
Object collider
Object gameMgr
Object backgroundMgr
Shape landingSite
SpriteSheet rocket_sheet
SpriteSheet fire_sheet
SpriteSheet thruster_sheet

Diagram 15: Game Objects

Rocket Lander! contains a number of game objects:

- Window represents the global namespace created when a browser opens a tab.
- HTMLCanvasElement is the canvas element CreateJS.Stage is placed inside.
- CreateJS is a reference to the CreateJS library
- createjs.Ticker is the library's method of handling time. This object is not instantiated by our code, but is referenced.

- Our game utilizes multiple PNG images for its graphics.
- queue is a createjs.LoadQueue that provides ways of loading PNG images.

- stage is a createjs.Stage, which is the container used to store and display all other game objects:

    - earth and ocean are createjs.Bitmap's which hold the image used for a game level background
    - earthslice and oceanslice are createjs.Bitmap's which contains a horiziontal section of the background image used with the given game level. By positioning this object in front of the rocket, all rocket fire animations that extend past the level of the ground / landingSite are hidden from view. This makes the ground feel solid.

    - Collider is an object that encapsulates functionality related to tracking the visible game objects and triggering events when they collide.

    - gameMgr is an object that encapsulates the functionality of the game stage and update.

    - backgroundMgr is an object that encapsulates the functionality of displaying the game backgrounds.

    - landingSite is a createjs.Shape which defines the location the rocket can land. It will be hidden from view by default, and the player will rely on background images for the visual cue of where to land.

    - rocket_sheet, fire_sheet, and thruster_sheet are createjs.SpriteSheet's which contains the data and image used to animation the rocket.

    - Rocket extends createjs.Container, and contains all the game objects and functionality related to the rocket.

        - createjs.Sprite body, legs, fire, thrusterL, and thrusterR each animation a different part of the rocket.
        - createjs.Shape tinyPt, smallPt, mediumPt, largePt, thrusterLPt, and thrusterRPt are hidden references to the end point of their respective animations. This allows smoke to be generated at the correct positions when the engine or thrusters are firing.

        References are stored inside the rocket so that as the rocket moves and rotates, these shapes do as well. Accessing a reference provides the current location of the Shape object without additional calculations.

    - GUI extends createjs.Container, and contains all game objects and functionality related to the user interface.

        - createjs.Text endText, statsText, helpText, and pausedText display text to the user.

        - FillBar extends createjs.Container, and contains all objects and functionality related to displaying the fuel remaining visually. It contains a Text object, and two Shape objects.

Diagram 16: Game States

Rocket Lander! can be subdivided into a number of states.

- The game begins in the loading state, where all images used in the game are loaded.
- After loading state comes initialize state, where game objects are created.
- Once game objects are created and added to the stage, the game is in run state. Here the rocket is moving through space and players control the rocket.
- At any time during run state, players can pause the game.
- The game can only return to run state when in pause state.
- If the rocket has landed or crashed, game changes to gameover state. Here specific animations are shown, and the player cannot fly the rocket.
- Once the ending sequence has been completed, game enters restart stage. Restart stage allows the game to reset the rocket's values and position, the fuel values, and other game variables. Once restart has been completed, game returns to run state.

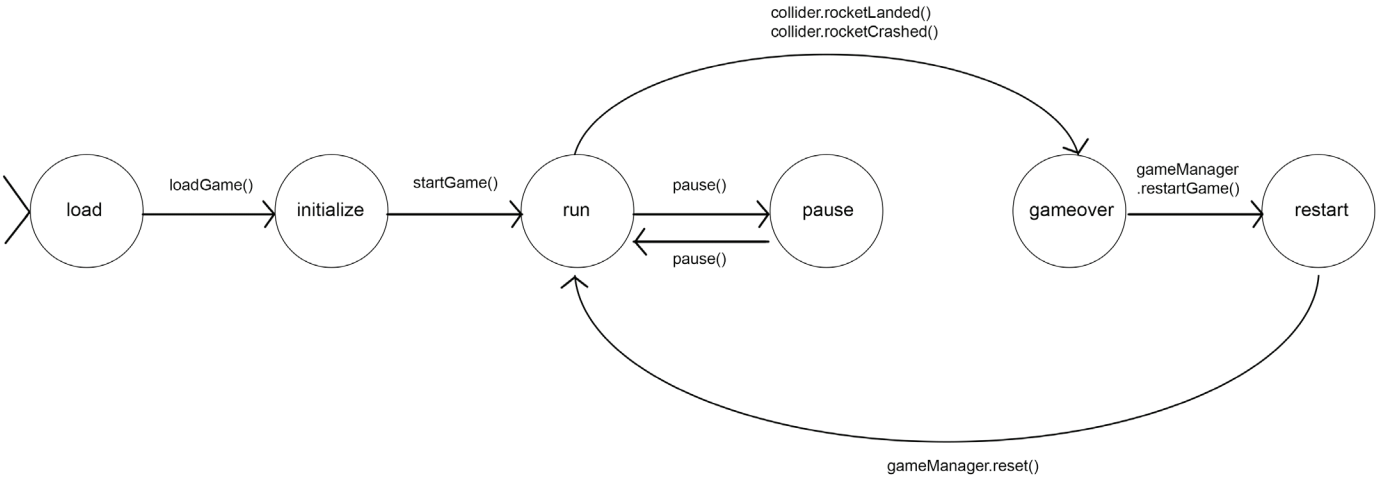


Diagram 17: Engine Animation States

In Rocket Lander! the rocket engine has a number of animations, depending on the situation.

- noFire: No flame animation is shown. The engine begins in this state.
- tinyFire: Smallest flame animation is shown as a cycle.
- smallFire: Slightly larger flame animation is shown as a cycle.
- mediumFire: Second largest flame animation is shown as a cycle.
- largeFire: Largest flame animation is shown as a cycle.
- cutLargeFire: Largest flame animation leads to mediumFire after one animationcycle
- cutMediumFire: Second largest flame animation leads to smallFire after one animation cycle
- cutSmallFire: Second smallest flame animation leads to tinyFire after one animation cycle
- cutTinyFire: Smallest flame animation leads to noFire after one animation cycle

There are multiple events that result in a change in animation:

1. FireEngine() is called when engine is not firing AND engineLevel is not 0.
   State changes from noFire to tinyFire, smallFire, mediumFire, or largeFire, depending on the engineLevel.

2. FireEngine() is called when engine is firing AND engineLevel has changed.
   State changes from current state to one state to the left or one state to the right, depending on engineLevel.

3. FireEngine() is called when engine is firing AND rocket fuel level reaches zero.
   State changes from tinyFire, smallFire, mediumFire, or largeFire to cutTinyFire, cutSmallFire, cutMediumFire, or cutLargeFire, respectively.

4. CutoutEngine() is called when engine is firing.
   State changes from tinyFire, smallFire, mediumFire, or largeFire to cutTinyFire, cutSmallFire, cutMediumFire, or cutLargeFire, respectively.