
Air Warfare Introduction

(Warning! Before start running the game,you may should use the project setting files which compressed in ProjectSettingFiles.rar to replace your project setting files.)

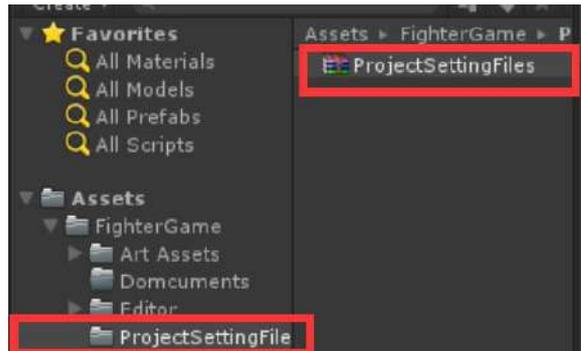


Figure 1 ProjectSettingFiles.rar

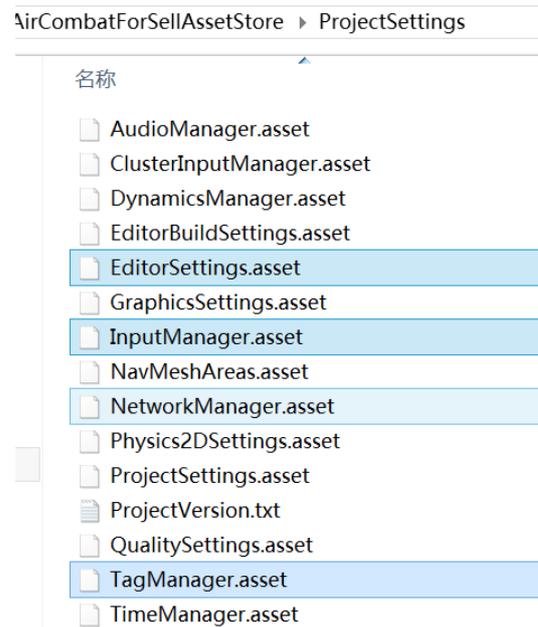


Figure 2 replace your project setting files

1. Synopsis



First of all, this article will show you the operation of the fighter, in order to let you know how to control fighter when game is running.

Then we will introduce the fighting details in this game, in order to let you know some details when fighter fight with AI fighter, such as how to lock multiple targets, the HUD meanings and so on.

Next we will introduce to you some technology which be commonly used in this game.

Finally we will introduce each system module of the fighter and AI fighter, in order to let you know the functionality of each system module.

2. The operation of the fighter

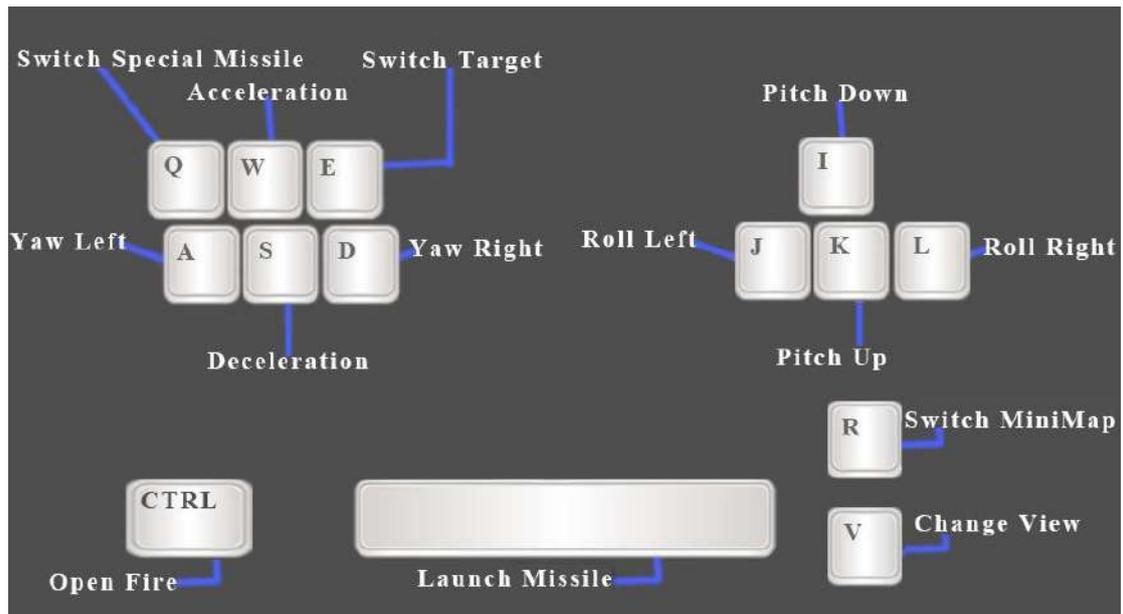


Figure 3 the operation of fighter

3. The introduction of fighting details when enter this game

(1).The Introduction of scenes

There are three scenes in this package,the Take Off scene,the In the Sky scene,and the Landing scene



Figure 4 three have three scene in this game

When you enter the scene named TakeOff,the fighter's initial position is on the runway, and is ready to take off. You should accelerate the fighter in order to fly to the sky,then you will fight with the AI fighters.

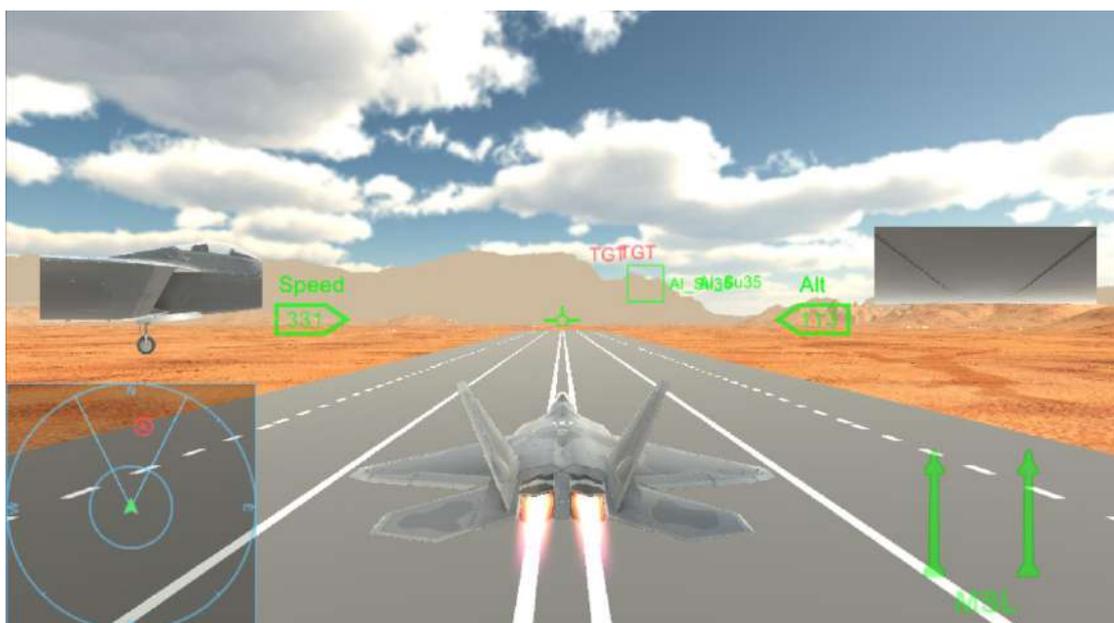


Figure 5 the scene named take off

When you enter the scene named In The Sky, the fighter's initial position is in the sky and you can fight with AI fighters directly.



Figure 6 the scene named In the Sky

When you enter the scene named Landing, you should decelerate your fighter in order to land it to the runway. (when fighter fly to the circles indicated by the arrow, the fighter's landing gear will automatically be put down)

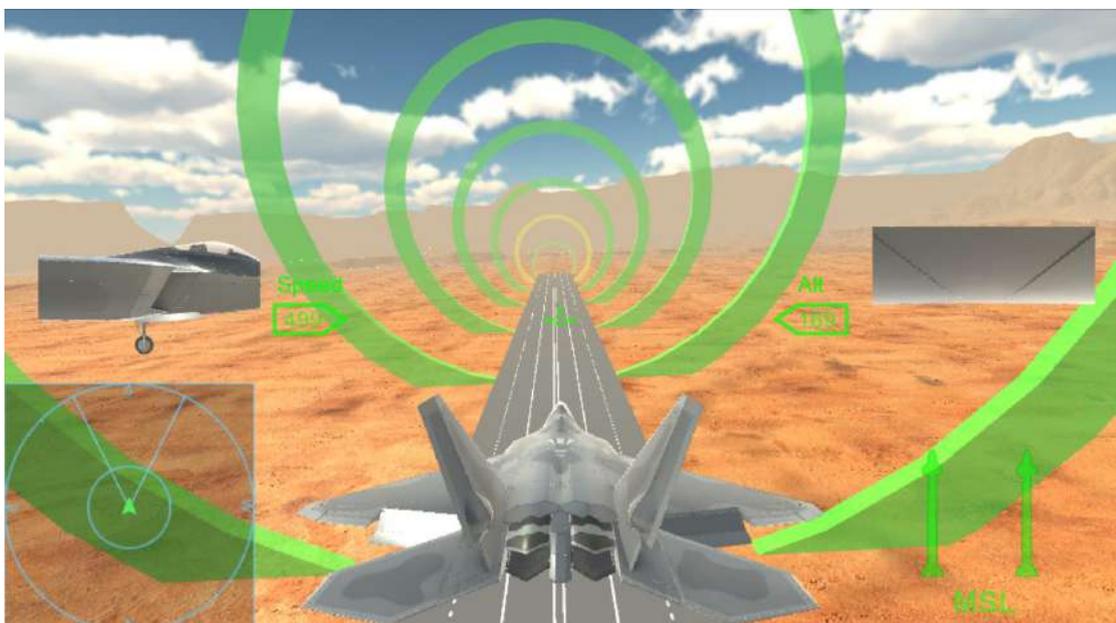


Figure 7 the scene named landing

(2).The introduction of MiniMap

There are two types miniMap in this game,the radar map and the satellite map. As the name suggests,the radar map take fighter as the center to display the units in a small area, the satellite map display the units in a larger area but take the gameObject named sceneCenter as the center.You can press switch MiniMap Key(Q) to change current minimap displayed on screen.

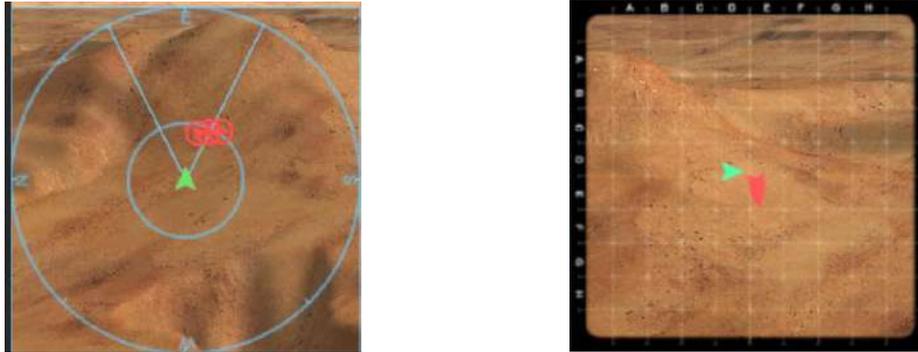


Figure 8 the radar map and the satellite map

(3).The introduction of Aim System

Aim system have two working modes,one mode is called single target mode,which means only one attack target can be locked at a time and the missile you will launch is called the general missile(this missile is a short range missile). another mode is called multiTarget mode, which means aim system can locked multiple target at a time,and the missiles you will launch is called the special missile(these missiles are the high-precision missiles).

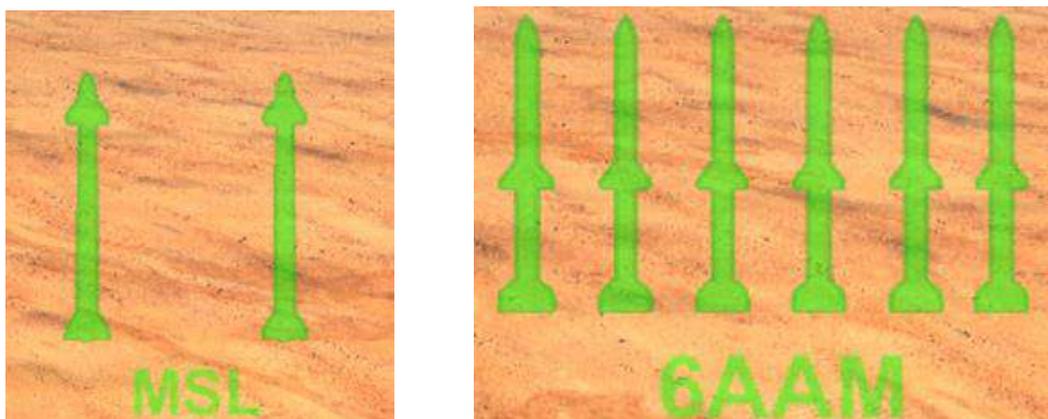


Figure 9 The HUD of general missile and the special missile

First,Let's take a look at the singleTarget Aiming Mode:

If there have enemy in the sight range of fighter's aim system,then the green UI boxes which stands for the enemies will display on the screen.If enemy enter the attack range of fighter's aim system,the color of UI box will turn red and the locked sound will be played to tell you that current attack target has been locked by the aim system and you can launch the missile.By the way,you can press switch target key(E) to switch current attack target if you want.when you select one target,the target's UI box will flash on the screen and the UI item on radar map will also flash to tell you which target has been locked by the aim system .

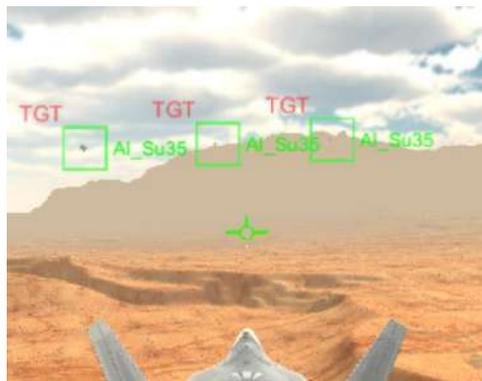


Figure 10 Target in sight

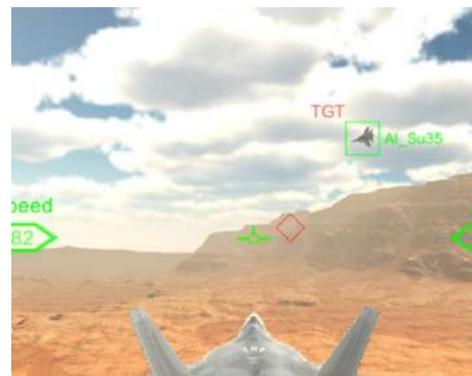


Figure 11 locking target



Figure 12 target has been locked

Now let's take a look at the multiTarget Aiming Mode:

If there have enemies in the sight range of fighter's aim system,then the green UI boxes which stand for the enemies will display on the screen.If one enemy enter the attack range of fighter's aim system,the color of corresponding UI box will turn red,if all the target has been locked, then the locked sound will be played to tell you that all the attack target has been locked by the aim system and you can launch the missile.By the way,you can press switch target key(E) to re-aiming attack targets if you want. The UI item on radar map will also flash to tell you which targets have been locked by the aim system .

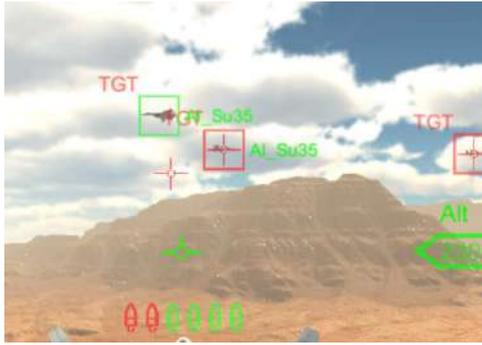


Figure 13 locking multiple Targets

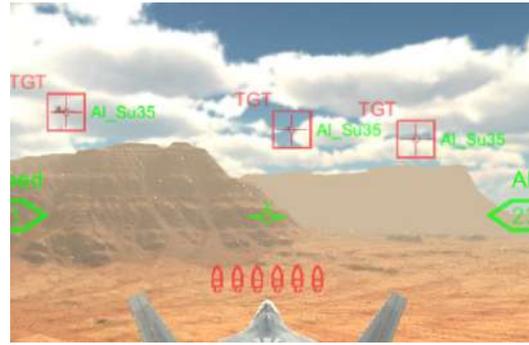


Figure 14 multiple Targets have been locked

(4).The Introduction of missile System

After launching the missile,the missile will be automatically reloaded in a few seconds,and the process of reloading missile will display at right bottom of the screen.

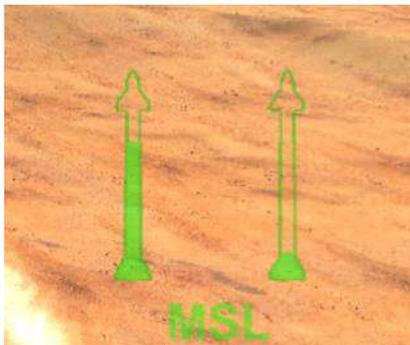


Figure 15 Reloading General Missiles

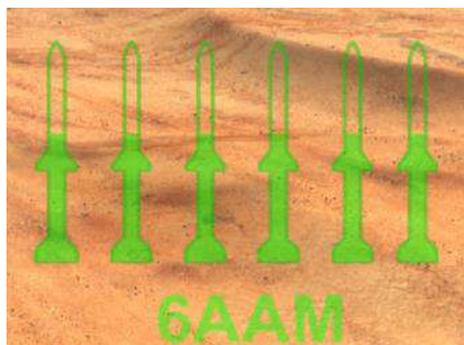


Figure 16 Reloading Specail Missiles

(5).The Introduction of machine gun system

When you use machine gun to open fire,there will display the crosshair at center of the screen,and the inner circle display the current temperature of machine gun. The temperature of machine gun has the maximum value,if machine gun is overheat,then the machine gun will enter cool down state,you should wait a few seconds until it could open fire again.



Figure 17 open fire



Figure 18 machine gun overheat

(6).The Introduction of HUD system

The HUD system display some information about your fighter,such as current speed,current altitude,the direction and so on.

When the camera in the normal mode,you can only see the current speed and the current altitude on the screen.



Figure 19 Camera normal view

You can press switch camera view key(V) to change camera view to the cockpit view, and you will see more detail information on the screen

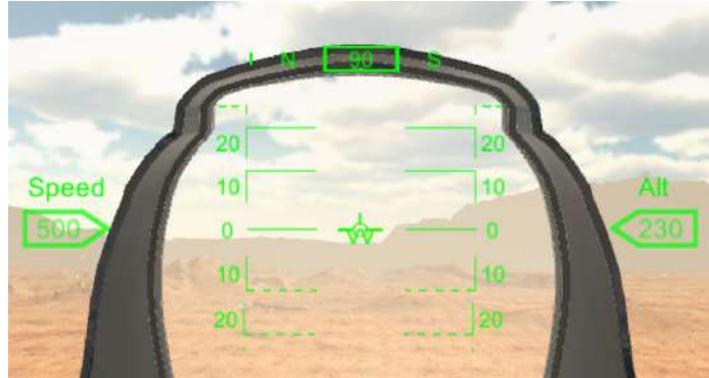


Figure 20 Camera Cockpit View

(7).The Introduction of Fighter's Damage

When your fighter was hit by the bullet or missile,the body of fighter will be on fire,and the screen will be full of blood effect. Remember,the more serious damage,the more blood effect will display on screen.At this moment, you should evade from the AI,and if your fighter not continue be hit by the enemy,then your fighter's life value will recover after a few seconds and the fire on the fighter will disappear.



Figure 21 light damage

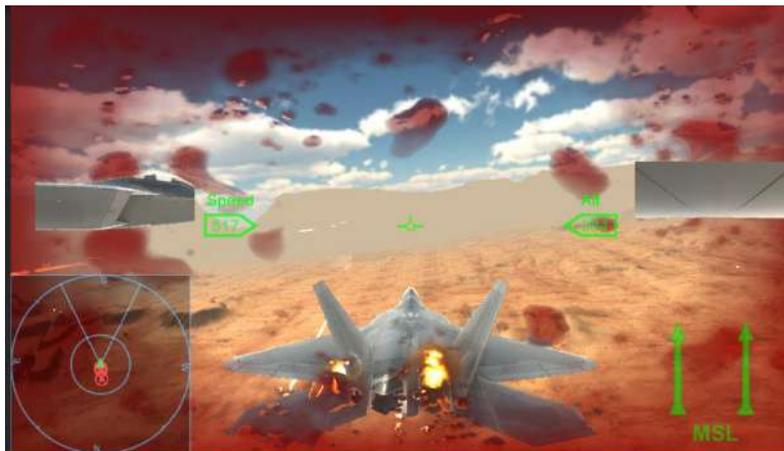


Figure 22 heavy damage

4. The technology used in this game

(1) The GameObject Pool technology

If we don't use the gameObject pool technology, we may create and destroy many objects during the game, but it has a strong impact on performance. Many of them, may simply be reused.

In this game, except for the player fighter, all the gameObject which will be created dynamically has been used the gameObject pool technology, such as the AI Fighter, the bullet, the missile and the particle effects, etc.

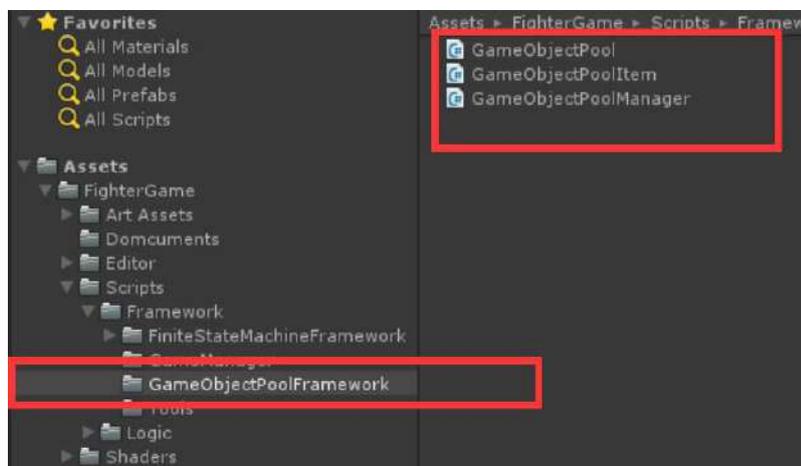


Figure 23 the GameObject Pool Framework

(2) The Finite State Machine technology

The finite-state machine is a model used to represent and control execution flow. It is perfect for implementing AI in games, producing great results without a complex code.

So the AI Fighter in this game have been implemented by using the finite state machine framework.

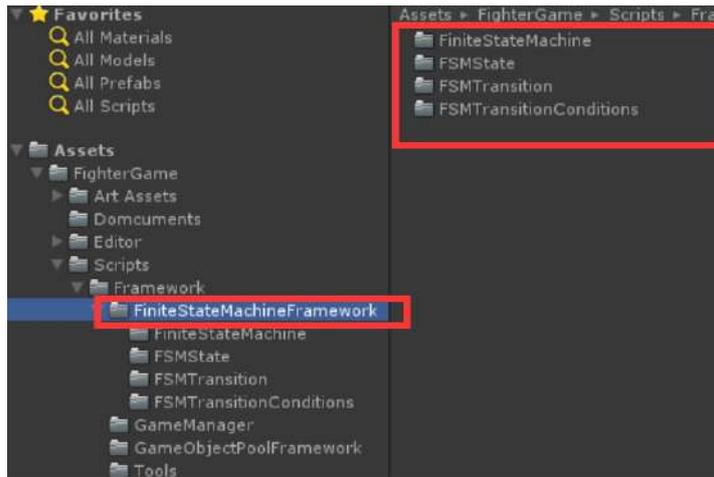


Figure 24 The Finite State Machine Framework

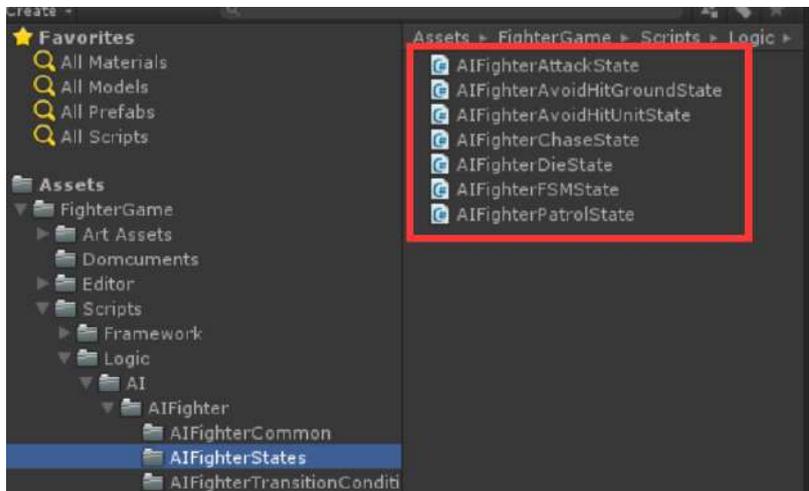


Figure 25 The States of AI Fighter

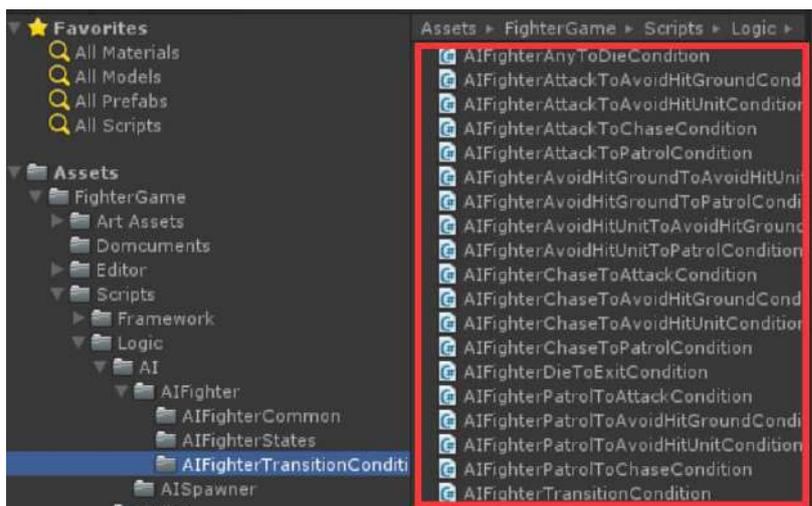


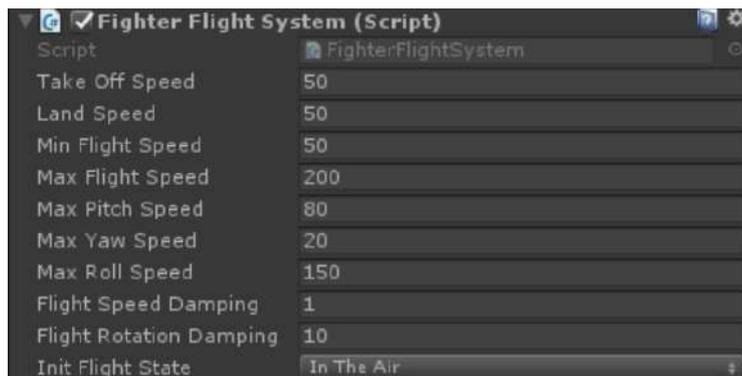
Figure 26 The Transition Conditions of AI Fighter

5. The introduction of each system module on the fighter

The System Modules we will talk about below, all fields are described in their code.

(1) Fighter Flight System

The fighter's flight is controlled by this system module, and this system has three flight states: the take off state, the in the air state, and the landing state. If you choose the take off state, you should put the fighter on the runway. If you choose the in the air state, you can directly put the fighter in the sky. The landing state is not exposed to the editor; in the scene named landing, we demonstrate how to land to the ground from the sky, when a fighter flies through the runway, it will enter a trigger named trigger, then the fighter will switch to the landing state and put down the landing gear, at this moment, you should operate the fighter to land on the runway.

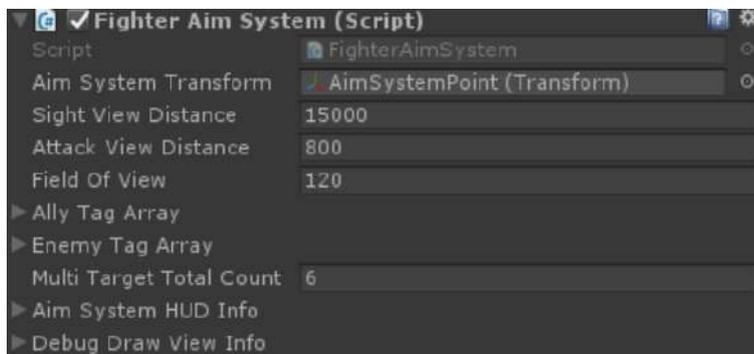
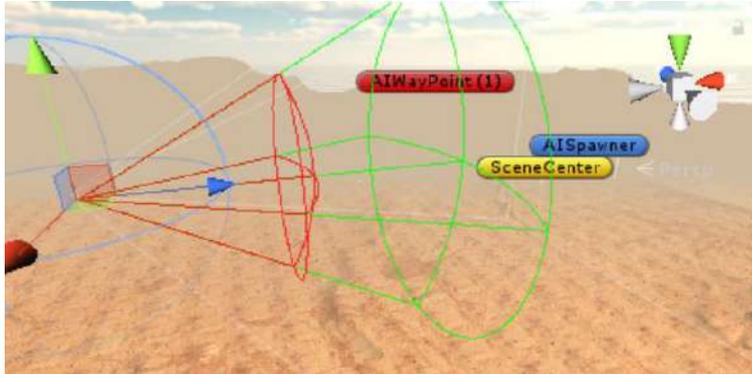


(2) Fighter Aim System

This is the most sophisticated of all system modules; it determines what the fighter could see and how far from the target then the fighter could attack. In the editor mode, select the fighter in the scene and click its Aim System component; you will see a cone-shaped area just like the image displayed below. The green area stands for the fighter's sight, and the meaning of the red area is that when the attack target enters this area, then the fighter could lock the target and launch a missile. The green cone area is determined by the field named Sight View Distance and the field named Field Of View. The red cone area is determined by the field named Attack View Distance and the field named Field Of View.

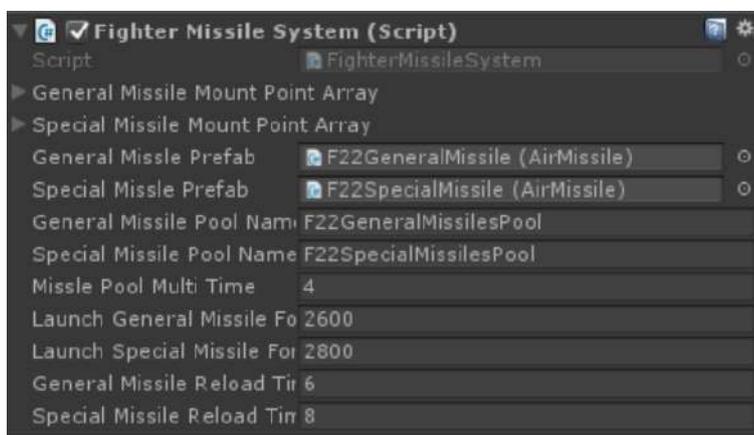
The Aim system has two working modes; one mode is called single target mode, which means only one attack target can be locked at a time and the

missile you will launch is called the general missile(this missile is a short range missile).Another mode is called multiTarget mode, which means the aim system can locked multiple target at a time,and the missiles you will launch is called the special missile(these missiles are the high-precision missiles).



(3) Fighter Missile System

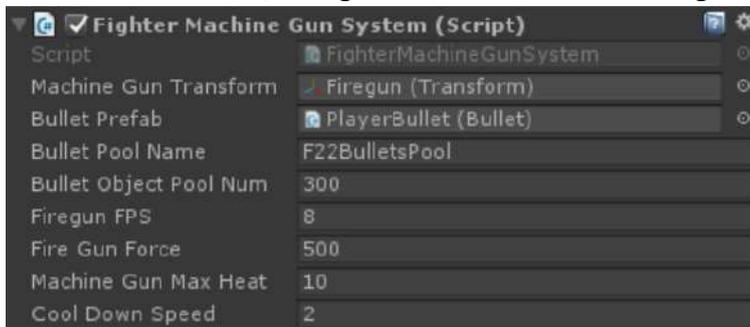
This module controls launch missiles and reload missiles. After launching the missile,the corresponding mount point will reload missile in a few seconds(The reload missile time is determined by the field named reload time), and the reloading process will display at the bottom right corner of the screen simultaneously.





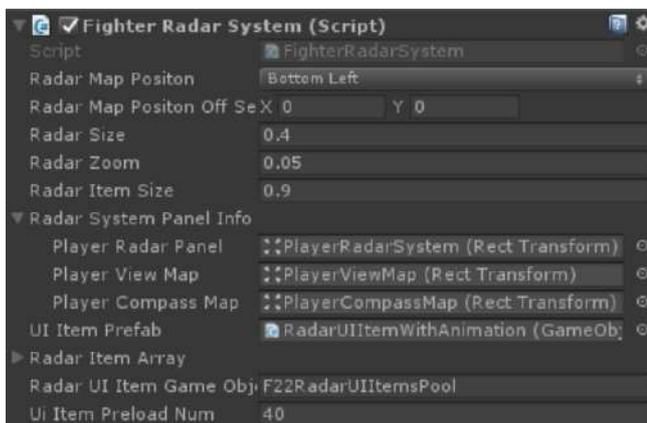
(4) Fighter Machine Gun System

This module controls fire the bullet. When fighter fire bullet continuously, the heat value of the machine gun will reach to the max heat value, then the machine gun will switch to the cool down state, after the heat value become zero, the fighter could fire the bullet again.



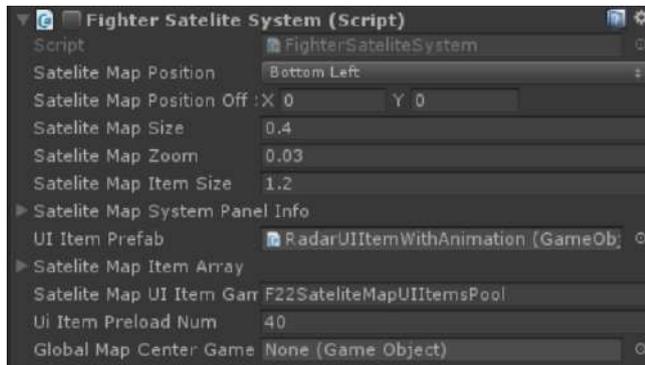
(5) Fighter Radar System

This module take fighter as the center to display some units that are closer to it in a small area, in order to let you know the units around you.



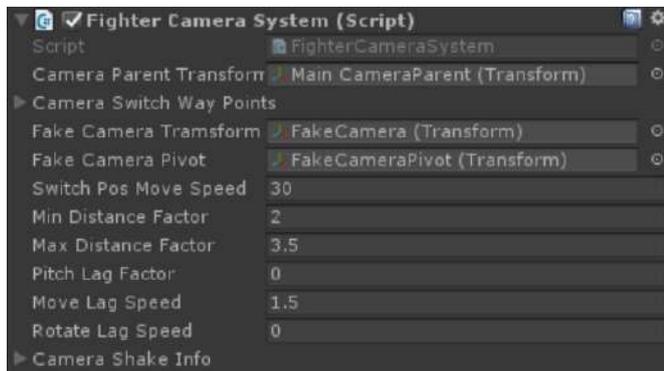
(6) Fighter Satellite System

This module take the gameObject named sceneCenter as the center to display all the units in current scene,in order to let you know each unit's current position in scene.



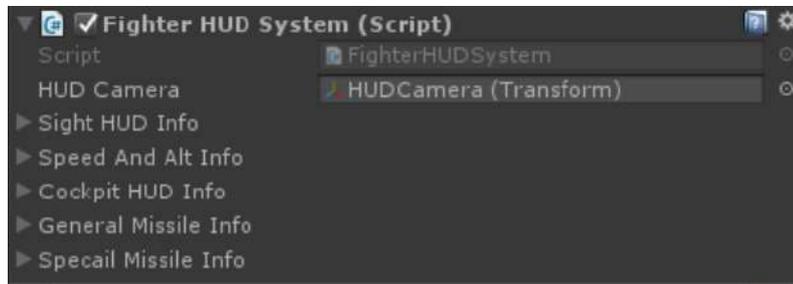
(7) Fighter Camera System

This system controls the camera's movement.If fighter is hit by the missile or the bullet,then this system will make the camera shake in order to notify player that the fighter was hit by something and have cause damaged.You can switch camera position to change view by press Change view key(V),and it will let your view changed between the normal view and the cockpit view.



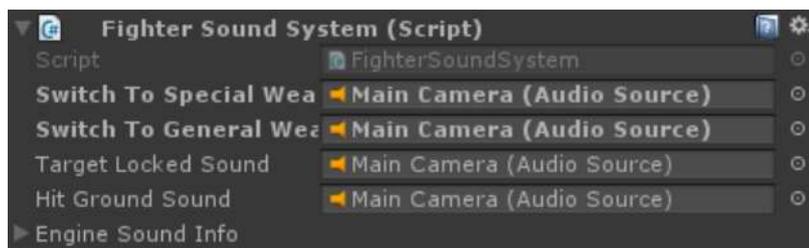
(8) Fighter HUD System

This module controls to show fighter's HUD on the screen, such as the Horizontal Lines, the Orientation, Current Speed and so on.



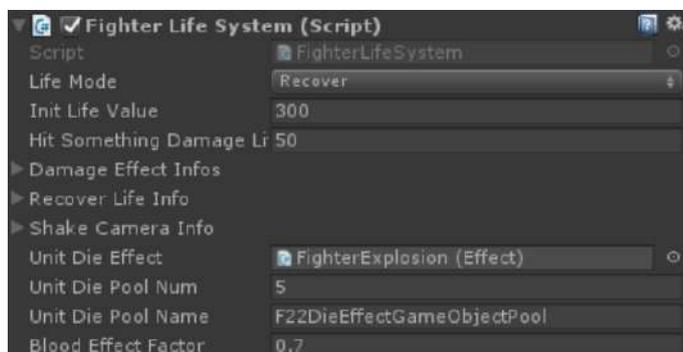
(9) Fighter Sound System

This module controls all the sound of the fighter.



(10) Fighter Life System

This module stores the life value of the fighter, and it has two modes, one mode is the Normal mode, which means that when the fighter was hit by the enemy's bullet or missile, the damage on the fighter will not disappear, and the life value will not recover, another mode is the Recover mode, which means that when the fighter was damaged, the life value will recover in a few seconds if there is no further damage on the fighter.

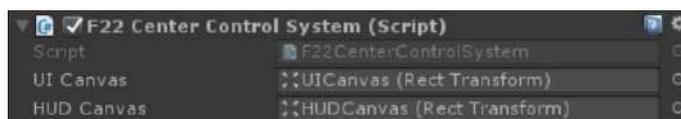


(11) F22 Center Control System

This module is the center control of all the system.

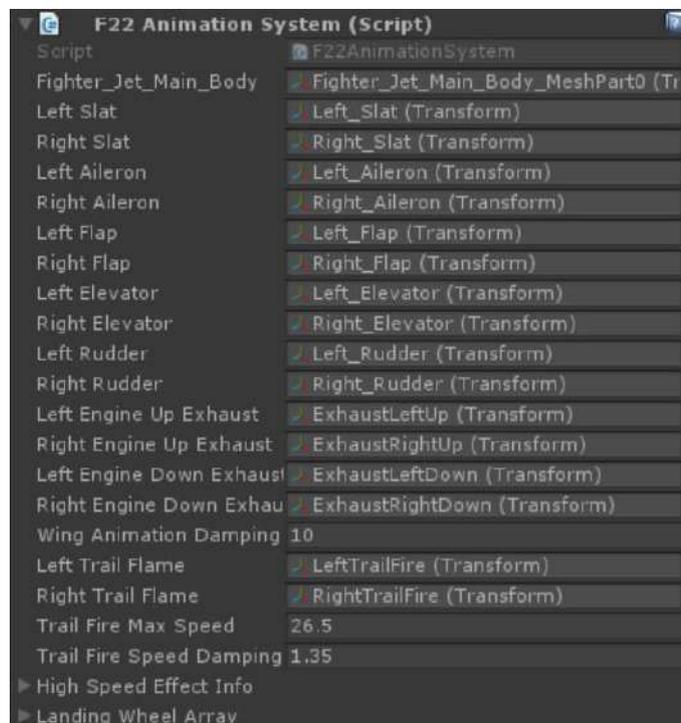
First, it will bind one system's event to another system's function, in other words, it coordinates the connection between different systems, and combine them into an organic whole.

Next, all the input commands are gathered in this module, that is to say, it is also an input manager of the fighter.



(12) F22 Animation System

This module controls fighter's all the animation, such as the wings animation, trail flame animation, open special missile door, put down landing gear and so on.

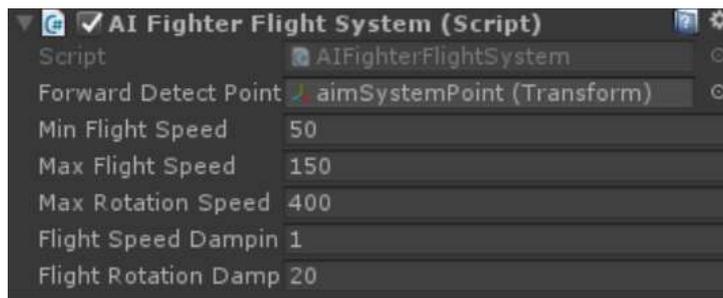


6. The introduction of each system module on the AI fighter

The System Modules we will talk about below, all fields are described in their code.

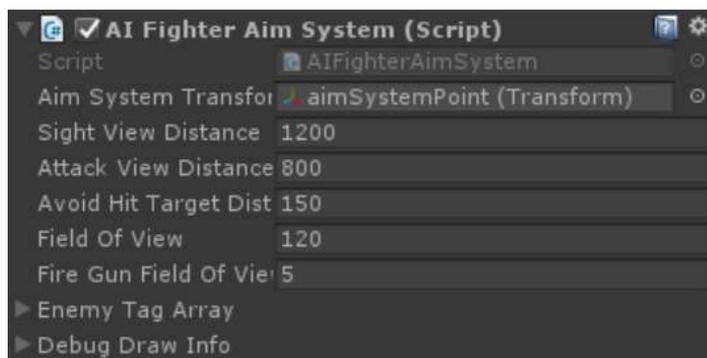
(1) AI Fighter Flight System

The AI fighter's flight is controlled by this system module



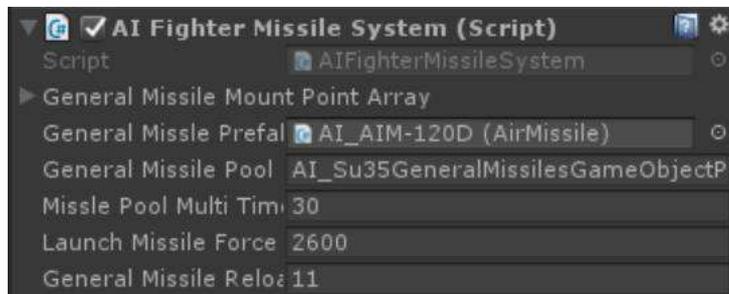
(2) AI Fighter Aim System

This system determines what AI fighter could see and how far from the target then the AI fighter could attack.



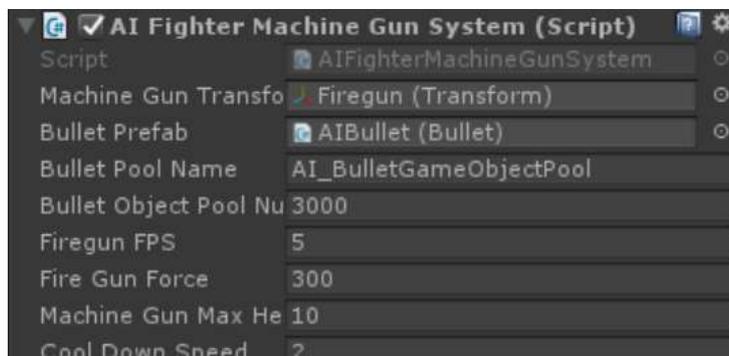
(3) AI Fighter Missile System

This module controls launch missiles and reload missiles. After launching the missile, the corresponding mount point will reload missile in a few seconds, and this time is determined by the field named reload time.



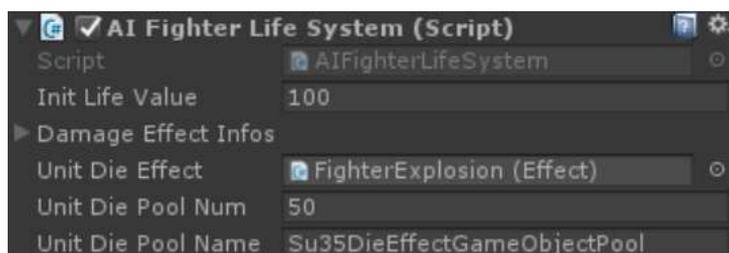
(4) AI Fighter Machine Gun System

This module controls fire the bullet. When AI fighter fire bullet continuously, the heat value of the machine gun will reach to the max heat value, then the machine gun will switch to the cool down state, after the heat value become zero, the AI fighter could fire the bullet again.



(5) AI Fighter Life System

This module stores the life value of the AI fighter, when the life value become zero, the AI Fighter will explode.



(6) AI Fighter Center Control System

The finite state machine of AI Fighter was implement by this module,and AI fighter will be control by the states in the finite state machine.



```
/// <summary>
/// AI fighter state machine initialize
/// </summary>
/// </summary>
/// 一个引用
private void FSMInitialize()
{
    FiniteStateMachine.AddState(new AIFighterPatrolState("AIFighterPatrolState", this));
    FiniteStateMachine.AddState(new AIFighterChaseState("AIFighterChaseState", this));
    FiniteStateMachine.AddState(new AIFighterAttackState("AIFighterAttackState", this));
    FiniteStateMachine.AddState(new AIFighterAvoidHitGroundState("AIFighterAvoidHitGroundState", this));
    FiniteStateMachine.AddState(new AIFighterAvoidHitUnitState("AIFighterAvoidHitUnitState", this));
    FiniteStateMachine.AddState(new AIFighterDieState("AIFighterDieState", this));

    FiniteStateMachine.CreateFSMStateToAnotherFSMStateTransition("AIFighterPatrolState", "AIFighterChaseState", new IFSM
    FiniteStateMachine.CreateFSMStateToAnotherFSMStateTransition("AIFighterPatrolState", "AIFighterAttackState", new IFSM
    FiniteStateMachine.CreateFSMStateToAnotherFSMStateTransition("AIFighterPatrolState", "AIFighterAvoidHitGroundState",
    FiniteStateMachine.CreateFSMStateToAnotherFSMStateTransition("class System.String", "AIFighterAvoidHitUnitState", n

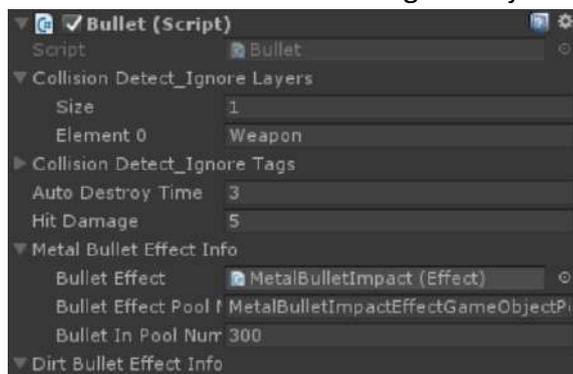
    FiniteStateMachine.CreateFSMStateToAnotherFSMStateTransition("AIFighterChaseState", "AIFighterAttackState", new IFSM
    FiniteStateMachine.CreateFSMStateToAnotherFSMStateTransition("AIFighterChaseState", "AIFighterPatrolState", new IFSM
    FiniteStateMachine.CreateFSMStateToAnotherFSMStateTransition("AIFighterChaseState", "AIFighterAvoidHitGroundState", :
    FiniteStateMachine.CreateFSMStateToAnotherFSMStateTransition("AIFighterChaseState", "AIFighterAvoidHitUnitState", ne
```

7. The introduction of other system module

The Modules we will talk about below, all fields are described in their code.

(1) Bullet

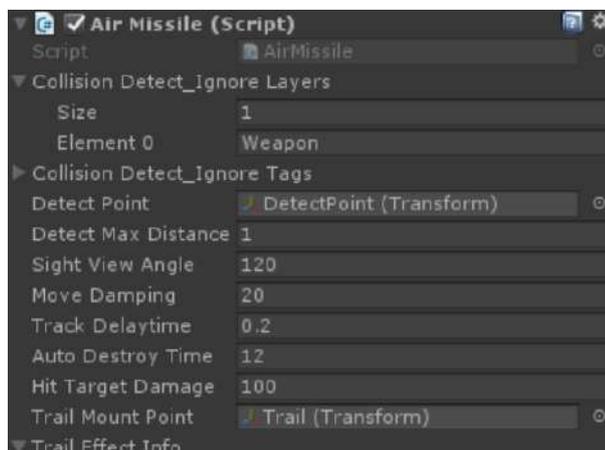
This module simulate the bullet behavior,when bullet was spawned after a few seconds defined by the field named Auto Destroy Time,it will be recycle by its GameObject Pool automatically. If bullet hit other gameobject,the impact effect will be spawned at hit position,and if that gameobject has the lifsystem component,then the bullet will assign the damage value to it,and decrease the life value of that gameobject's lifeSystem.



(2) AirMissile

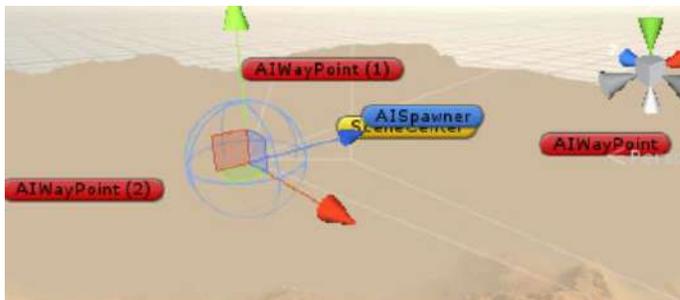
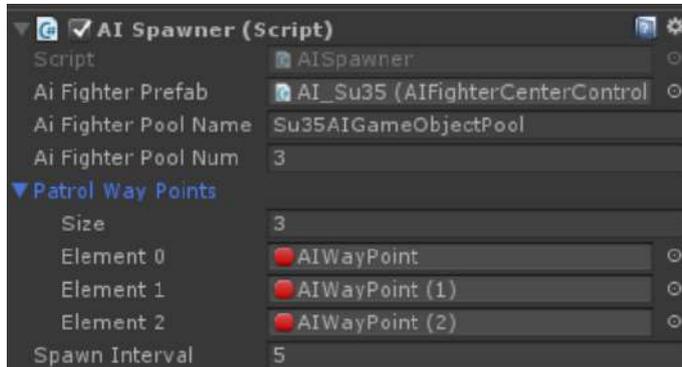
The air missile has its own field of view determined by the field named Sight View Angle,if the target always in its field of view,air missile will continue to track the target.if the target is out of air missile's FOV,then we say air missile lost target,it will not track target any longer.

If air missile hit other gameobject,the explosion effect will be spawned at hit position,and if that gameobject has the lifsystem component,then the air missile will assign the damage value to it,and decrease the life value of that gameobject's lifeSystem.



(3) AISpawner

The AI fighter must be spawned by the AISpawner, don't forget to set the patrol waypoints for it. The patrol waypoints will be assigned to each AI fighter when they are spawned.



8. Contact

If you have any questions, please send email to me: 18311310080@163.com