Small Team, Huge Game, and Lua

Brian Cronin

UNKNOWNWORLDS

ENTERTAINMENT

About Natural Selection 2

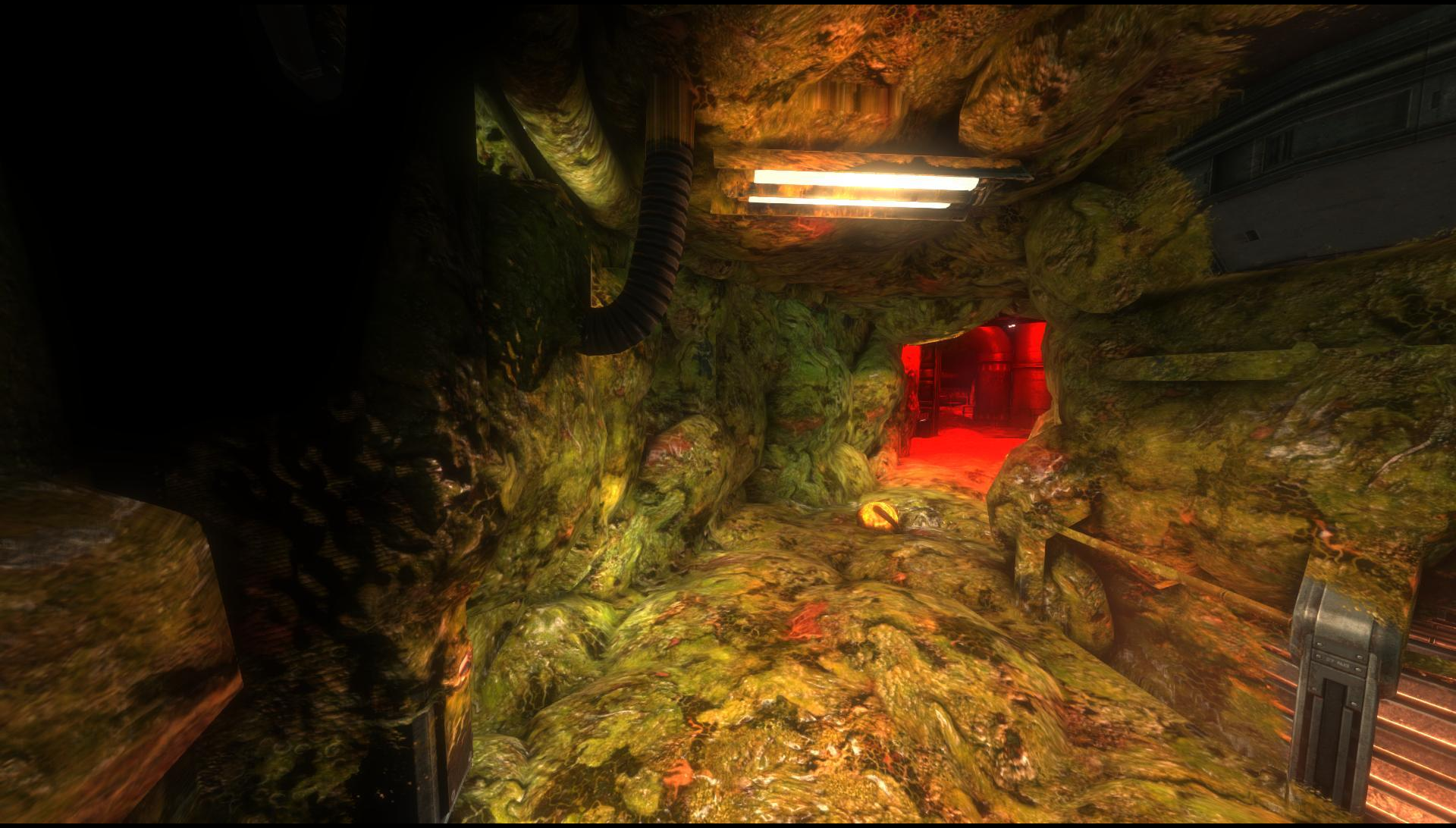
- UWE formed in Oct. 2006 in San Francisco, CA
- Core team of 9 with several others around the world
- NS2 is a sequel to a modification of the game Half Life
- Custom game engine

Two very unique teams

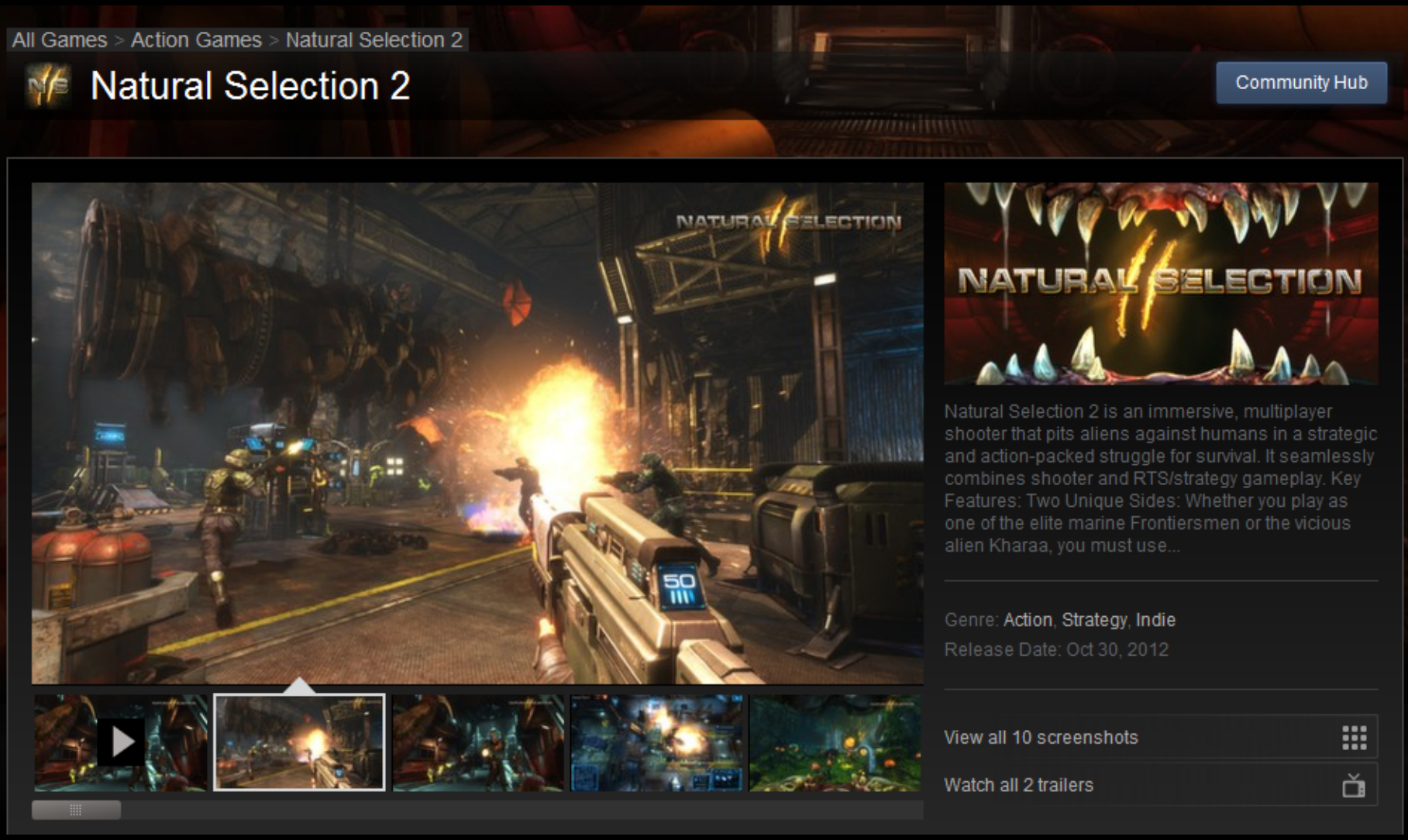
Online multiplayer

Hybrid first person shooter/real time strategy

Dynamic Environments

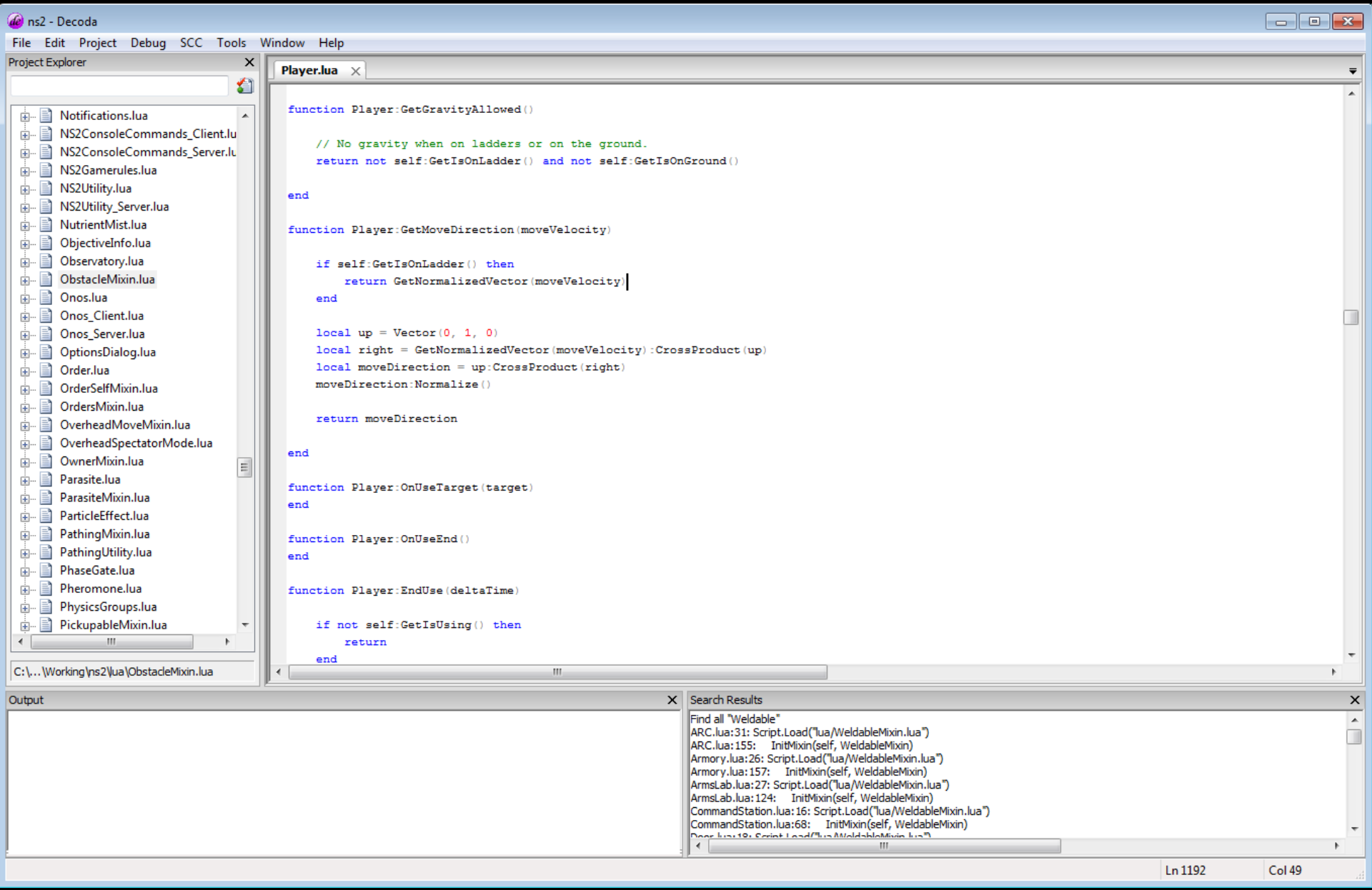


Released Halloween 2012

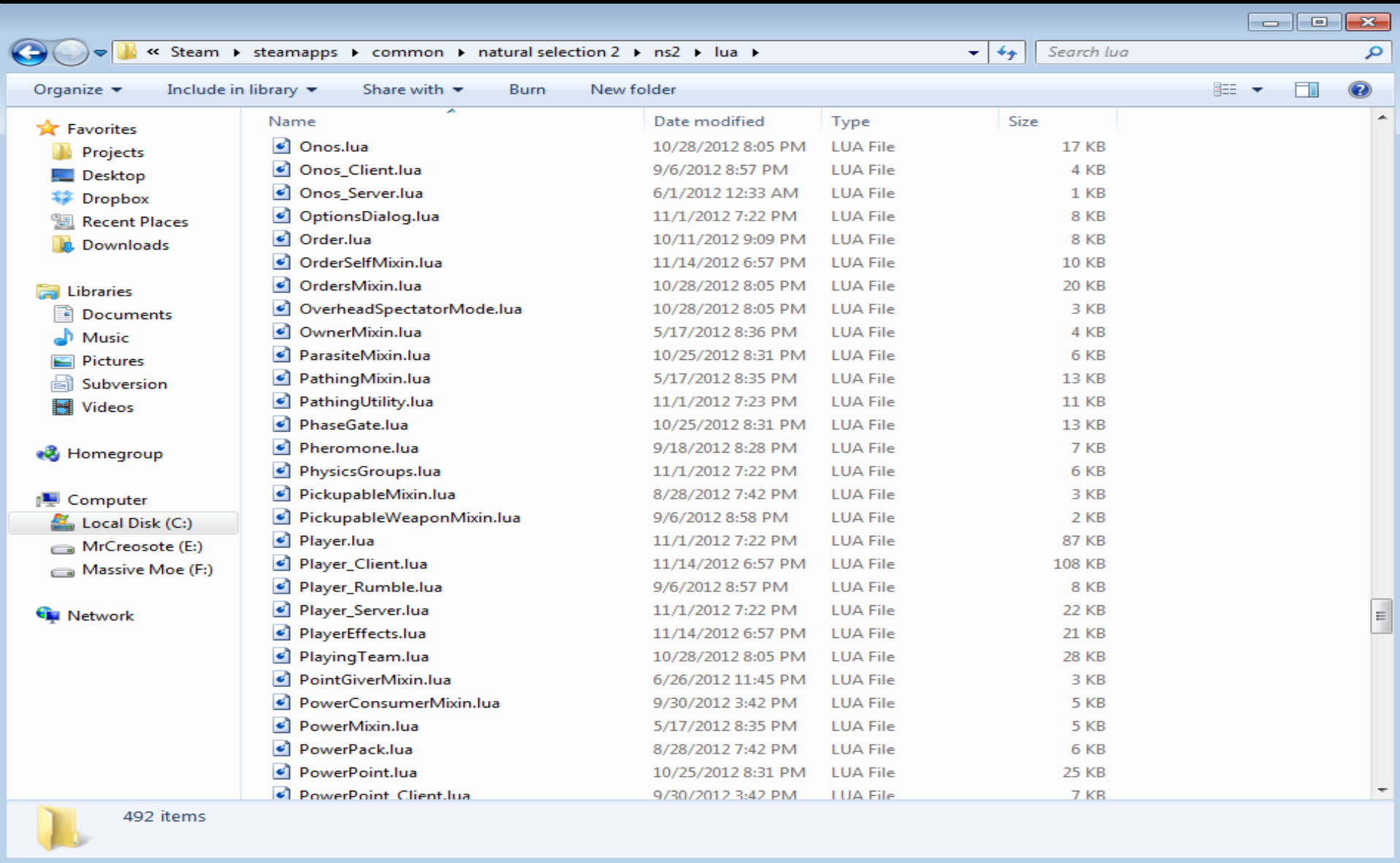


Engine written in C++

Gameplay written entirely in Lua



Lua source shipped with the game



Overview

- Lua integration within the game engine
- OOP without the hierarchy
- Script errors
- Open development

Hooking into the engine

- Two ways the game code is notified of engine events
- Global events
- Entity events

Global events

```
local function OnClientDisconnected(reason)
    Shared.Message("You were disconnected: " .. reason)
end

Event.Hook("ClientDisconnected", OnClientDisconnected)
```

```
Event.Hook("Console_hello_world",
function() Shared.Message("Hello Lua Workshop!") end)
```

Entity events

First, what is an entity?

- Persistent networked object
- Server -> Clients
- Prediction
- Lag compensation
- Container for physics, graphics, etc
- Queryable

Player, Structure, Door, Weapon, Health pack, etc

Entity events

- From engine to specific entity
- Automatically networked

Player:OnInitialized()
Player:OnDestroy()
Player:OnProcessMove(move)

Cool picture break

OOP without the hierarchy

Traditional Hierarchy

- Entity
  - Actor
    - BlendedActor
      - ScriptActor
        - LiveScriptActor
          - Structure
            - Hive
            - Armory
              - AdvancedArmory
          - Player
            - Marine
              - JetpackMarine
            - Alien
              - Skulk
              - Fade
              - Gorge

Problems with the hierarchy

Where to add new functionality?

CloakedActor

LiveScriptActor

- Structure
  - Hive
  - Armory

Problems with the hierarchy

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Problems with the hierarchy

Where to add new functionality?

LiveScriptActor

- CloakedActor?
  - Structure
    - CloakedActor?
      - Hive
    - Armory
  - CloakedActor?
    - Player
      - CloakedActor?
        - Alien

Problems with the hierarchy

Overrides lead to bugs:

```
function Marine:OnKill()
    Player.OnKill(self)
    self:RemovePoints(10)
end
```

Problems with the hierarchy

Overrides lead to bugs:

```
function Marine:OnKill()
    -- The Marine sometimes respawns very fast!
    if self:CheckForQuickRespawn() then
        self:RespawnQuick()
    else
        Player.OnKill(self)
        self:RemovePoints(10)
    end
end
```

OOP without the hierarchy

Traditional Hierarchy

- Entity
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        - **LiveScriptActor**
          - Structure
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The Overly Responsible LiveScriptActor

- Being alive, health, and armor

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- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)
- Scoring

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)
- Scoring
- Team

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)
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- Energy

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)
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- Energy
- Construction

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)
- Scoring
- Team
- Energy
- Construction
- Using
- Orders
- Power
- Researching
- Stunning
- Upgrading

Cool picture break

Mixins

- Where to add new functionality?
- Overrides

What is a Mixin?

- A piece of functionality
- "Attaches" itself to an object
- Is NOT organized within a hierarchy

LiveMixin

```
LiveMixin = { type = "Live" }

function LiveMixin:__initmixin()
    self.health = 100
end

function LiveMixin:TakeDamage(amt)
    self.health = self.health - amt
end

function LiveMixin:Heal(amt)
    self.health = self.health + amt
end
```

Adding mixins to an object

```
local player = Server.CreateEntity("Player")

InitMixin(player, LiveMixin)

player:TakeDamage(50)
player:Heal(10)
```

Behind the scenes

```
function InitMixin(entity, mixin)

    for name, func in pairs(mixin) do
        entity[name] = func
    end

end
```

How to handle overrides

```
local CloakableMixin = { type = "Cloak" }

-- Uncloak when taking damage.
function CloakableMixin:TakeDamage()
    self:Uncloak()
end
```

How to handle overrides

```
local CloakableMixin = { type = "Cloak" }

-- Uncloak when taking damage.
function CloakableMixin:TakeDamage()
    self:Uncloak()
end

function LiveMixin:TakeDamage()
```

How to handle overrides

- Only call the first function attached?
- Require explicit calls to specific mixins?
- Call all the functions attached?

How to handle overrides

- Only call the first function attached?
- Require explicit calls to specific mixins?
- Call all the functions attached.

Behind the scenes

```
function InitMixin(entity, mixin)

    for name, func in pairs(mixin) do
        if entity[name] == nil then
            entity[name] = func
        else
            AddFunctionToCallerList(entity, name, func, mixin)
        end
    end

end
```

How to handle overrides

```
local player = Server.CreateEntity("Player")

InitMixin(player, LiveMixin)
InitMixin(player, CloakableMixin)

player:Cloak()
player:TakeDamage(50)
assert(not player:GetIsCloaked())
```

Cool picture break

Querying for mixins

```
function Bomb:Explode()

    local nearbyEnts = GetNearbyEnts(10)
    for i = 1, #nearbyEnts do
        nearbyEnts[i]:TakeDamage(25)
    end

end
```

Querying for mixins

```
function Bomb:Explode()

    local nearbyEnts = GetNearbyEnts(10)
    for i = 1, #nearbyEnts do
        nearbyEnts[i]:TakeDamage(25)
    end

end
```

Querying for mixins

```
function Bomb:Explode()

    local nearbyEnts = GetNearbyEnts(10, "Live")
    for i = 1, #nearbyEnts do
        nearbyEnts[i]:TakeDamage(25)
    end

end
```

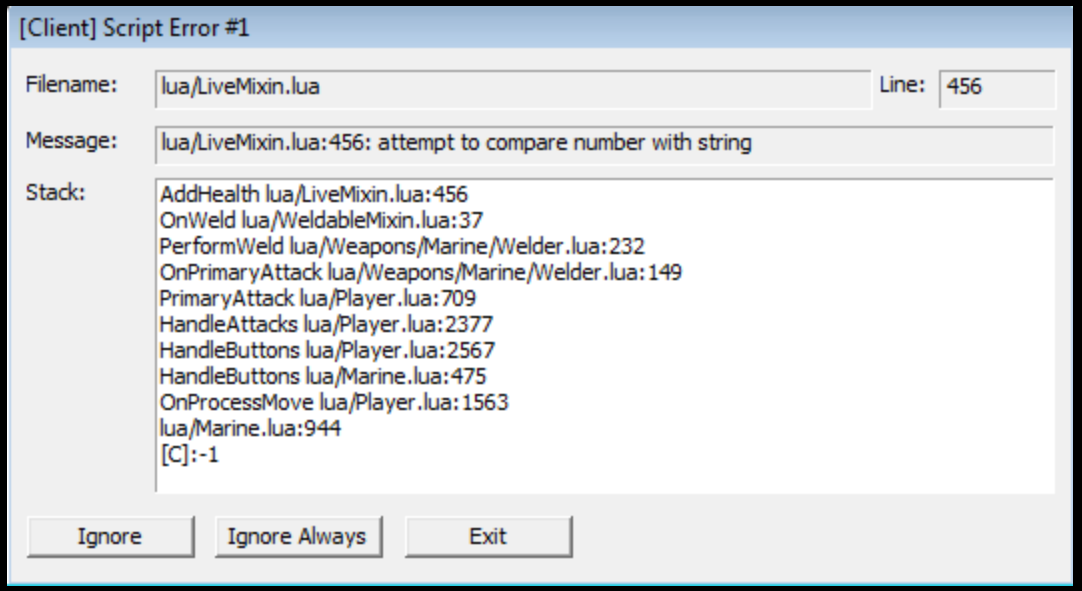
109 Mixins in NS2

- PowerSourceMixin
- ModelMixin
- FireMixin
- FreeLookMoveMixin
- FollowMoveMixin
- OrdersMixin
- PathingMixin
- PickupableMixin
- PointGiverMixin
- ...

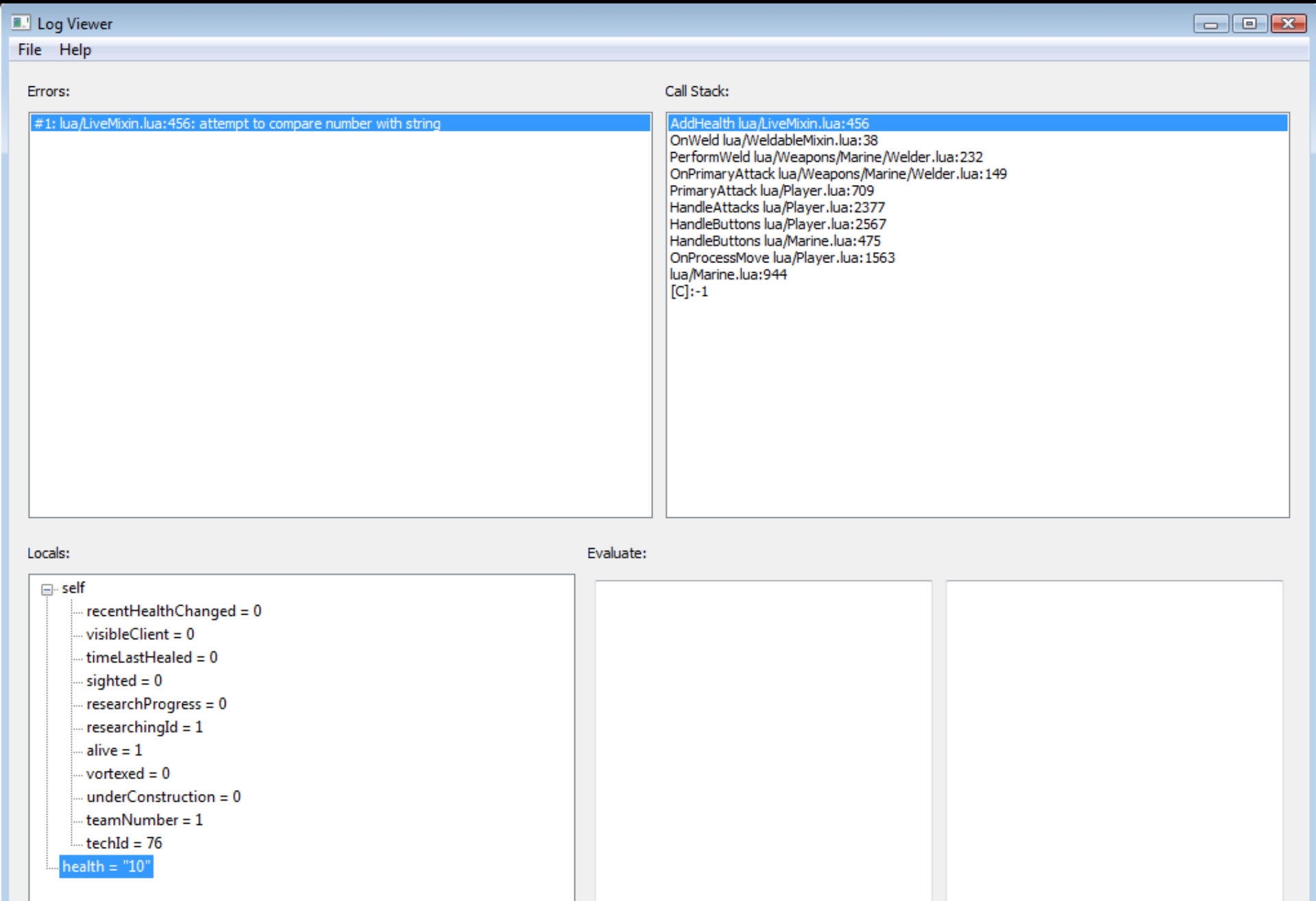
Script Errors

- Line number
- Call stack
- State
- Automatic collection

Script Errors



Script Errors



Script Errors

```
function WeldableMixin:OnWeld()
    self:AddHealth("10")
end
```

Script Errors

Garry's Mod Errors Top Errors

Top Reported Errors

1 Minute | 5 Minutes | 15 Minutes | **1 Hour** | 1 Day | 1 Week | 1 Month

87	bad argument #1 to '?' (string expected, got no value)	sandbox
73	lua/autorun/shared.lua:16: ')' expected near 'ply'	base
68	lua/effects/bodyshot/init.lua:17: ')' expected near 'physics'	sandbox
54	gamemodes/perp/gamemode/cl_vehicles.lua:98: attempt to call method 'InVehicle' (a nil value)	perp
51	...d cow's weapons/lua/effects/effect_mad_gunsmoke/init.lua:41: Tried to use a NULL entity!	darkrp
50	...d cow's weapons/lua/effects/effect_mad_gunsmoke/init.lua:22: Tried to use a NULL entity!	darkrp
45	gamemodes/perp/gamemode/cl_modules/radio.lua:15: Module not found!	base
42	lua/weapons/cse_base/shared.lua:19: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
42	lua/weapons/cse_base_as/shared.lua:16: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
42	lua/weapons/cse_base_bs/shared.lua:16: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
41	lua/weapons/cse_base_a/shared.lua:18: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
41	lua/weapons/cse_base_abs/shared.lua:16: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
41	lua/weapons/cse_base_s/shared.lua:16: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
39	LuaCmd:1: attempt to call method 'ChatPrint' (a nil value)	1942rp

Script Errors

Garry's Mod Errors Top Errors

Details

error #1210070651 | base | 7,041 reports | 1,625 reporters | first seen 9 days ago

Error

```
gamemodes/perp/gamemode/cl_modules/radio.lua:15: Module not found!
```

Call Stack

```
 1. require - [C]:-1
  2. unknown - gamemodes/perp/gamemode/cl_modules/radio.lua:15
   3. include - [C]:-1
    4. unknown - gamemodes/perp/gamemode/cl_init.lua:44
```

Open Development

- Bug fixes
- Optimizations
- Gameplay features

Open Development

Your location: Translation > German

Menu

- Arabic
- Chinese (Simplified)
- Chinese (Traditional)
- Croatian
- Czech
- Danish
- Dutch
- English (British)
- Finnish
- French
- **German**
- Greek
- Hungarian
- Italian
- Japanese
- Korean
- Lithuanian
- Norwegian
- Polish
- Portuguese (Brazil)
- Portuguese (Portugal)
- Romanian

Filter

Delete filter

Options

Show all strings | Hide accepted strings | Download file

Strings to translate - German

ADRENALINE_SPUR_HINT ("More alien energy") [Use original text as translation]
"Zusätzliche Energie für Aliens" [1p. / approve / delete]
"Zusätzliche Alien Energie" [0p. / approve / delete]
"Zusätzliche Alienenergie" [0p. / approve / delete]

ADRENALINE_SPUR_TOOLTIP ("Gives aliens more energy") [Use original text as translation]
"Gibt Aliens zusätzliche Energie" [2p. / approve / delete]

ADRENALINE_TOOLTIP ("Double energy pool.") [Use original text as translation]
"Verdopplung des Energiepools." [2p. / approve / delete]

ADVANCED_ARMORY_HINT ("Flamethrowers, grenades") [Use original text as translation]
"Flammenwerfer, Granaten" [6p. / approve / delete]
"Flammenwerfer und Granaten" [-2p. / approve / delete]
"Flammen- und Granatwerfer" [-2p. / approve / delete]

ALIEN_ALERT_NEED_ENZYME ("Player requesting Enzyme Cloud") [Use original text as translation]
"Spieler fordert Enzymwolke an" [1p. / approve / delete]

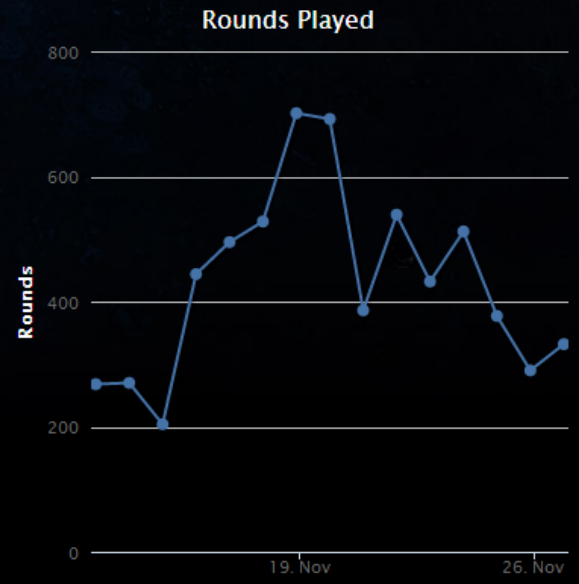
ALIEN_ALERT_NEED_MIST ("Player requesting Nutrient Mist") [Use original text as translation]
"Spieler fordert Nährstoffwolke an" [0p. / approve / delete]

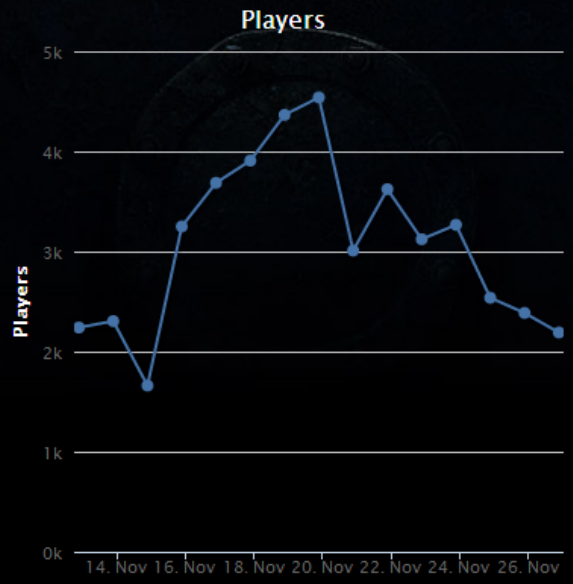
AMMO_PACK_TOOLTIP ("Ammo to fill any weapon") [Use original text as translation]
"Munition zum Befüllen jeglicher Waffen" [1p. / approve / delete]
"Munition zum Befüllen jeder Waffe" [-1p. / approve / delete]

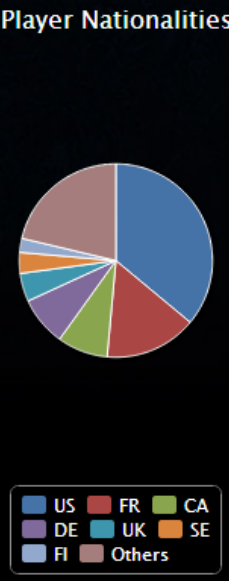
ARC_HINT ("Commander artillery") [Use original text as translation]
"Commander Artillerie" [-1p. / approve / delete]
"Mobile Artillerie" [0p. / approve / delete]
"Commander-Artillerie" [0p. / approve / delete]

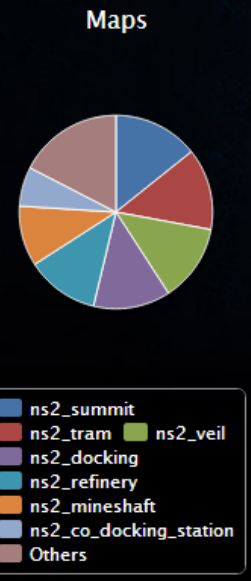
ARC_ROBOTICS_FACTORY_HINT ("Builds MACs and ARCs") [Use original text as translation]
"Baut MACs und ARCs" [4p. / approve / delete]

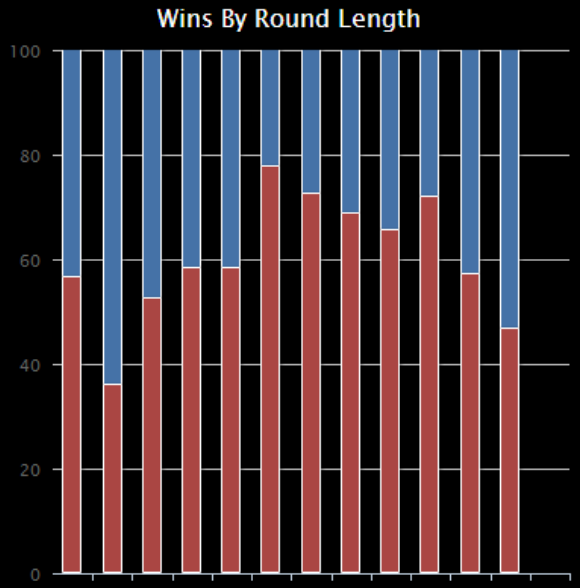
Open Development

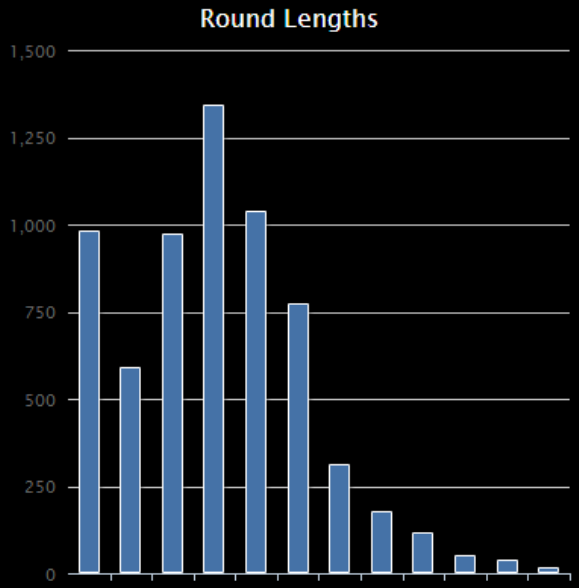


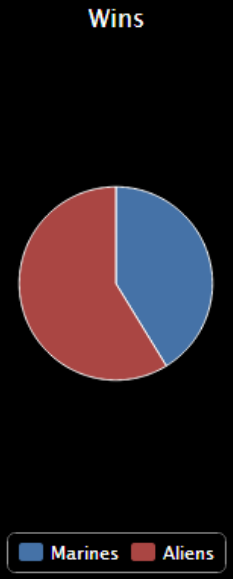






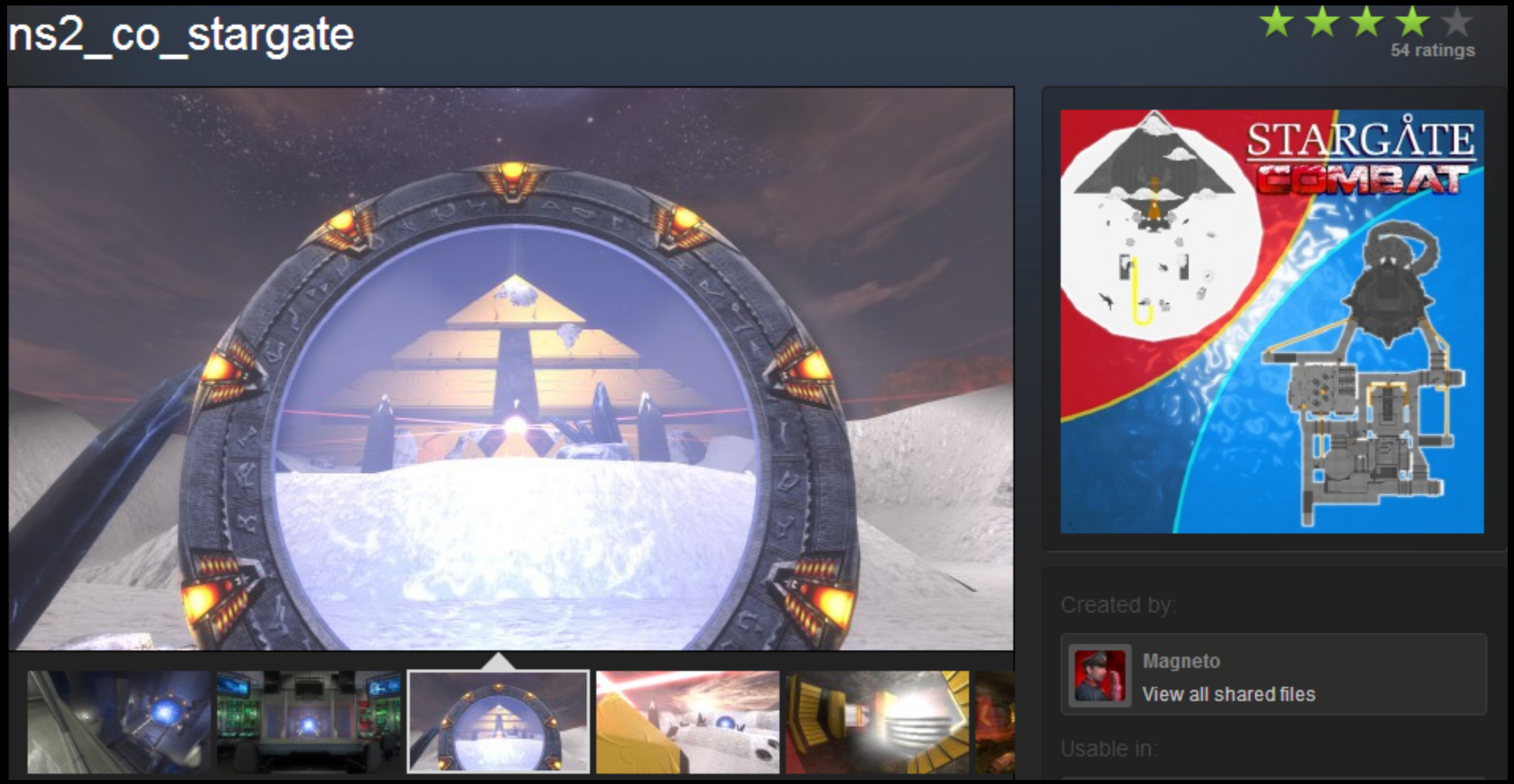






Many bots have been harmed during the development of this site.

Open Development



Open Development

★★★★☆
e_X_w Shotgun
by aageon

★★★☆☆
Colonial Marines - Exo Sui...
by Nomad

★★★★☆
Compact LMG
by Ice

★★★☆☆
Custom Shotgun Mod
by Nick²

★★★★☆
Hello Kitty Rifle
by NoFucksGiven.Jpg

★★★☆☆
Blood Gorge
by [CYNICAL_MASS]

★★★☆☆
Colonial Marines
by Nomad

☆☆☆☆☆
Colonial Marines - Hands
by Nomad

☆☆☆☆☆
J13 Elite Crosshairs
by Pizza Supreme

Open Development

Thank You!

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CARGO TRANSFER SOUTH
NATURAL SELECTION II
COMMANDER: MOTIG^
TEAM RES: 200
300
56 RESOURCES