

# Game Design Document for COMP3000 Project

Brainstorm Page

Feedback and backlogged changes

## Introduction and game premise

This game aims to be a first person, stealth focused tactical shooter with game systems that make the player feel cool by earning it. Skill is rewarded with style and efficiency, but is expected to be learned gradually through repeat playthroughs. One scenario can be played out in many ways, and it's up to you to find your answer.

## Inspirations, personal preferences and initial ideas

I want this game to be one that rewards players who are curious, who wish to master systems not to optimise playtime but to seek enjoyment in something. I am the type of player who will experiment with game systems to understand how they work from the ground up, to better play out scenarios in a way that feels like I chose my own way to solve it, a method that feels cool, looks cool and demonstrates an understanding of game knowledge alongside tight execution. I love stealth and movement choreographies in games, a form of video where the creator plans an elaborate sequence of actions like stealth kills or parkour sequences with the goal of creating a video that looks cool and demonstrates knowledge and skill. Whenever I play games I seek enjoyment by peering into the depths of that game's systems, aiming to understand it and use it to feel cool and give the game more worth.

A large inspiration when it comes to this feel is Assassin's Creed. While every game in the franchise varies dramatically, they all follow a similar sort of feel that has them aligning with my preferences almost perfectly - freedom, complex systems, player expression and fantasy. Assassin's Creed 1 is a tightly focused game where skill in each of its core pillars are rewarding. Your approach can vary wildly to another player, it's mechanics are designed to reward pushing yourself and learning it's intricacies, and by delving into those systems you achieve a narrative symbiosis with your character and the setting. I won't go into too much detail but I do break down AC1 and how it achieves this in my analysis doc for it.

Dishonored is another example. Players tend to play the low chaos, non lethal route to start with to stay narratively 'canon', so they use the opportunity to explore and learn the game's systems. But after some hours playing, those who choose to delve into those underlying systems and push the boundaries may end up like GrayMischief or Fighter Tree on Youtube, pulling off stunts that the regular play may not even know were possible. That feeling of constructing your own solution that looks and feels cool is the experience I want to capture.

However I also wanted to take an element from the ghost recon games and Doorkickers 2. Most stealth games revolve around balancing clarity of information, often providing you with safe spaces to plan and then operate in. Ghost Recon's random enemy placement and lack of information means a vital skill comes in the form of pre planning. The old rainbow six games and doorkickers 2 excell at this, as well as modern tac shooters. You need to create a playstyle that lets you succeed in any situation - managing exposure to enemies, checking corners and moving while considering possibilities rather than acting with intentionality. I love how that manages to inject decisionmaking into areas where enemies may not be, and I want to capture that idea too.

## Desired game feel and design

Taking a note from Zubek's Mechanics, Dynamics, Aesthetics approach, I want to ensure the whole experience adheres to a specific fantasy, tightly woven with game systems in a similar way as Assassins Creed 1 handled it.

In this game you work as a team of 4 military mercenaries who are sent out to do jobs for various contractors. The world is this dark, semi post apocalyptic setting that blends the dreariness of AC1 and Armoured Core 6 with the dark magic of Dishonored. Certain individuals are given magic powers that specialise in a certain area, as well as a plethora of gadgets.

The game will be mission based with open levels, as if playing Ghost Recon Wildlands but outposts are individual missions.

### Aesthetics and narrative feel first

In order for the game to feel both extrinsically and intrinsically satisfying, i want to take a lesson out of AC1's book and find ways to blend the game's core pillars with the narrative, to ensure that every part of the game loop makes narrative sense and the player's personal development in improving their understanding and skillset has them feeling more and more immersed within that aesthetic.

### Game structure and core loops

The game will feature these main stages:

- Mission briefing
- Deployment and preparation
- Information gathering
- Setup
- Plan
- Execute
- Adapt
- Recover
- Exfil

Covering an entire mission, these stages are the main loops you will encounter.

### Teammate control and planning design

The most important system that drives this game is the ai teammate control mechanisms. I wanted to learn from systems used in other games and create something that solves a lot of the problems i personally faced while playing other games with teammates to control.

Some games like Swat 4 have you giving a command, and the teammates execute it perfectly. If you die, you lose, if a teammate dies it isn't the end of the world. That dynamic means more often than not the extent of your interaction is giving them a single order and then watching them execute it. Doorkickers 2 is the complete opposite. Ai still perform the actions you give them, but you place every move marker, every action, every change in aim position. Failure is down to your inability to plan, and success is down to your knowledge and skill. However, since it is purely top down, it lacks the tactile feel of being in the moment actually playing the game. I have done a lengthy analysis of other teammate control systems in games, present in my design document here <ADD LINK>.

As such, I have some guidelines that I want to adhere to when it comes to how the ai are controlled and how teammates affect the gameplay:

1. Every major action or decision an ai makes should be created and directed by the player
2. it should be clear exactly what an ai will do when given an instruction, and conveyed beforehand
3. The success and failure of a teammates actions should be the result of a mistake in planning and awareness by the player
4. it should be simple and straightforward to create tasks while planning, but with complexity in its potential
5. The player should be able to involve themselves in the actions of the ai without feeling like an observer, the only meaningful contributor or a detriment.

To achieve these design guidelines I want to implement the following:

- Switch from a first person perspective to a top down view at will
- Command ai to move using a map drawing system
- Provide specific action instructions both contextually and non contextually.

### Teammate control specifics

I want to mix ideas from all these games into one that fits the desired pacing.

To start with, you have 3 teammates excluding yourself. You can select them with the different F keys.

### Contextual actions

Some actions that would otherwise take time to accomplish on the map which I don't feel is worth the time will be quick contextual actions. In something like Swat 4 these will be commands like 'move there' or 'stack up here'. Complicated actions require user input in order to adhere to my rule of being engaging, but these ones can get by being simple.

These actions could be:

- Move to location
- Stack up here
- Cover here (aims at selected location)
- Take out this guard (choke, knife, gunshot)

for the most part they are actions that would take 4 presses to do with the map, more easily accessible to improve pacing without sacrificing the goals of this teammate system.

### State changing orders

Move, aim and ability orders all come under 'actions'. State changing orders are those that alter a soldier's movement speed, stance, behaviour etc - something that alters how they behave from that point onwards. I would like this to be done through a quick menu like the contextual actions, set up like how Arma 3 tackles it.

To start with will be the movement and stance orders:

- Slow walk - super slow and quiet
- Tactical - not slow, not fast. Good speed to round corners and check spots
- Breaching - move as fast as possible while allowing for aiming still
- Sprint - as fast as possible, but with the slowest aim speed

Next will be the stance behaviours:

- Low profile - Defaults move speed to slowest and stance to lowest. An emergency stop and drop
- Crouch
- Prone
- Copy stance - replicates your stance
- Automatic - changes stance based on selected move speed

after this will be engagement rules:

- Stealth - only fire when actively engaged
- Fire at will - fire when a shot is available on any visible target
- Confirm target - requests a shot confirmation before firing (see section on topic)
- Fire if safe - Perform a witnesses scan on the enemy, if it comes back saying the kill is secure then take it

### Shot confirmation

In the specified engagement state, enemies will be seen by the ai and reported to the player. There will be a voice line and a pop up on the side of the screen with two options. Pressing the 'view camera' button will show a PIP image of what they see, letting you see yourself what enemy they are aiming at. You can then confirm or deny with a button press.

### Contextual order queuing

Multiple of these quick actions can be queued where it makes sense, for instance multiple move commands can be chained in sequence. Holding shift and placing the order will chain it. Can then press any of the number keys and it will tie the start of that sequence to a go code.

#### Teammate switching

In order to allow you feel like part of the team, you will be able to switch teammates. This will be done by holding ALT and pressing the number key for that teammate.

#### Top down map view and orders

The bulk of teammate ordering is done in the top down map. This gives you a greater field of view and allows you to plan in more detail.

#### Time freeze

In order to give yourself time to plan and not feel rushed, time can be frozen on command as you enter the map view. Once a shot is fired or an enemy does this freeze time period enters a cooldown, so you can't just use it mid combat for instance to get a quick win.

#### Movement in top view

In order to offer the best possible control over teammates and feel like you are properly controlling them, movement orders can be given by drawing on the map. Simply pressing will create a movement marker to that position which they will pathfind to. Drawing a line creates a path that follows the cursor, indicating the exact path your teammate will take, with animated lines showing the speed of movement.

#### Aim orders

Covering angles and clearing effectively is vital in the planning phase. So the aim orders need to cover plenty of bases.

- Hard cover - aim in the designated direction, keep aiming in that direction relative to their position even while moving
- Pie - select a location to aim at, will continuously point at that location while moving
- Soft cover - aim at in a direction. Keep aiming for a few seconds and then return to the forward position while moving

#### Information gathering design

The amount of information available to the player has a drastic effect on their playstyle. In Assassin's Creed for instance you are given the ability to see enemies through walls at a distance and close up. That information gives you the room to plan ahead. The risk of being seen is low since pairing that with the third person camera gives you ample time to reposition before someone turns a corner, and you can plot out your next steps while up high or waiting by said corner. Swat 4 or Thief 1 in contrast gives you no such information, so players will instead behave more cautiously. The lack of information - specifically enemy locations and behaviours - shifts your playstyle to one where you peek corners carefully, checking every possible spot and planning for all eventualities. You often get caught out and have to react accordingly, so maintaining stealth becomes harder, with a greater element of risk.

In this game, I want to lie somewhere in the middle of that spectrum. You should be able to gain information about the world, guard placements and behaviours, but said information should be a little harder to gain, with elements of intended 'opaqueness' where you will have to implement precautionary approaches to clearing.

Each of my characters has a dedicated information gathering tool available, each one with strengths and weaknesses. The sniper has a projectile fired camera, gunslinger has a ground based mobile drone, the breacher has a pulse detector and the assassin can possess enemies. Each of these are meant to compliment the playstyle of the class but also adhere to a set of rules regarding information transparency:

1. Information gathering tools should have 'blind spots', or weaknesses that mean precautionary tactics must be employed
2. Complete observation of a game scenario requires the use of all characters

#### Stealth design

Given the more precautionary and pre-emptive style of gameplay, one where you use information and act in a sequence of events to move through or clear an area, stealth will primarily be used as a way to set up plays and change positions to execute certain plans. There will however be specific situations where pure stealth is utilised. Players can choose to go pure stealth and the game will allow for and help promote it.

Safe spaces will be used as areas of comfort, granting players a chance to plan, hide and observe. Enemies will sometimes contest these safe spaces but since player skill should come from execution and planning, I don't want it's stealth to be more reactionary like Thief, Filcher or Gloomwood. Lack of information should introduce the reactionary and dynamic encounters as you round a guard you weren't expecting.

#### Camera perspective

The player perspective as a surprising influence over how a game is played. In Ghost Recon Breakpoint, the third person perspective means you can aim at a corner and see the exact location and movement of an enemy, pre aim them and walk out to shoot them before they can react. It puts power in your hands, letting you act with more information. Meanwhile something like Thief purposefully hides information. Peeking around a corner can have a guard noticing your head, sound being the only form of safe intel gathering which is itself unclear and inaccurate.

#### Balancing between combat and stealth

One thing I dislike in games is when the fail state of stealth, combat or escape, lacks any meaningful challenge or satisfaction. I will cover the specifics of how these fail states are designed later, but I want to go over how I will balance the choice between combat and stealth. In many stealth games you do have the option to move with speed through an area, eliminating threats efficiently with little pushback. Ghost Recon succumbs to this. Enemy reaction time, damage values, weapon accuracy and information transparency means you have ample ability to skip stealth and fight through them with relative ease.

In this game I want the player to be strong when they can maintain stealth, but weak when detected and engaged. Detection can be leveraged as a stealth tool, but you should be punished for detection since the game gives you more tools to plan an encounter. Games like Ghost Recon or SWAT make it easier to fight back since they intentionally reduce information clarity, so easy combat and recovery is a balancing act to reduce punishment, but given the lengths of planning and information tools available, I want to make this an important difference.

To achieve this I will balance weapon mechanics, resources, enemy reaction time and combat dynamics.

- Teammates and the player will experience suppression when under fire
- Ammo is scarce and enemies take more than one shot to kill
- The player should use AI for multikills, or clever environmental and skill usage. Weapons should be designed such that fast flicks aren't as viable and you shouldn't be able to take out many enemies solo, but short ones can work. Cover a small sector.
- Enemies react quickly to gunshots, and will fire relentlessly

#### Player weapon mechanics

In tactical shooters, especially Doorkickers 2, the foundational rule that determines your success or failure is your ability to have your gun up, aimed such that any enemy that can shoot you is within a cone of vision that lets you shoot them with minimal adjustment. The idea is that exposing your sides to an enemy should be fatal. To avoid fast flicks, the weapon will lag behind a bit during turns, similar to Stalker 2. The sight misalignment will mean that when making a sharp flick it takes a second for the sight to stabilise and be usable. Which can lead to decisions - either fire while looking in the rough direction of the enemy and hope for a hit, or wait for it to align. That time wasted would be enough for the enemy to fire on you.

Shooting while on the move will be disincentivised. The goal should be to use utility to aid in clearing a corner, using multiple characters to aid in that task. So while moving to the side and aiming, weapon sights will sway to introduce some inaccuracy. You can risk shooting while moving or stand still and wait for it to stabilise.

When under fire the weapon will buck, moving its sight off centre, making it unviable to aim with. With the aim of getting players to reposition instead of peeking and shooting them there and then.

#### Ammo economy and enemy armour

As mercenaries, you are given few resources and expected to perform well. Playable characters have only 1 mag to use. For instance a pistol may only have 7 bullets. This will get the player to think more about their ammo usage as shots matter more. In the previous scenario, spraying will waste precious resources for little gain, but waiting to stabilise will take too long, so there is incentive to retreat and hide. Enemies also have a form of armour. Chest shots will deal little damage. They may have helmets which require one shot to break / fling off, and another to kill. Some helmets can have exposed spots at the back or sides which can be used to grant one shot kills if positioning is good. Similar to how Dishonored gives helmets to Overseers, bullets can be more about stunning the enemy. If they cannot be oneshotted, you can shoot their leg, or gun arm, or helmet and it'll stun them, potentially exposing weaker parts and giving you a chance to run up and melee kill them.

Gaining ammo is to be handled in a unique way too. Doom eternal has an ammo economy built around fighting with weapons, then melee killing a demon to replenish your stock and continue. A somewhat similar approach is taken here. Enemies have magazines attached to their belts, bio-locked magazines that if it detects that the owner is dead, will lock up. However if the player can utilise stealth, distractions and the environment to get behind them, you can pickpocket their ammo. This replenishes your supply, but also lowers the enemy's supply. This means ammo won't be gained as easily by expending it to grant kills, and will get you using stealth and the utility of other characters to get behind, pickpocket and choke out guards to build up that offensive force.

One issue I considered while brainstorming this idea is that stealthing will replenish your bullet supply, a loud offensive resource used for killing. The player who chooses to play stealthily won't benefit from this as much. So some enemies will also carry parts used to make stealth tools, or the bullets themselves also act as a source of 'mana' to let characters perform their abilities.

Tool, gadget and ability design

When it comes to gadgets and abilities, I have some set rules I wish to abide by:

1. Gadgets should be useful in isolation, powerful in conjunction
2. Have usages outside of their immediate use case to promote experimentation
3. Not supplant player skill or knowledge, but aid it and act as an extension of it

Dishonored's abilities are all exceptionally designed. Each one has its own use cases in isolation but can all either bounce off of each other or be used in unexpected ways. That level of freedom, creativity and internal satisfaction for using these systems in ways that don't *feel* intentional is what I want to capture.

I also want to refrain from abilities or gadgets that give you only positive buffs that offer no real changes to gameplay, or hand you things without much player involvement. For instance, abilities that once activated simply make you harder to detect, or a 360 degree wallhack scanning tool, or a large AOE instant kill ability. Should all have certain use cases and their benefits can be seen through clever usage, not a simple button press.

Player satisfaction and game loops

With all that defined, the aspects that make up the core game loop are more clear. I want the player to start off in this semi-big map with characters that need to be given instructions, a goal to complete and ways to go about it in their own way. Using stealth to position teammates, tools to gather information, then figure out a way to take out enemies with style and finesse, combining player skill and game systems to act as a form of self expression. You will need to use multiple teammates to cover angles, peek precisely and manage what you will do if you encounter an enemy. It's all about planning and pacing, with systems in place to reward mastery.

When first playing the game, the player will probably use a single character and use the others as backup, or maybe not use them much. But as the moment to moment gameplay becomes more intuitive, should see how using them is beneficial. I want them to replay levels and try different tactics, playstyles and approaches. Get them to experiment and seek out mastery for their own enjoyment. Then put together a fantastic performance using teammates and themselves to clear areas and complete objectives like watching a cutscene from cod modern warfare.

First development milestone

In order to avoid immediate feature creep I want to come up with a first milestone and stick to it. I want to get something in my hands to then playtest and make changes to after trying it rather than trying to figure out the design before actually

playing it.

The core systems should be in place to act as a proof of concept. Meaning the following:

A weapons system with no art or nuance. Weapon presets for:

- Sniper
- Revolver
- Pistol
- Thrown Daggers
- Shotgun

Simple to implement abilities with less advanced functionality to allow for testing. I want to show how each character feels unique, and showcase the design approach of abilities and gadgets but not delve too far into it where change is difficult.

Will add (in their simple forms):

- Teleport anchor
- Subterfuge
- Coin toss
- Dagger blink
- Hidden veil
- Decoy
- Grapple grab

For ai Control I want to have:

- Teammate selection with F keys
- Targetted move command (contextual and map)
- Directional aim command (contextual and map)
- Pie aim command (contextual and map)
- No aim command (contextual and map)
- Top down map order assigning

For action queuing I will use a simpler system, as after testing I will try and find a system that I feel will work well.

- Hold shift to queue actions
- Press a key while selecting a teammate to execute all tasks.

## Links

Github Repository - <https://github.com/TheBulletKin/COMP3000-Project>

Trello board -

<https://trello.com/invite/b/671a5ca24230e67bbb8b0897/ATTI65f5451d0f93e6b88abdf832905eb68479840ACB/comp3000-computing-project>

## Presentation

The game will use a low poly aesthetic similar to Swat 4, Splinter Cell Chaos Theory and the original Ghost Recon, mostly because it would allow for faster asset creation and therefore more time to spend on more important features, but also because I personally prefer that art style. Games like Thief and Gloomwood have such good visual language through atmosphere, environmental world building, thematics and tone that I feel it is most definitely possible to create a game that

looks good through composition and colour over pure visual fidelity. Valheim, Chaos Theory, Swat 4 and Gloomwood are all examples of games that use their low fidelity aesthetic to astounding lengths to create visuals and atmosphere that rivals modern games.

<https://drive.google.com/drive/folders/1UKSFCTcfrYpjASkJpOwO2PhHEA3s7vLZ?usp=sharing>

It will have a fairly dark tone akin to the modern warfare or splinter cell campaigns, with teammates who behave seriously but have some characteristic charm.

## Game design specifics

### First Person Perspective

I've written a big passage in my personal game design notebook about how the camera perspective influences game design and aesthetic, so more details are there:

#### Game Design

For this game I want the tactical decisionmaking to be important - making the use of teammates an actually important dynamic, improving the experience for those using real world doctrine and helping teach it to those who don't know about it. It is a stealth game in the sense that you should take people out silently, but a core part is managing exposure and sightlines, clearing rooms with those deeper strategies. As such, I will start by trying out a first person perspective.

I've written some paragraphs on how third person changes up the game. Most notably it makes stealth easier by making information gathering free. If I did go to third person then I could introduce some better movement and action animations, but I'd have to change enemy perception and level design to accomodate. Would need some system in place to stop you from being able to quick peek around a corner and dome people.

To avoid over designing and trying to figure out what will and won't work, I'll stick to first person for now. After getting the game systems in place I can create a prototype for a third person perspective and see how it plays. Can compare experiences and decide what will be best there.

### Enemy Ai Design

The ai will take the form of traditional stealth ai. They will start unaware of your presence and perform various idle activities along set routes with predictable patterns and schedules. They will be able to observe you and change state. (The method in which detection builds and initiates a change of state is undecided).

They will investigate last known positions, read changes of state in the room, all stuff that stealth ai has been able to do in other similar games

### Stealth design

Many games tackle stealth in different ways. Some aim to depower the player so that combat feels like an instant loss, some want to make you avoid enemies instead of take them out, some want you to be super strong even if you are caught to really sell the power fantasy.

Quick pros and cons:

The 'ghost' stealth aesthetic:

- Very weak in combat or combat has lasting consequences. Mgsv guard adjusting to playstyles or gloomwood's survival resource management. It wants you sneak past to avoid those states
- Requires solid stealth mechanics to make gathering information, moving through the world and using tools fun. Make you feel like you've outsmarted tough enemies
- General aesthetic needs to make enemies feel powerful. Make you feel cool by sneaking past unseen - have people comment on how you have achieved your goals while being this 'ghost'. Be within arms reach of grabbing them, like you have control over them.



- Make the inbetween gameplay entertaining by filling the gaps with environmental narrative, puzzles and extending the stealth gameplay loops.

Predator stealth game aesthetic:

- games like Dishonored, Tsushima and assassin's creed make you super strong. They give you lots of space to breathe and observe enemy paths, like high spots to perch on.
- You would spend time reading enemy movements and positions as well as the environment to then execute a plan
- You'd have many tools that allow for ranged kills, guard displacement (like noise makers), traps and so on. You are usually fairly overpowered, so the fun comes from finding out how to take out enemies in the base in creative ways that look cool.
- Combat is often fairly easy to sell the power fantasy and not punish messing up stealth, but it can be tough too.
- You feel like a badass in these games. Like you have control over the situation. There is often less tension, but a perfectly executed stealth takedown that maintains stealth feels

The aesthetic of this game is that you are part of an elite group of stealth spies out to achieve certain tasks. Therefore it'll take more of a predator stealth approach - where you watch from the shadows and execute a stealth clear with style and efficiency, over trying to sneak past unseen. The latter is definitely a potential playstyle that will have it's own reward systems and mechanics, much like games like Blacklist.

The stealth will utilise light and sound, although primarily be line of sight and light based since some fast movement is intended by design, and footsteps revealing positions from a distance would break that aesthetic. Enemies will have audible footsteps on different materials as a form of information gathering, but the player and their teammates will have muffled footsteps that can only be heard when really close up.

Pools of shadow act as safe spaces, activating the optic camo on teammates that will turn them near invisible.

## Teammate control systems

Teammates for the most part require strict instructions to be provided in order to perform a task. Unlike games like Swat 4 or Ready Or Not, you won't just be pressing 'breach and clear' and the ai do all the work for you, since that feels unengaging as you play the part of an observer while the ai performs tasks with swift execution and literal aimbot.

## Problems with other control systems

Each of the games this is inspired by have their own problems with control systems.

Modern Ghost Recon offers squad commands, but nothing more advanced beyond just moving and regrouping. They don't ever help much unless in combat. Swat 4 has great first person contextual control that allows for dynamic and reactive gameplay decisions, but it has no pre planning and the ai intelligence has it feeling more like the ai perform all the tasks themselves and you are simply observing. Doorkickers has a great mix of both reactive and pre planned actions, but is top down perspective only. Arma 3's ai has plenty of control options, but the wide open maps and perspective lock to first person on one character with a rather poorly detailed map leads to a lot of babysitting and managing, as the AI aren't smart enough to do things by themselves. Old Ghost Recon had the problem of ai planning being a little simple, without much complexity or control.

I want this game to be a tactical shooter type thing with an emphasis on team control, letting you set up cool multi-team breaches and look cool doing it, as if you are playing in a cinematic.

To do this I will have a few main ai control methods:

- Direct control - The ability to switch to any team member and control them. This means dying as one character simply lets you take over another.
- Quick contextual actions - Means assigning tasks by looking at objects and positions in first person. For example, point at the ground and press a button to queue a move command, then drag to a point in space for a look at command.
- Manual 'ghost' planning - Enter the perspective of a teammate and control them in a sort of future sight space. The world freezes and you move the character manually, a bit like Lana from Siege.
- Simple map actions - Use the map to create squads, move to parts of the map etc.

Each of these control schemes aim to fix the problems that arise in these other games. Manual 'ghost' planning instead of simply using contextual actions or the map allows for fine control over positioning, avoiding issues present in arma for instance where you keep constantly moving the ai so they get a good sightline. It also lets you manually control where they look, meaning I wouldn't need to make the ai look at spots themselves. You will be able to see the actions of other teammates in this ghost mode too, letting you time your movements perfectly.

Quick contextual actions allows for fast commands that don't need to be manually plotted, like stacking up or simply moving to a location. It won't allow for more complex actions, but will reduce time spent repeatedly planning simple moves.

In a similar vein, the map can be used to make broader actions. The majority of the complexity will be in the ghost planner, but the map can allow for larger distance movement and ai control without needing to manually guide each teammate.

[https://drive.google.com/drive/folders/1gNtvRf45HlqbUsuo\\_BeFNHqUbXc5xHDV?usp=sharing](https://drive.google.com/drive/folders/1gNtvRf45HlqbUsuo_BeFNHqUbXc5xHDV?usp=sharing)

## Audio Design

Since the game intentionally lacks a third person perspective, information gathering is more risky and personal. In games like Thief and Gloomwood, audio plays a big role in reading the environment. Audio will simulate propagation through corridors and big rooms, providing greater positional information about ai movement, with loud footsteps that differ in sound and texture based on material walked on to better read the environment.

## Other information Gathering Methods

Those games, Thief and Gloomwood, also use leaning as a key information gathering tool. Leaning lets you see into a room while reducing your chances of detection, but you can still be seen if an ai is looking directly at you. it's a riskier means of information gathering.

Beyond the physical actions to gain information you will use modern and advanced tools to gain information. An important thing for me is not to take away steps that make the game fun, there should always be some kind of conscious action that goes into gathering information, moving and shooting, so no gadgets like the sonar grenade from ghost recon that will reveal all enemies through walls, I want there to always be a risk and reward.

For example, in order to see enemies behind a door I would use something called a mirror, a long stick with a camera at the end that can see beneath doors. This grants you free information, but you are just as likely to get shot as enemies can shoot through doors, and the lowered perspective means there will naturally be parts of the room you cannot see.

Some other gadgets like fireable cameras could let you see round corners, but they'd require manual operation.

There will be more, but a fundamental design concept for me is that everything has risks and benefits to make their use more weighty and thoughtful.

(The following is just me rambling about ideas)

In order to give ai more worth and push that team feel, there could be a system in play where anything an ai sees, you see. There is that mounted camera idea like in Swat 4, which would be useful if you want to make quick contextual actions to that team member or simply see what they see, but I might consider another method. This is good for when you only control one character, but since I want to be able to switch to any character it might make it redundant. A different approach could be that anything an ai sees could be given a wireframe highlight through the map, so you can see geometry that your character currently cannot, as well as enemies that your ai can currently see, letting you perform contextual actions on their silhouettes. Whether this will break balance is undecided, but it as an extension to the mounted camera idea that i'd like to explore as it is a problem I encounter in other similar games. You would still need an ai to be exposed to that enemy or geometry, but it has you benefiting from the positioning of your ai and can use that information to make more informed decisions. Would also need to consider the fact that the top down map

So all in all:

- A helmet mounted camera can show current ai activities but makes it hard to use that information yourself. However useful for providing quick contextual actions to the ai.
- That might be less useful if you can just switch to other ais, a component I want to include as it lets you feel comfortable with participating.

- Wireframe view of what the ai sees still requires exposure and risk, but can give you more awareness, giving teammates more worth and letting you observe their actions.

## Enemy Design

Enemies will be ferocious in combat, dealing heavy damage and flanking constantly, using their own resources and utility to take it down. But players will still have plenty of time to maintain their stealth status if they get initially spotted, in order to sell the fantasy of the secret spy and to make stealth more satisfying.

## Player movement

Alongside walking, crouching and lying prone, the player will have other movement driven actions to perform. Vaulting up short obstacles. grabbing ledges while falling. leaning around corners. rappelling up large walls.

## Environmental Interaction

As the environment plays such a large part in stealth game design - Sight line management, pathfinding, shadow spaces etc. - the player will be able to manipulate elements of the play space. Throwing bottles as distractions, destroying lights to create safe spaces, opening windows for entrance paths and so on. it is important for there to be multiple opportunities to use the playspace for creative thinking to keep repeat runs fun.

## Immersive Sim synergy and gameplay approach

I want the game to incorporate some element of Immersive sim design, allowing for systemic problem solving through gadgets and mechanics with broad dynamics that allow for creative problem solving. Gadgets should be able to be used together in sometimes obvious but sometimes unexpected ways, to open up avenues for creative stealth gameplay. Mechanics should have many interactions that feel natural, so that players can intuit their interaction and use pre established knowledge to come up with new plans.

## Weapon mechanics

One of the core design decisions that separates tactical shooters from others is that weapons kill fast, are inaccurate on the move but are deadly when covering the right spots.

In this game I want security and angle management to be key, so flicking and nailing targets should be disincentivised. As you rotate the camera the weapon will veer off to the side a bit, taking a short second to align again. This will allow for minor adjustments but big sweeps will be inaccurate, since the need to do so means poor positioning and planning.

Recoil will be fairly stable to sell the professional spy mood, but repeated fire will cause spread through weapon shake to make panic shooting less viable.

Ammunition will take a magazine approach, with long reload times. Reloading should be a carefully performed action that is done when someone else can cover your spot, so magazines that are reloaded persist their ammo counts, and reloading takes some time, this is to hopefully make the act of reloading a more conscious decision.

When moving, there should be some slight weapon sway. running around a corner and nailing someone shouldn't be dead accurate as that promotes a less incremental clearing style, but it is necessary at times to clear rooms. Make up for this with an enemy surprise factor, but find a way that allows for a system that makes fast clearing fun, but not meta. Maybe something learnable like sway timed to footsteps.

## Game Structure

The game is overall mission based, with a narrative that provides context to each level. When booting the game up you will go to the main menu, from which you can choose to load into the next story mission or choose a mission that was previously completed to play in a story mode or a more sandboxy mode (which will have the same objectives but none of the narrative dialogue).

During gameplay you will rely on quicksaves, with autosaves at certain areas that make sense to have them. Ultimately you will be able to save and load whenever.

The game ends when you either complete all the objectives or die. Failing the mission will make a new screen appear that asks the user if they wish to reload a save, reloading any of their quicksaves or autosaves for the mission. Or they can return to the main menu.

Winning the game will then also allow for the player to advance to the next level or return to the main menu.

## Game Dynamics and USP

With some of the major game design aspects and mechanics covered, here are some dynamics that I would expect to come from these design decisions, with the aesthetic they aim to fulfill.

### Information Gathering Phase

Before proceeding with or creating a plan there will be a phase of information gathering. This dynamic exists in nearly all stealth games - be it watching from a perch in Assassins Creed or Dishonored, or hiding in a shadow in Thief or Splinter cell, and the mechanics should support a feeling of covertly watching a group, analysing their movements and identifying points of weakness and infiltration.

You will make use of the stealth and enemy mechanics to stay hidden, all the while using observational tools and gadgets to get a read on the location.

### Planning phase

With information gathered, the player should have an understanding of enemy patrol routes, actions and more importantly weak spots they can use to infiltrate - be that an open window or an unguarded route. Using first person contextual actions or the planning map the player will construct a plan of action. Telling where squad mates shall move, what angles they cover and what movement styles and rules of engagement to adhere to. You can have squads split off and do individual actions tied to go codes, or all work together, there is flexibility in how you can choose to organise your squad which opens the doors for much greater replayability.

You place waypoints, aim direction, wait timers, go codes, special actions with the goal of being as safe as possible and clearing the space as effectively as possible. It will be a problem solving challenge as you figure out how to move through the space unseen, while covering all the bases to ensure a successful run.

### Execution Phase, player reactivity and player involvement

With a plan defined, waypoints will be placed as hud elements that tell you where you planned for yourself and squad mates to go, which can be toggled on or off at will. This solidifies the importance of the plan, as you can comfortably follow your orders and see how they play out.

You will be able to view the actions of teammates to gain greater spatial awareness, either with a helmet or gun mounted camera that appears as a window on screen, or with some kind of highlight through a wall that lets you observe their actions.

Importantly, I have chosen to make it so that special actions don't feature complex ai tasks that are performed automatically. In ready or not and swat 4 I found that the contextual action 'breach and clear' would always have the ai breaking open a door, breaching and clearing space by themselves with little player involvement. Additionally, if the player dies, it's game over - if an ai dies then you can still continue. As such I want the player to have a hand in controlling the ai, and death isn't as punishing. So the act of the player plotting out a plan for each room breach with the overhead map will make the ai breaching more involving and engaging. Even if you let the ai do the work, you are the one who gave them the plan.

To give players the freedom to be involved with their plan and not fear risk, you will be able to switch to any team member and the role of leader transfers to them. So if your current character dies you will take control of another. Since you will be able to give yourself tasks to perform in a plan, which is highlighted on the hud for you, this will allow for players to feel an incentive to join in and not just be a bystander. being able to feel included in the plan and work alongside ai teammates will

push that team oriented aesthetic, and have you feeling like this powerful force that pushes through the compound with efficiency and style.

There will be some cases where a simple movement command wants to be issued, and the act of opening the map and performing it may be tedious, so there will be some commands you can issue in first person. Set a move marker on the floor, then look at some geometry to send someone there, or tell the ai to stack up on a door or cover your back as you move. While breaching and moving should be manually prepared, these kinds of actions are menial tasks that would be more beneficial as a dynamic command.

While executing a plan you may notice a flaw in your design, in which case the player should be able to choose between continuing or restarting to make some changes to said plan.

## Trial and error

The game is intentionally hard, and many first plans will fail in a similar way as they will do in Doorkickers or Rainbow Six. The goal and intended game loop is to try repeat runs of the same level but with different plans - each trying different routes and special actions. This will replicate that feeling of mastery that you see in players who perform choreographed stealth content on youtube, people who repeat the same outpost multiple times to learn the ai paths and systems, to then perform a swift stealth clear in a stylish and effective way. That feeling of style and mastery of mechanics is one I want to portray in this game, as it is a powerful motive that has players feeling like they can express themselves in unique ways.

Examples of this kind of choreographed playstyle shown below:

<https://youtu.be/u2bMNGz8MbQ>

<https://youtu.be/ZnvEQwthwvc?si=cmOuyY44HiVp3F52>

As such, the game should make retrying a plan or level as quick and seamless as possible. Long loading times and disruptive menus make replays feel like punishments, but I want it to feel like an intended system. Inspiration taken from Ultrakill or Doorkickers 2, for example, which when you die lets you press 1 button and instantly respawn at the last menu, with the music continuing to play as a means to assure you that this is how it's meant to be played.

Players will most definitely be able to play through it the first time, and those who do will be able to experience more tension and dynamic gameplay as that is natural when game systems and rules are not known, but since the game's aesthetic is that of professional prowess, I feel incorporating this philosophy is important. Ultimately both methods are viable, and it's up to the player.

## Unique selling point and experience

With these dynamics in mind, the unique selling point is that it is a blend of mechanics and dynamics that hasn't been seen before. Rainbow six and doorkickers excel at ai control and tactical gameplay, Modern Warfare and SC:Blacklist excel at cinematic stealth feel, Chaos Theory and Dishonored excel at stealth systems that provide a very endearing aesthetic. This project aims to be a mix of them all - providing that cinematic stealth feel through player actions over scripted sequences, ai control systems with depth and challenging gameplay to make proper use of that depth, while incorporating stealth systems that introduce a different gameplay loop to those more action oriented games.

## Game content / scope

### Characters

I want the game to feature different characters, with ability sets and differences akin to those of Daud, Corvo and Emily from Dishonored 1 and 2. They tie into the story, but I want each to actually feel different to play. The intention is that each are fun on their own, but using the teammate control system will amplify their potential.

Name	Sundance / Dante / Loki / Coyote / Gambit
Archetype	Trickster Cowboy - Distraction, diversion and style
Weapon	Barrel loaded revolver. Good stun potential and armour shredding. Long reload. Low ammo pool.

	Can be charged up to fan the hammer in a slow mo state.
Gadgets	Coin toss - Throw a gold coin. Shooting it triggers Metal Rebound, and bouncing it up in the air again. Must be picked up or caught in mid air. Pickpocketing enemies recharges it as you steal their coin. If it hits the ground, nearby enemies will move to it to investigate. If attuned, only that enemy will investigate, otherwise only the nearest enemy. Grappling Wire - Can be used to snatch items at range, collecting or grabbing them. Can pickpocket guards at range, or choke them and pull them towards you, even steal their ammo or weapons. Can throw enemies left or right based on mouse movement.
Information Gathering	Drone - Ground based drone that can be driven. Able to jump. Limited field of view as it is on the ground but is persistent.
Abilities	Sonic attunement - Can point at a spotted guard and attune your gadgets and abilities to them. Subterfuge - Disguise yourself as an alive or incapacitated enemy. If that enemy dies or wakes up you change back. Decoy - Create a duplicate that starts invisible. Activate to make it visible and taunt enemies, or swap positions with it
Passives	Metal Rebound - Shooting a metal object causes the bullet to ricochet to the nearest enemy, or currently attuned enemy or object.
Playstyle	Less movement options than the others outside of the decoy. Based around manipulating and tricking guards. You steal their ammo reserves, bait them by using the coin, and then execute them with style by using the metal rebound passive or your charged revolver shot.

Name	Strongarm / Longbow / Gridlock / Checkmate / Stillwater / Warden
Archetype	Sentinal Sniper - Flank watching, angle holding, defensive
Weapon	Sniper rifle. Designed for long range targeting, with high penetration and damage. Can fire a special ammo type that pierces through buildings, enemy armour and knocks them back, impaling them. Secondary: Suppressed pistol. Weaker with less ammo.
Gadgets	Proximity sensor - Reveals and alerts you of enemies that enter its area. Teleport Anchor - A thrown translocator that you can teleport to by holding the button and pressing the number. Can teleport to anywhere on the map. Can teleport back to where you teleported from.
Information Gathering	Projectile camera - Fire a camera to a surface you are aiming at. Can enter it's view and launch the camera to another surface. Reveals enemies it sees. (alternate) can fire towards a light source to disable it, destroying the camera.
Abilities	Dimensional Rift - Create a portal in front of you anywhere in the level. Can link to another portal that you make. Can make it person sized or a small hole. Able to shoot through or move through. Hidden veil - Creates a zone that when crouching or prone, makes you invisible.
Passives	Steady hand - Can enter a mode while sniping where you will flick towards anyone who enters your field of view, but cannot rotate while in this mode.
Playstyle	All about setting up a perimeter. Roam the map and place teleport anchors. Create portal to add more sightlines. Proximity sensors tell you to teleport to an anchor and snipe them. Able to cover long angles and flanks for the team.

Name	Shade / Paradox / Silas / Cairn / Quill
Archetype	Darkmage Assassin - Mobility, speed, violence
Weapon	Primary: Blade Melee weapon. Can kill quicker than other characters. Charged attacks stun enemies and break armour.

	<p>Secondary: Throwing knives</p> <p>Click for quick through, charge for a longer distance throw. Can freeze in time, maintaining it's momentum.</p>
Gadgets	
Information Gathering	<p>Chain possess - Take control of a guard, controlling their movements. Can chain link to other guards for a reduced cost. Will highlight possessed enemies. Can control whether they feel nothing, feel nauseous, call for help or attack someone when you exist this state.</p>
Abilities	<p>Dagger blink - Teleport to the last thrown dagger. If stuck to a wall, you stick to the surface. In all cases you retrieve the dagger. If stuck to an enemy, performs and attack based on where it lands.</p> <p>Blind - Target a light to sap its energy and disable it. Target an enemy to stun them and nearby enemies, making them blind.</p> <p>Link - Connects the fate of two entities. Stunning one stuns the other, knocking back one knocks the other, killing one kills the other etc.</p> <p>Freeze time (maybe alternative to just freezing daggers)</p>
Passives	<p>Primordial Rage - Kills raise a meter. After a certain number of kills you enter a raged state, where you must return to a personal prison realm to calm down before returning. But when you return you create a zone that fears and stuns enemies.</p> <p>Eternal fear - Kills in swift succession cause nearby enemies to tremble in fear, potentially stunning them.</p> <p>Assassin mobility - Can double jump and climb up ledges easier. Able to jab a dagger in the wall to cling to it.F</p>
Playstyle	<p>Based around setting up multikills and executing them quickly. Stand up high, use posses to gather information. Throwing knife to stun, get a kill, teleport and kill the next use abilities to get kills in quick succession. Then use your darkmage outburst to fear nearby enemies.</p>

Name	Breacher / Gale / Vault
Archetype	Assault Breacher - Entry fragging, frontal force
Weapon	<p>Primary: Shotgun</p> <p>Short range shotgun. Able to stun and shred armour, slow fire rate.</p> <p>Secondary fire: Big bullet</p> <p>Fires a high calibre rifle round from another barrel on the shotgun, able to deal precision damage at range or disable lights.</p>
Gadgets	<p>Flashbang - A flashbang with timer adjusting and bounce limit control. Stuns anyone who looks at it.</p> <p>EMP Grenade - Sends out an EMP pulse that disables lights and electronics like communications.</p>
Information Gathering	<p>Pulse Detection - Send out a pulse that reveals enemies in its radius over long range, but for a short time.</p>
Abilities	<p>Silence - Creates an area where sound cannot be emitted, from enemies or yourself, so everything is silent.</p> <p>Rush - Stun proof, able to run through doors and other objects. Raises movement speed.</p>
Passives	<p>Footstep Detector - Can see footsteps that make sound, projected onto the floor they are on. But cannot detect those standing still or on carpet.</p> <p>High intensity Training - Can punch enemies, sending them back several meters into other enemies or objects.</p>
Playstyle	<p>More of a tactical shooter type feel. Pieing corners and playing slow. Can use silence to barge the door down and get loud kills without alerting others. Can use traditional stealth to stay hidden and plan attacks.</p>

## Maps / Missions

The game will follow a mission based structure similar to rainbow six and splinter cell. For the purposes of this project I will aim to implement one map with level design, aesthetic feel, narrative background and art to provide a microcosm for what the game should ultimately play out like, and then 2 other levels with narrative, objectives and gameplay styles planned out to demonstrate the feel I am going for with this project.

There will be no voice acting, cutscenes or any major narrative. Story and backdrop will be delivered through in-world environmental storytelling like laptops, notes and audio logs. Objectives will be revealed before the mission in a text based briefing format.

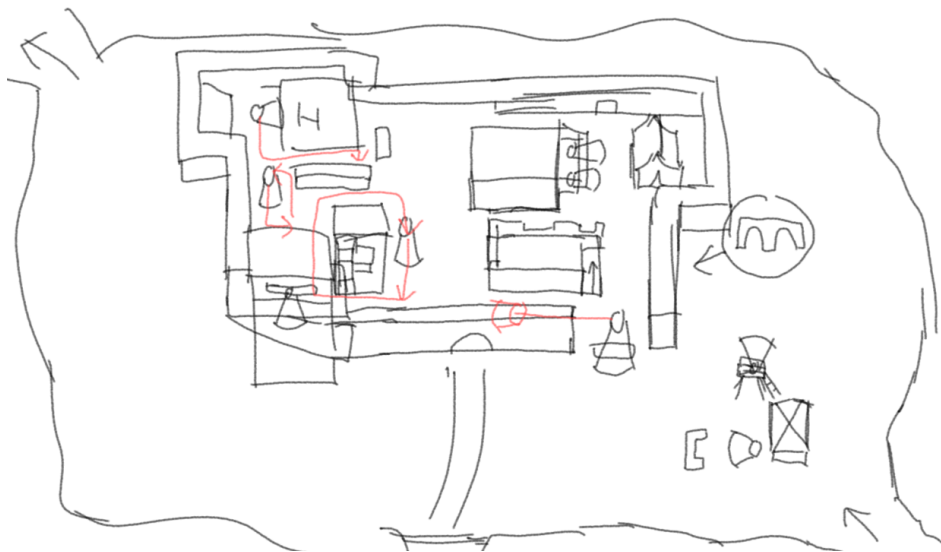
## Missions

First mission will be a fairly easy tutorial mission. Designed to make stealth forgiving, combat easy but also teach the importance of team management.

Need to steal some data from the hands of the enemy.

You and two other teammates to start with.

A facility with a fairly open space outside it.



Level narrative:

- Start in the bottom right
- Must take out the sniper tower to move forward. Teaches about long range enemies and taking out sightlines to allow for movement.
- Take out the guard below him, an easy kill that acts as fodder.
- Can see the next guard out of his peripheral vision. Shooting him then will alert one behind, so they need to move forward and sweep the corner to take them out and anyone behind.
- Then has the option to split off. One teammate goes up the ramp and observes the two guards overlooking the tent. The high up teammate takes out the guards on the balcony, and anyone who flanks behind the tent. Player enters the tent and takes one piece of intel. Can send the high up teammate down to look over the rest of the base.

## Weapons

I want every soldier to have a silenced pistol by default, as that is a weapon whose aesthetic dissuades forward combat and ties in nicely with the stealth gameplay design.

There will be a form of knife or melee weapon that allows for sneaky and silent stealth kills.



No other weapons will be included for the purpose of this project, as I want to ensure careful balance and not add something that tips the game's design to a more action oriented approach.

## Gadgets

To start with I want several gadgets that can cover the different phases of gameplay as a demonstration of what kind of creative solutions there can be for problems.

Observational Gadgets, used to gather information about world geometry and enemy positions

- Placeable camera - Will be placed on the floor or a wall, highlighting enemies it sees as well as the geometry it can see.

Security Gadgets, used to stop enemies from flanking you and aiding in holding space:

- Motion detector - will make a sound and ping the area where an enemy has recently passed
- Sticky shock mine - Electrocutes and incapacitates enemies

## Enemies

Enemies will be simple military defense troops of no nationality, to avoid any potential social problems. Armed with pistols and assault rifles. I may consider more enemy types like snipers, heavy units and stationary gunners but those can be additional to add later on.

## Ai Control Actions

As described earlier there will be numerous actions that ai can perform. While I want a good variety, there are some that are more important than others that should be prioritised for the project.

The following are different states that can be set on given ai, which will control their behaviours when performing regular tasks.

Rules of engagement:

- Fire on sight - whenever an enemy is seen is engaged immediately
- Stealth - Avoid firing, seek nearby shadow, hiding places or cover
- Confirm target - When a target is seen a pop up appears on the virtual camera or through the wireframe view, asking confirmation from the player whether they can shoot. Will shoot if fired upon.
- Custom - rules defined outside of the mission with some kind of rules editor

Movement Stances:

- Stand
- Crouch
- Prone

Movement Behaviour:

- Rush - Will move to the next waypoint regardless of enemy fire
- Clear and confirm - Follow the path but will stop when engaging, wait for clear then continue

The following are examples of some of the orders that could be given.

Movement order (when looking at or clicking the ground)

- Move to a targeting location
- Move in formation (allocate a formation, move as one unit)

Aim order

- Hard angle - Look a certain direction and stay facing that direction as they move
- Pie - aim at a piece of geometry and keep looking at that geometry as they move
- Temporary aim - Look in a direction for a few seconds, then aim in the direction of movement

Stack up (when facing a door or corridor)

- Split stack - two people on either door
- Linear stack (left or right) - all team members on one side of a door

Door actions

- Check lock
- Mirror
- Plant breach charge

## Objectives

First objective added will be simple, just kill all the bad guys.

Later objectives could be to hack something, plant c4 somewhere, plant a bug (in a pure stealth mission).

## Story

Want to stick to a dishonored style setting, dark and gloomy, that mixes dark magic with modern military. Sort of like a darker version of Tactical Breach Wizards. That much I know but I'll need to do some sketches and come up with more ideas.

given the emphasis on teamplay and teamwork I want to try and make it somewhat character driven. Much like Swat 4 and Ghost Recon Wildlands or Bad Company 2 I want each character to be named, have their personality, view and backstory that offers unique gameplay for each as well as potential for writing between them.

Could be a group of mercs who do jobs for various people. Unrelated jobs at the start that allow for simple tutorial missions before becoming more complex as their reputation grows.

As mercs they'll be able to loot stuff and steal things with no reprimand. Find ammo on the field, can spend money to make the job easier by buying favours.

Revenge plots are cool, as seen in assassins creed, Tsushima and Dishonored. The whole 'agency has been compromised and turned against you' thing has been done a dozen times. But I might give it a spin to see what I can do with it.

Story could start with them all masked, with no details about names or characters, similar to MW3 start. Work through the first mission and give out pointers. Can make sense narratively if it's their first mission together.

Demonstration of skills and base level personality traits at the start. Show them using their skills and traits to good use, but also their weaknesses. Make them somewhat stoic and unlikeable, all people who have been dealt a bad hand. Unique voice lines for actions to separate them all.

Leave some mystery behind the setup though, don't need to explain specifically how they met for instance.

Character ideas:

- Hooded assassin - Wears a hood and a mask. Hidden identity. Uses crossbows and daggers. Emphasis on dark magic. About fast movement, stringing kills together but mostly utility. Can kill, but will gain rage for every kill, beyond a certain threshold he goes crazy, a spell placed on his attire banishes him to a realm while he cools off. Uses spells to help the team. Enemy distraction, possession, displacement.
- Sundance - Cowboy like feel. Uses revolvers and throwing daggers. All about not playing fair. Can ricochet bullets off of metal surfaces and tosses a coin. Can muffle audio, distract guards or trick them. Disarm, other forms of manipulation that lets him pry on their weakness.
- Strongarm - Sniper user with a silenced pistol. Will gain teleportation to a device he throws, and can quickly move between them. Primary role is setting up sightline coverage with a sniper that fires on anyone that enters the narrow FOV. Informational traps and lethal / non lethal traps. Access to some kind of drone or other informational tool.
- (Unsure) - Breacher type character. Smg or automatic type weapon. Flashbangs, explosive grenades. Can push enemies back. Main purpose is taking space and clearing rooms.

First mission has them rescuing someone, a trial in stealth. They are simple military folks at this point, but one says they prefer crossbows and daggers, wears a hood and has a scarf with some pattern on it. Bit mysterious.

Something happens in this mission or outside of it that leads to them all dying. But the hooded one somehow returns to life. Some goes crazy and kills the rest. Some entity saves the others and revives them to see his carnage before he vanishes. Escape sequence where they each gain a power.

## 10. Development Processes

### 10.1 Risk Plan

Likelihood ratings:

High - 50%+ chance of happening

Significant - 30-50% chance of happening

Moderate - 10 - 29% chance of happening

Low - Less than 10% chance of happening

Event	Impact	Likelihood	Mitigation
Loss of laptop or home computer	Unable to proceed with any development	Low	Keep hardware in good condition and safe.
Loss of internet	Unable to proceed with development that requires online tools	Low	Make sure phone is available to utilise mobile data if necessary
Extended research required to complete task	Sprint goals may be delayed or restructured to allow for research to be done in implementing a feature.		Such events can't necessarily be mitigated, but organising tasks such that one that I can implement with my current knowledge first can mitigate some of the impact.
Testing demonstrates deficiencies or errors in design	Reconsideration of project design will need to be performed, followed by a restructuring of past code that may take significant time	High	Evaluate design before implementing. Test frequently so design changes and refactoring workloads are smaller.

Sickness or other health problems	Less effective development performance	Moderate	
Testing demonstrates poor performance	In order to reach performance goals the code base would need to be analysed, with solutions researched and implemented.	High	Research performance enhancing solutions prior to implementation and make regular performance tests.
Loss of project data	Unable to proceed with development until recovered	Low	Use version control software to back up code for easy cloning if lost. Back up assets onto cloud storage to be downloaded if lost.

## 10.2 Version Control

Version control will be handled by Github. I will make regular commits to document and track progress, allowing for easy rollbacks if issues are faced as well as up to date backups should any project files be lost. Link to the Github repository are at the top of this document.

## 10.3 Workload Management

In order to define the tasks needed, and various milestone goals, I will use trello. Lists will be created covering sprint goals, currently in development tasks as well as tasks for the near future and their priority.