SpaceCraft
## Mod Proposal

"[…] for the eyes of the world now look into space,
to the moon and to the planets beyond,
and we have vowed that we shall not see it governed
by a hostile flag of conquest,
but by a banner of freedom and peace"
-John F. Kennedy, 1961

Main Features:

➔ Ballistic Missiles as Fast Transportation and Dangerous Weapons

➔ Space Exploration and Space-Borne Combat

➔ Limited Fuel and Newtonian Physics in Deep Space

➔ Planetary Landings

➔ Local Gravity on Asteroids and Small Moons

➔ Post-Terran Mining as a Fast and Dangerous Way to Get Rich

➔ Space Stations as Platforms for Efficient Smelters and Orbit-To-Ground Weapons

➔ Component Failures can Kill You or Leave You Stranded in Space

➔ Research can be Conducted to Avoid Frequent Failures and Unlock New Technology
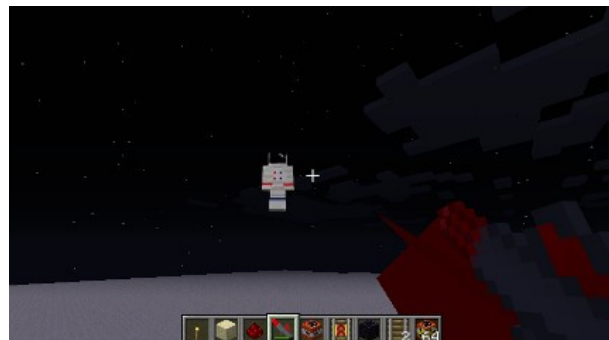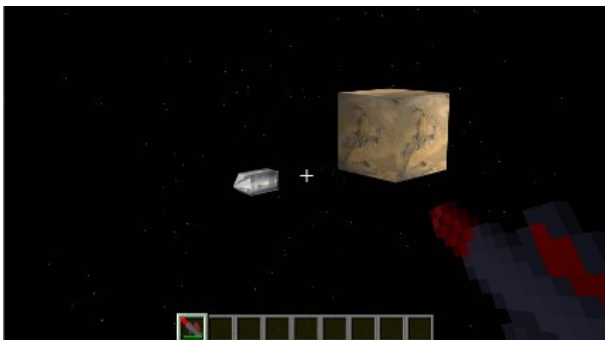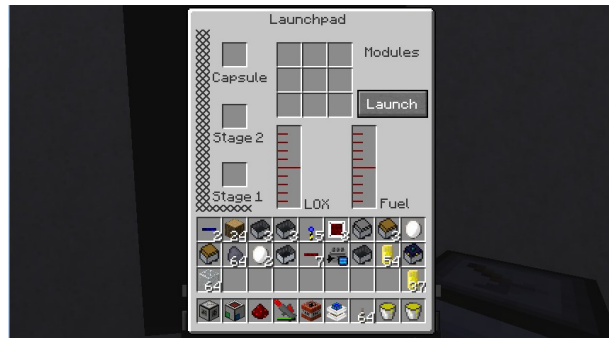
(note: pictures in this document are concept art and not actually in-game screenshots.)

Table of Contents

1 Modules

Core Module - contains Spacecraft, Components and things not related to Space Stations
Station Module - contains Space Stations and associated things.
Weapons Module – contains Warheads and all Capsule Modules with weaponry.

2 Requirements

Minecraft 1.4.2, Forge, Buildcraft, Railcraft. IndustrialCraft is optional for the Core Module, but is required for the Station Module.

3 Spacecraft

3.1 A Component is any object that can be used in assembly of a Spacecraft.

3.2 Components have special fields for reliability values and failure pools. (See Reliability Rules for more.)

3.3 Booster Stages, Capsule Modules, and Capsule objects are all considered Components.

3.4 Although not used in Spacecraft assembly, a Space Suit is also a Component, because it has reliability figures and failures.

3.5 Spacecraft is a Player-made object, capable of transferring between Space Dimension and Object Dimensions.

3.6 Spacecraft consists of the Rocket (which is used up during the Ascent phase,) and the Capsule (or Warhead)

3.7   Rocket consists of two identical Booster Stages. Both are used during Lift-Off and Ascent, only one is used in Orbit Insertion.

3.8   a Spacecraft with a Warhead instead of a Capsule is considered a Missile.

3.9   Although a Missile is not practically a space craft, and it never leaves the Object Dimension, it is still considered a Spacecraft for simplicity.

3.10   Capsule is composed of the main Capsule object and several Capsule Module objects, which are optional.

3.11   When Player is in full control of a Spacecraft, they can adjust its orientation by looking at a certain point. The Spacecraft will then use its RCS system to match its orientation with this point. In other words, you look where you want to go and the Spacecraft does its best to match. Players can also fire engines and weapons.

3.12   If Spacecraft experienced a Computer Failure, Player controls RCS ([Reaction Control System](#)) thruster valves directly by moving the mouse. This control scheme is meant to be much more challenging.

3.13   When Player is in partial control of a Spacecraft, they can change the current Mission Phase via GUI, but otherwise have no control over the vehicle.

3.14   When in full control of the Spacecraft, Player must mind its inertia. The heavier the Capsule, the more inertia, the more difficult it is to fly. High inertia also makes RCS respond sluggishly.

3.15   When Landing with a Capsule, its internal fuel reserves are used during Landing and Launch. It's the same fuel which is used for maneuvering.

3.16   When Landing with a Lander, Lander's internal fuel supply is used instead. If a Lander is reusable, it's remaining fuel is carried over to the next Landing.

3.17   For the purpose of calculating Inertia, effective Mass of any Armor Module is doubled.

4   Reliability Rules

4.1   Component Reliability is a deciding factor on frequency of failures (see Spacecraft Rules for def. of Component)

4.2   Reliability is an inverse of chance of Failure. i.e. 90% reliability implies 10% chance of a Failure. (see Failure Rules)

4.3   Each Component has Base Reliability, Current Reliability and Max. Reliability

4.4   Base Reliability and Max. Reliability are constants set for each Component in mod configuration. They cannot be changed in game. They are known as Reliability Constants.

4.5   There is also Researched Reliability, a separate variable for each Component, but stored in Player data

4.6   Researched Reliability reflects the amount of research a Player has done on a given component.

4.7   Current Reliability is a value of each Spacecraft Component

4.8   Current Reliability is set upon crafting of the Component. The value which is set is copied from the Player's Researched Reliability for this Component.

4.9   After a Component is crafted, its Current Reliability doesn't change, even if the player conducts a Research after crafting it, or another Player uses the Component.

4.10   Before a Component is Discovered, it can be crafted, but upon creation its Current Reliability is set to 0 (100% Failure chance)

4.11   After a Component is crafted, its Current Reliability is presented as a horizontal bar across the item icon. The one that is usually identified with tool damage in Minecraft.

4.12   When a Component is first discovered, its Researched Reliability is set to the value of Base Reliability.

4.13   The Player can then perform Research on a chosen Component, which results in an increase of its Researched Reliability. This means any Component of this type crafted after the Research will be more reliable.

4.14 For every successful Mission, the Researched Reliability of each Component involved is raised by 1%, up to its Max. Reliability value (see mission rules)

4.15 Each time a given Component suffers a Catastrophic Failure, its Researched Reliability is halved. This may cause Component's Researched Reliability to fall below its Base Reliability. (see failure rules)

4.16 Each time a given Component suffers a Non-Catastrophic Failure, its Researched Reliability is reduced by 1%

4.17 The chance that an individual component fails cannot be confused with the chance that a Failure occurs during the whole Mission. Since there are multiple Possibilities of Failure during the whole Mission, Components will perform much worse than their Current Reliability suggests. For example, an 80% Current Reliability for a Booster Stage may seem like a good number, but it can fail during the Lift-Off, during Ascent, and during Orbit-Insertion. This gives us three times the success chance of 80%, which is $(0.8)^3 =\sim 50\%$ of success. This means the 80% Reliable Booster will experience a Failure every second launch, which is much worse than the Reliability figure suggests.

5 Failure Rules

5.1 Each Component has two pools which contain effects of Failures. One pool contains Non-Catastrophic Failures, the other one contains Catastrophic Failures.

5.2 Catastrophic Failures result in Player being killed or left stranded in space

5.3 If the Player survives a Catastrophic Failure (for example, was rescued by another Player) the Failure still counts as Catastrophic as far as Reliability is concerned (see Reliability Rules)

5.4 Non-Catastrophic Failures harm the performance of Spacecraft, but allow the Mission to continue (or be canceled)

5.5 For each Mission Phase, there occurs at least one Possibility Of Failure (see Mission Rules for Mission Phases)

5.6 Exactly one Possibility Of Failure occurs at the start of each Phase.

5.7 If 10 minutes has passed after the last Possibility Of Failure was evaluated, and the current Mission Phase has not changed, an additional Possibility Of Failure is generated.

5.8 An Active Component is the most important Component during given Phase

5.9 Each Phase has one and only one Active Component. (Active Components of all Phases are listed in Mission Rules)

5.10 When a Possibility Of Failure occurs during the Mission, the following algorithm is followed:
1. let c be the Active Component
2. let x be a random number from <0,100>
3. if x is greater than the value of Current Reliability of c then go to step 5 (a Failure occurred)
4. else stop (there was no Failure)
5. let x again be a random number from <0,100>
6. if x is greater than the value of Current Reliability of c then go to step 10 (the Failure is Catastrophic!)
7. else: (the Failure is Non-Catastrophic)
8. from the pool of Component's Non-Catastrophic Failures, pick one and apply it to the Component
9. stop
10. from the pool of Component's Catastrophic Failures, pick one and apply it to the Component
11. stop

5.11 A Failure is applied after a random delay. If the Mission Phase changes before the delay has run out, the Failure is avoided.

5.12 Likewise, if a Player leaves the Spacecraft before the delay finishes, the Failure is avoided.

5.13 The Possibilities Of Failure are only evaluated if a Player is using the Spacecraft. For example, the Spacecraft cannot experience a Failure while the Player is spacewalking outside it.

5.14 The above rule does not apply to unmanned Spacecraft, but it does apply to Space Stations

5.15 During the evaluation, any damage done to Spacecraft, divided by 5, is subtracted from Reliability the Active Component. i.e. If at the time of evaluation Spacecraft has 50% damage, then 10% is subtracted from reliability of the Active Component

5.16 Catastrophic Failure occurring due to damage is still considered a Catastrophic Failure with all consequences.

5.17 If a Booster Failure occurs during Lift-Off, Ascent and Orbit Insertion Phases, and the Booster is equipped with safety mechanism, The mechanism will always activate, unless the mechanism itself was a subject of the Failure

5.18 When a Failure occurs to Player's vehicle, they will hear a warning signal. Also, a brief chat message will be generated describing the Failure, so that they'll know why they died. (We can use "Failure Name" column from the Failure Pool chapter.)

6 Mission Rules

6.1 Mission is defined as a time period, starting with Lift-Off, and ending with Landing (or destruction in case of a Catastrophic Failure)

6.2 Mission is considered "manned" if a Player is physically within the Capsule during Lift-Off. Otherwise the Mission is "unmanned"

6.3 Each Mission consists of distinct Phases which appear sequentially one after another. In some cases Player can choose the next Phase out of possible ones.

6.4 Phases fulfill two roles. One is the regulation and separation of Possibilities Of Failure (see Failure Rules.) The other role is to smooth the transition between Space Dimension and other Dimensions.

6.5 Mission phases:

6.5.1 1. Lift-off. Starts with ignition, ends with the Rocket clearing the Launchpad. It should not take more than 6 seconds. The Player has no control of the Rocket. Rocket goes straight up. The next phase is 2. Active Component: First Booster Stage

6.5.2 2. Ascent. Starts after Lift-Off, ends when the Rocket passes y=500 (or 250 if 500 is not technically possible.) After Ascent, one Booster Module is expelled from the Rocket. the next phase is 3 or 7 depending on components used in the Rocket. Active Component: First Booster Stage

6.5.3 3. Orbit-Insertion. Upon entering this Phase, the Player is presented with a loading screen, while they leave the Overworld and end up in Space Dimension (see Space Dimension). After this Phase, the second Booster Module is expelled from the vehicle. The position in Space Dimension is calculated from the position of Launchpad. The next Phase is 4. Active Component: Second Booster Stage

6.5.4 4. Orbital. In this Phase, Spacecraft is fixed in the Space Dimension. The Player is given partial control and can leave the Spacecraft. The GUI can be used to decide the next Phase, which is either 5 or 6. Active Component: Capsule

6.5.5 5. Exploration. The Spacecraft is gently pushed away from its Orbital position. The Player is given full control of the Capsule and can use it to explore the Space Dimension. If the Spacecraft gets close to any Space Object, the Phase is automatically switched to 4. If their velocity is too great, they go straight to 7 or 9. In the former case, penalties apply to Reliability depending on the
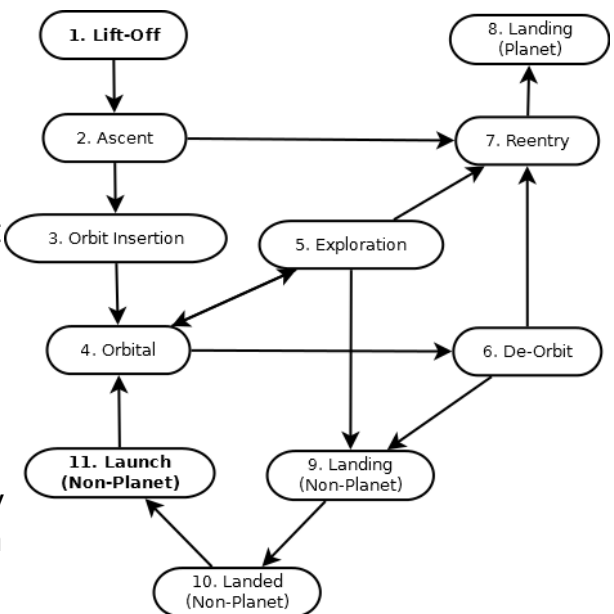
value of velocity, and the landing site is chosen randomly. In the latter case, the velocity vector is preserved between Phases. (see Space Dimension for def. of Space Object) Active Component: Capsule

6.5.6 6. De-orbit. The Player is presented with a GUI where they choose the landing site. At this point it is determined whether a landing is possible or not, in the latter case the option to land does not appear. If the Space Object in question is a Planet then the next Phase is 7. Otherwise it's 9. At the end of the Phase the Player is moved to appropriate Object Dimension (see Space Dimension for def.) Active Component: Capsule

6.5.7 7. Reentry. This Phase is an opportunity for heat-shield Failures. It ends with y falling below 250 (or below 200 if values above 250 are not possible.) Active Component: Capsule

6.5.8 8. Landing (Planet). The Capsule falls straight down until it meets ground or deep water. If ground is encountered, the capsule crashes, killing the Player. In case of water, the Capsule settles on the surface and spawns a boat, which can be used by the Player. The Capsule sinks and despawns within 30 seconds of being left by the Player. The definition of "deep water" is deliberately vague at this point. The Capsule also spawns a number of XP Orbs. The number is directly proportional to the number of Failures that did not occur. (+1 For each Possibility Of Failure that turned out negative, but NOT for Failures avoided by changing Phase.) Active Component: Capsule

6.5.9 9. Landing (Non-Planet). If the Spacecraft contains a Lander Module, it is detached and used for landing. Otherwise the whole Capsule does the landing. The Player is given direct control over the descent and can use yaw, pitch and thrust controls to land on chosen spot. Local gravity is observed. Barring crash or Catastrophic Failures, the next phase is 10. It is also possible for the Player to abort landing by reversing the fall and moving above specified height. In that case the next Phase is 4. Active Component: Capsule or Lander

6.5.10 10. Landed (Non-planet). The Lander (or the Capsule) is fixed to the ground and the Player is free to step outside and explore. They can use GUI to enter Phase 11. If a Player has landed with a Lander, and meanwhile their Spacecraft is destroyed by another Player, the Lander will refuse to launch and the Player will be stranded. Active Component: none (there are not Possibilities of Failure during this Phase)

6.5.11 11. Launch (Non-planet). The Capsule (or Lander) lifts off the surface and returns to orbit. If the Lander is used, it rejoins the rest of the Spacecraft. The next phase is 4. Active Component: Capsule or Lander

6.6 Launching a Rocket in the Nether will always result in a crash, since in the Nether the topmost layer consists of Bedrock.

6.7 It is possible, but wasteful to place a Launchpad in an Object Dimension different from a Planet. It is more practical to build a Launch Site instead.

7 Space Dimension

7.1 It is a new kind of dimension parallel to the Overworld (like Nether or The End)

7.2 Space Dimension has no gravity and no air.

7.3 Space Dimension contains no blocks and no chunks.

7.4 Space Dimension contains Space Objects, which are represented as simple meshes, visible from very far away.

7.5 Space Dimension can also contain Players and Spacecraft.

7.6 Space Object is any natural occurring object in Space Dimension. It can be a Planet, a moon, an asteroid, etc.

7.7 Space Station is also a Space Object

7.8 Every Space Object contains its own specific Dimension, which is known as Object Dimension. (see

Object Dimension for more)

7.9 The number, positions, and properties of the Space Objects depend on the world Seed.

7.10 The sole exception is the Overworld Planet, which is always present at center of the Space Dimension

7.11 The behavior of Spacecraft in the Space Dimension is controlled by Mission Phases (see Mission Rules for a list of Phases)

7.12 Leaving the spacecraft while in the Space Dimension and without a Space Suit will result unsatisfactory mark on Player's official testing record, followed by death. (see GLaDOS)

7.13 If a Player in a Space Suit moves too close to a Space Object, they automatically enter Landing or Reentry phase. Just with their Space Suit. Unless the gravity in the Object Dimension is very weak, the Player is most likely to die on impact with the surface. Otherwise they are still very likely to get stranded.

8 Object Dimension

8.1 Every Space Object contains its own specific Dimension, which is known as Object Dimension.

8.2 Overworld is considered as an Object Dimension, but it is a Planet and hence rules below do not apply

8.3 There are no separate rules for Object Dimensions of Planets, because the Overworld is supposed to be the only Planet in existence.

8.4 The span of the Object Dimension is limited to cover its Space Object.

8.5 Object Dimension contains blocks and chunks specific to its Space Object.

8.6 The Space Dimension uses local gravity: the Player is pulled in the direction of the center-most block, with a force proportional to the total number of blocks in the Dimension, but inversely proportional to their distance from the center-most block. Hence the Newton's Law of Gravity ($F=GmM/r^2$) is preserved.

8.7 For sufficiently small Space Objects, it is possible for the Player to enter its actual orbit simply by jumping up and forward. The consequence of this rule is Fun.

8.8 Space Dimensions are abundant with ores. The Primary Ore is randomly selected and is the most common ore in the Space Dimension, with up to 10 times the Overworld spawn rate.

8.9 Ores other than the Primary Ore spawn up to 3 times as frequently as in Overworld.

8.10 Ores can be mined with a pickaxe.

8.11 Buildcraft Engines will not work in the Object Dimension

8.12 When outside the Spacecraft, Player must wear a Space Suit, otherwise they die.

8.13 It is not possible to activate a Nether Portal in the Object Dimension.

8.14 If the last block of the Object Dimension is removed, the Space Object is deleted.

8.15 If the last Player or player-made object leaves the Object Dimension, and the total number of blocks in the Dimension is below a specific value, the Space Object is deleted.

8.16 Upon deletion of a Space Object, its representation in the Space Dimension ceases to exist, and so does its Object Dimension. Any Players or Landers or Capsules present a that moment are automatically transferred to the Space Dimension. Launch Phase is skipped for Spacecraft. Any Spacecraft in the Orbital Phase around the deleted object are automatically moved to Exploration Phase.

9 Space Stations

9.1 A Space Station is a special kind of Space Object and it comes with a special kind of Object Dimension

9.2 An Object Dimension of a Space Station is known as Station Dimension.

9.3 When a Space Station is first established, a pre-fab Station Dimension is created for it

9.4 Station Dimension has no gravity, but has air.

9.5 Station Dimension is separated into two parts: the Inside and the Outside. A Space Suit is necessary to survive on the Outside

9.6 If the barrier between Inside and Outside is breached (for example by removing a wall block) then Space Suit is required to survive on the Inside

9.7 Only certain blocks are allowed to be placed in a Station Dimension:

9.8 Inside: Station Block, Airlock Block, Cable Block, 0g Smelter, IC cables, IC Power Containers (BatBox, MFS, MFSU)

9.9 Outside: Solar Panel, IC Power Containers, IC Cables

9.10 Station Dimension can be expanded by placing additional Station Blocks.

9.11 Airlock is a property of the Space Station Space Object

9.12 Airlock Object is a physical object in its Object Dimension.

9.13 Placing an Airlock Object in the Object Dimension of the Space Station creates a new free Airlock property.

9.14 Destroying the Airlock Object will remove its Airlock Property. Any Spacecraft assigned to this property is moved to Orbital Phase around the Station.

9.15 When Orbiting a Space Station, the Spacecraft GUI displays "Dock" option instead of "Land" option.

9.16 Before a "Dock" option is only allowed if there are unoccupied Air Locks in the Station

9.17 Upon Docking, Spacecraft is assigned to an Airlock, and disappears from both dimensions

9.18 Upon Docking, the Player is transferred to the Object Dimension of the station and placed near Airlock Object.

10   Launchpad

10.1 Launchpad is a special object made out of Launchpad Blocks. It is used to assemble, refuel and launch Spacecraft.

10.2 Launching Spacecraft is described by following procedure:

10.3 1a. Two identical Boosters are placed in Booster Slots

10.4 1b. Capsule or Warhead is placed in the Capsule Slot

10.5 2. Any Capsule Modules are placed in Capsule Module Slots

10.6 3. Launchpad is filled to the capacity with proper fuel (depends on chosen Boosters) and with LOX

10.7 4. Suborbital launches will allow the Player to enter destination coordinates in the same World.

10.8 5. "Launch" button will then become available and upon pressing it, a 20-second countdown will start.

10.9 If the player wants to board the Spacecraft, they must get to the capsule before the countdown finishes.

10.10 Launchpad will not accept Fuel or LOX if both Booster slots are empty

10.11 If a Booster Slot is cleared after accepting Fuel and Lox, both stored liquids are lost.

10.12 Launch Site is a special version of Launchpad for Object Dimensions other than the Overworld. It requires no Booster Stages and only 10% of the fuel and LOX as the Launchpad.

10.13 Each Booster Stage has specified Lift value.

10.14 Each Capsule and Capsule Module has specified Mass value.

10.15 If the sum of Mass of the Capsule and all used Modules is greater than Lift value of a single Booster Stage, then Launch is impossible.

10.16 The Lift and Mass values ale purposely left without a unit. The author of these rules is too lazy to research proper, realistic values.

10.17 The Player and any items in Player's Inventory are not considered in the Lift-Mass equation.

10.18 If The Rocket is Launching and a Catastrophic Failure occurred within the Lift-Off phase, the Launchpad will sound alarm siren.

11   Research

11.1 Research is conducted by a Player in a Research Station.

11.2 Research Station allows the Player to exchange experience levels for higher Spacecraft tech.

11.3 Specifically, Research Station allows to Invent new Components and increase reliability on already invented Components.

11.4 Research Station has four functions:

11.4.1 Invention – takes 5 levels, has 50% of discovering 1 item, 20% of discovering 2 items, 5% of discovering 4 items. Types of discovered items (Components, actually) are randomly chosen from a pool of not-yet-invented ones. Low-T Components are always invented first. i.e. T-2 Booster can only be Invented if all T-1 Components have already been invented.

11.4.2 Small Research – Takes 5 Levels, increases Researched Reliability of a chosen Component by 1-5%, up to Max. Reliability of that Component.

11.4.3 Medium Research - Takes 15 Levels, increases Researched Reliability of a chosen Component by 10-15%, up to Max. Reliability of that Component.

11.4.4 Large Research - Takes 30 Levels, increases Researched Reliability of a chosen Component by 25-30%, up to Max. Reliability of that Component.

11.5 Upon using the Research station, Player selects a function, and then in case of Research, selects the Component to be Researched. Both Research and Invention have immediate effects.

11.6 Components crafted before the Research or Invention remain unchanged, even if they were subject of the Research/Invention

11.7 Components crafted after the Research or Invention are affected.

11.8 All Components need to be Invented in order to function properly (i.e. with Current Reliability > 0)

11.9 All Capsule Modules, with exception of the Lander, are not Components and therefore don't have to be Invented or Researched.

12   Space Combat

12.1 Players can engage in space combat by firing Weapon Modules attached to their Capsules.

12.2 When the trigger button/key is pressed, all mounted weapons will be fired.

12.3 There are three different Firing Modes: Parallel Mode, Linked Mode, and Sequential Mode.

12.4 When the Weapons are in Parallel Mode, Weapon Modules will fire a their normal firing rate, and at the time of firing any additional Weapon Module will result in an additional projectile being spawned. i.e. all weapons fire at once, but each weapon type fires at its own rate. This is similar to "Full Guns" mode in Wing Commander games.

12.5 The Linked Mode is just like the Parallel Mode, but all Weapons have their firing rate synchronized with the slowest-firing weapon. This results in all firepower being concentrated in the same time window.

12.6 The Sequential Mode distributes projectiles equally over time. Each type of Weapon Module always spawns one projectile, and any additional Weapon Module of the same type will increase the firing rate.

12.7 Firing Modes can be toggled by the Player at any time.

12.8 Weapons are mounted on gimbals, in the forward-firing position.

12.9 If the Player is looking at a point within 10 degrees radius from the front of the Spacecraft, the Weapons will fire at the Player's aiming point.

12.10 If the Player looks further away than 10 degrees from front, weapons will not fire, and Azimuth Limit warning will light up on the Player's display.

12.11 This can be tuned later, possibly allowing turret-mounted weapons.

12.12 Absorbing projectiles will cause the Spacecraft to lose HP and eventually be destroyed in an explosion. The explosion is fatal to the pilot.

13   Components

13.1 T1 Components - suborbital only, low precision, low Reliability Constants. Comparable to: Vostok

Capsule

     13.1.1 T1 Warhead - explosion force of 2xTNT Mass: 250

     13.1.2 T1 Capsule - no maneuvering at all except for deorbit, no life support (space suit mandatory) Mass: 1000

     13.1.3 T1 Space Suit - Oxygen for 15 minutes, has no armor value

     13.1.4 T1 Booster - cheap but unreliable, uses Buildcraft fuel. Lift: 1000

  13.2 T2 Components - Limited use for exploration, medium precision, medium Reliability. Comparable to: Gemini Capsule

     13.2.1 T2 Capsule - capable of leaving orbit, very small fuel supply for maneuvers. Life support present. Incapable of landing on Space Objects other than the Overworld. Mass: 2500

     13.2.2 T2 Lander - unreliable with low fuel, single use only. Mass: 800

     13.2.3 T2 Space Suit - Oxygen for 25 minutes, has 0.25 armor value, increases walking speed while in Object Dimension (except for Planets)

     13.2.4 T2 Booster - Has an Abort Mechanism for the Orbit-Insertion Phase, uses Rocket Fuel. Lift: 5000

  13.3 T3 Components - Acceptable for exploration, high precision, high Reliability. Comparable to: Soyuz Capsule

     13.3.1 T3 Capsule - comfortable fuel supply, can land anywhere Mass: 4000

     13.3.2 T3 Lander - better fuel supply and maneuverability, single use. Mass: 1000

     13.3.3 T3 Space Suit - Oxygen for 45 minutes, has 0.33 armor value, increases walking speed while in Object Dimension (except for Planets), jumps higher

     13.3.4 T3 Booster - has an Abort Mechanism for Ascent and Orbit-Insertion Phase, uses Rocket Fuel. Lift: 10000

     13.3.5 T3 Nuclear Warhead – same as T1 Warhead, but uses IndustrialCraft's Nuke. Mass: 5000

  13.4 T4 Components - Best possible reliability figures. Beyond present technology.

     13.4.1 T4 Capsule - Big fuel reserve, can be re-used after landing by hitting it with a pickaxe. (Modules are lost) Mass: 7000

     13.4.2 T4 Lander - Lots of fuel, reusable. Mass: 1500

     13.4.3 T4 Space Suit - Oxygen for 120 minutes, has 0.5 armor value, increases walking speed while in Object Dimension (except for Planets), jumps higher, has a jet pack (non-functional on Planets)

     13.4.4 T4 Booster - has an Abort Mechanism for all ascent Phases, uses HE Rocket Fuel. Lift: 20000

14 Capsule Modules

  14.1 When assembling a Spacecraft at the Launchpad, Player can attach up to 9 modules to the Capsule.

  14.2 Modules are special items that extend functionality of the Spacecraft

  14.3 Lander (T1-T4) – The only module that is also a component. Allows Players to land on Space Objects without expending fuel supply from their Capsule. (Mass for each T-level Lander is given in Components chapter)

  14.4 Dart Gun* – Basic projectile weapon, causes minimal damage to target. Uses arrows from Player's inventory. Mass: 100

  14.5 Dart Rifle* – Same as Dart Gun, but more expensive and capable of automatic fire. Mass: 400

  14.6 TNT Cannon* - Fires slow but devastating projectiles. Expensive and heavy. Takes ammo from Player's Inventory. First it uses any available T3 Nuke Warhead, then it uses T1 Warheads, and finally, TNTs. Mass: 4000

  14.7 Lasgun* - The most expensive weapon. Vaporizes targets with laser blasts. Travels instantly, but damage is reduced by range. Uses fuel as ammo. Mass: 1000

  14.8 Capacitor* - Increases damage of the Lasgun up to 20%. Mass: 500

14.9 Beam Deflector* - Decreases damage taken from the Lasgun up to 20% Mass: 1000
14.10 Iron Armor – Very heavy, increases HP of the Spacecraft Mass: 2500
14.11 Steel Armor – Heavy, gives more HP than the Iron Armor Mass: 2000
14.12 Titanium Armor – Lighter, gives slightly more HP Mass: 2500
14.13 T-Alloy Armor – Same as Titanium Armor, but even lighter. Mass: 2000
14.14 Diamond Armor – Very light with huge HP increase. It is not certain if anyone is going to use it because it costs a lot of diamonds and Capsule Modules are always lost after landing in Overworld. Mass: 1000
14.15 Fuel Tank – Heavy, but increases total fuel reserve. It should be more economic to invent a better Capsule than to stuff a low-level capsule with Fuel Tanks to increase its range. Mass: 2000
14.16 XL Fuel Tank – Even Heavier, but much more fuel. Mass: 4000
14.17 Overthruster – Increases main engine thrust value. Mass: 2000
14.18 RCS Booster – Increases maneuverability. Mass: 2000
14.19 Cloaking Device – Reduces range at which Players can see the Spacecraft. Mass: 2000
14.20 Sensor Array – Compensates the effect of other Player's Cloaking Device. Mass: 1000
14.21 Backup Computer – Renders the Spacecraft immune to the first computer-related Failure Mass: 1000
14.22 Anti-Missile Rocket – Not usable in Spacecraft, but SDI uses it to shoot down Missiles.
14.23 Space Construction Module – Allows to build one Space Station. Mass: 2500
14.24 Modules marked with * are parts of the Weapons Module. A Minecraft Module is not to be confused with a Capsule Module :)

15   Machines

15.1 Launchpad - required to assemble and launch Spacecraft on a Planet (see: Launchpad)
15.2 Launch Site - Functionally identical to Launchpad, but does not require Rockets.
15.3 Rocket Refinery - converts buildcraft fuel to rocket fuel at 4:1, uses up to 18 MJ
15.4 HE Rocket Refinery - Converts LOX and Rocket Fuel to HE Rocket Fuel, uses up to 24 MJ
15.5 0G Ore Smelter - quadruples efficiency of ores. Only works at 0g (part of Station Module)
15.6 Research Station - player can trade xp levels for increases in reliability and new tech levels
15.7 Air Separator - Produces LOX when powered by Buildcraft Engines, uses up to 50 MJ
15.8 SDI – Shoots down incoming Missiles, needs anti-missile rockets in its inventory to work. It also needs an active Radar Station within 20 blocks to work.
15.9 Radar Station – constantly consumes 6MJ, detects incoming missiles. SDI needs it to work. The Radar Station will sound an alarm siren when it detects an incoming missile.

16   Ores

16.1 Titanium Ore - only generates as deep and is as rare as diamonds. Required for anything above T1

17   Items

17.1 Titanium Ingot – Spacecraft building material, acquired by putting Titanium Ore Block in a Furnace.
17.2 Titanium Alloy – Spacecraft building material, obtained by putting a Titanium Ingot in a Blast Furnace.
17.3 Launchpad Block – Needed to build a Launchpad or a Launch Site
17.4 Station Block – An Expensive block required to build and expand Space Stations.
17.5 Airlock Block – An even more expensive block required to equip Space Stations with Airlocks
17.6 Titanium Plate – Made from Titanium Ingots in Rolling Machine
17.7 T-Alloy Plate – Made from Titanium Alloy in Rolling Machine

18   Liquids

18.1 Rocket Fuel - obtainable by processing Buildcraft Fuel in a Rocket Refinery, required to launch T2 and T3 Rockets.

18.2 HE Rocket Fuel - obtainable by processing Rocket Fuel in HE Rocket Refinery, required to launch T4 Rockets

18.3 LOX - Liquid Oxygen, required to launch Spacecraft, produced by Air Separator, required to launch any rocket

19   Recipes

19.1 Machines

19.1.1 Rocket Refinery: 3x Golden Gear + 1x Refinery

19.1.2 HE Rocket Refinery: 3x Diamond Gear + 1x Rocket Refinery

19.1.3 0G Ore Smelter: 8x Titanium Ingot, 1x Golden Gear

19.1.4 Research Station: 5x Golden Chipset, 4x Iron Ingot

19.1.5 Air Separator: 4x Diamond Gear, 2x Tank, 2x Piston, 1x Refinery

19.1.6 SDI: 2x Piston, 2x Golden Gear, 2x Redstone Golden Chipset

19.1.7 Radar Station: 1x Redstone Golden Chipset, 3x Iron Block, 1x Iron Ingot, 1x Piston

19.1.8 Launchpad: 32x Launchpad Block

19.1.9 Launch Site: 4x Launchpad Block

19.2 Items

19.2.1 Launchpad Block (x4): 8x Iron Bars, 1x Steel Ingot

19.2.2 Space Fabric: 5x Cotton, 4x Leather

19.2.3 Titanium Plate (Rolling Machine): 9x Titanium Ingot

19.2.4 T-Alloy Plate (Rolling Machine): 9x Titanium Alloy

19.2.5 Station Block: 4x Titanium Ingot, 5x Steel Ingot

19.2.6 Airlock Block: 8x Titanium Ingot, 1x Steel Ingot

19.3 T1 Components

19.3.1 T1 Booster: 1x Redstone Iron Chipset + 8x Iron Ingot

19.3.2 T1 Capsule: 1x Redstone Iron Chipset + 8x Iron Ingot

19.3.3 T1 Warhead: 1x TNT + 1x Redstone Iron Chipset + 7x Iron Ingot

19.3.4 T1 Space Suit Helmet: 5x Cotton, 1x Tank

19.3.5 T1 Space Suit Chestplate: 8x Cotton, 1x Redstone Iron Chipset

19.3.6 T1 Space Suit Leggings: 7x Cotton

19.3.7 T1 Space Suit Boots: 4x Cotton

19.4 T2 Components

19.4.1 T2 Booster: 1x Redstone Golden Chipset + 8x Steel Ingot

19.4.2 T2 Capsule: 1x Redstone Golden Chipset + 8x Steel Ingot

19.4.3 T2 Lander: 6x Iron Ingot, 1x Redstone Golden Chipset, 1x Tank

19.4.4 T2 Space Suit Helmet: 5x Leather, 1x Tank

19.4.5 T2 Space Suit Chestplate: 8x Leather, 1x Redstone Golden Chipset

19.4.6 T2 Space Suit Leggings: 3x Cotton, 4x Leather

19.4.7 T2 Space Suit Boots: 2x Cotton, 2x Leather

19.5 T3 Components

19.5.1 T3 Booster: 1x Redstone Diamond Chipset + 8x Titanium Ingot

19.5.2 T3 Capsule: 1x Redstone Diamond Chipset + 8x Titanium Ingot

19.5.3 T3 Nuclear Warhead: 1x Nuke + 1x Redstone Gold Chipset + 7x Titanium ingot

19.5.4 T3 Lander: 6x Titanium Ingot, 1x Redstone Diamond Chipset, 1x Tank

19.5.5 T3 Space Suit Helmet: 5x Space Fabric, 1x Tank

19.5.6 T3 Space Suit Chestplate: 8x Space Fabric, 1x Redstone Diamond Chipset
        19.5.7 T3 Space Suit Leggings: 6x Space Fabric
        19.5.8 T3 Space Suit Boots: 4x Space Fabric
    19.6 T4 Components
        19.6.1 T4 Booster: 1x Redstone Diamond Chipset + 8x Titanium Alloy
        19.6.2 T4 Capsule: 1x Redstone Diamond Chipset + 8x Titanium Alloy
        19.6.3 T4 Lander: 6x Titanium Alloy, 1x Redstone Diamond Chipset, 1x Iron Tank Gauge
        19.6.4 T4 Space Suit Helmet: 2x Space Fabric, 3x Titanium Alloy, 1x Iron Tank Gauge
        19.6.5 T4 Space Suit Chestplate: 2x Space Fabric, 6x Titanium Alloy, 1x Redstone Diamond Chipset
        19.6.6 T4 Space Suit Leggings: 3x Space Fabric, 3x Titanium Alloy
        19.6.7 T4 Space Suit Boots: 2x Space Fabric, 2x Titanium Alloy
    19.7 Capsule Modules
        19.7.1 Dart Gun: 6x Iron Ingot, 1x Bow, 1x Piston, 1x Redstone Iron Chipset
        19.7.2 Dart Rifle: 3x Dart Gun, 3x Piston, 1x Redstone Golden Chipset, 2x Steel Ingot
        19.7.3 TNT Cannon: 1x Iron Tank Gauge, 2x Redstone Diamond Chipset, 2x Piston, 4x Titanium Alloy
        19.7.4 Lasgun: 3x Redstone Diamond Chipset, 5x T-Alloy Plate, 1x Diamond
        19.7.5 Capacitor: 4x Diamond, 2x Titanium Alloy, 1x Redstone Golden Chipset
        19.7.6 Beam Deflector: 3x Glass, 6x Titanium Alloy
        19.7.7 Iron Armor: 4x Iron Plate, 1x Steel Ingot
        19.7.8 Steel Armor: 4x Steel Plate, 1x Titanium Ingot
        19.7.9 Titanium Armor: 4x Titanium plate, 1x Titanium Alloy
        19.7.10 T-Alloy Armor: 4x T-Alloy Plate, 1x Diamond
        19.7.11 Diamond Armor: 3x Diamond Block, 6x Titanium Alloy
        19.7.12 Fuel Tank: 1x Tank, 8x Steel Ingot
        19.7.13 XL Fuel Tank: 1x Iron Tank Gauge, 8x Titanium Ingot
        19.7.14 Overthruster: 1x Iron Tank Gauge, 6x Titanium Ingot
        19.7.15 RCS Booster: 4x Titanium Plate, 1x Iron Tank Gauge
        19.7.16 Cloaking Device: 3x Obsidian, 2x Redstone Golden Chipset, 3x Redstone Diamond Chipset, 1x
            Ender Pearl
        19.7.17 Sensor Array: 3x Radar Station, 3x Redstone Golden Chipset, 3x Titanium Ingot
        19.7.18 Backup Computer: 8x Titanium Ingot, 1x Redstone Diamond Chipset
        19.7.19 Anti-Missile Rocket: 1x Warhead, 1x T1 Booster Stage, 1x Rocket Fuel Bucket (Bucket is lost)
        19.7.20 Space Construction Module: 6x Station Block, 3x Airlock Block

20   Failure Pools

20.1 Booster Stage (Non-Catastrophic):

No.	Failure Name	Phases	Consequence
1	Control System Malfunction	1,2,3	Spacecraft enters the Space Dimension in an incorrect place
2	Stage Malfunction	1	Rocket fails to launch
3	Ignitor Malfunction	1	Rocket launches before countdown finishes

20.2 Booster Stage (Catastrophic):

No.	Failure Name	Phases	Consequence
1	Rocket Engine Failure	1	Explosion
2	Stage 1 Failure	2	Craft falls down and crashes

3	Stage 2 Failure	3	Craft moves to phase 7, random location
4	Stage 1 Separation Failure	2	Craft falls down and crashes
5	Stage 2 Separation Failure	3	Craft reaches orbit, but booster stage remains attached. The only option is to de-orbit.
6	Fuel Fire	1	Explosion after several seconds

20.3 Warhead [also, Nuclear] (Non-Catastrophic)

No.	Failure Name	Phases	Consequence
1	Guidance Malfunction	7	Misses the target slightly
2	Detonator Malfunction	8	Explosion force reduced by 50%

20.4 Warhead (Catastrophic)

No.	Failure Name	Phases	Consequence
1	Premature Detonation	1,2,3,8	Explodes with full force
2	Power-On Failure	8	Dud (no explosion at all)

20.5 Capsule (Non-Catastrophic)

No.	Failure Name	Phases	Consequence
1	Gyro Malfunction	5,9,11	Partial loss of one control axis (yaw or pitch)
2	RCS Software Malfunction	5,9,11	Control axis are reversed
3	Electrical Malfunction	4,5,6,9,11	Damage done to Spacecraft
4	Hydraulic Malfunction	4,5,6,9,11	Craft less responsive.
5	Life Support Malfunction	4,5,6,9,11	Player dies if without a Space Suit
6	Computer Malfunction	4,5,9,11	Control scheme changed to direct RCS valve control
7	Fuel Leak	4,5,9,11	Fuel slowly runs out

20.6 Capsule (Catastrophic)

No.	Failure Name	Phases	Consequence
1	Capsule Sunk	8	Sinks immediately on landing, possibly fatal.
2	Heat-shield Failure	7	Fatal explosion
3	Power-On Failure	3 > 4*	Vehicle unresponsive, Player stranded
4	Engine Failure	4,5,6	Vehicle unresponsive, Player stranded
5	Engine Failure	9,11	Total loss of thrust, possible crash
6	RCS Failure	5,9,11	Total loss of direction control, Player possibly stranded
7	Parachute Failure	8	Vehicle hits water with great velocity, possibly fatal.
8	Separation Failure	3	Phase changed to 7, added penalties

* - this malfunction occurs only on transition from phase 3 to 4

20.7 Lander (Non-Catastrophic)

No.	Failure Name	Phases	Consequence
1	Docking Failure	6	LM no longer usable, Phase switches back to 4
2	Docking Failure	11	LM won't reconnect, Player must spacewalk to the Capsule
3	Electrical Malfunction	6,9,11	Damage done to Lander
4	Hydraulic Malfunction	6,9,11	Lander less responsive.
5	Life Support Failure	6,9,11	Player dies if without a Space Suit
6	Computer Failure	6,9,11	Control scheme changed to direct RCS valve control
7	Gyro Failure	9,11	Loss of one control axis (yaw or pitch)
8	RCS Software Failure	9,11	Control axis are reversed
9	Fuel Leak	9,11	Fuel slowly runs out

20.8 Lander (Catastrophic)

No.	Failure Name	Phases	Consequence
1	Power-On Failure	6	Vehicle unresponsive, Player must spacewalk to the Capsule
2	Engine Failure	9,11	Total loss of thrust, possible crash
3	RCS Failure	9,11	Total loss of direction control, possible crash

20.9 Space Suit (Non-Catastrophic)

No.	Failure Name	Phases	Consequence
1	Space Suit Malfunction	-	Damage done to Player
2	Space Suit Oxygen Loss	-	Work time reduced
3	Space Suit Valve Failure	-	Player gets dizzy (portal-entering animation?)

20.10 Space Suit (Catastrophic)

No.	Failure Name	Phases	Consequence
1	Pressurization Failure	-	Instant Death

(Space Suits never count as Active Components, but they can experience failures while Players wear them)
(You may have noticed that most Catastrophic Failures are called "Failures", while most Non-Catastrophic Failures are called "Malfunctions". This is not a coincidence, but it is also not a strict convention.)

21 Version Plan

21.1 Version 0: Proof that following features are possible and practical to implement:
    21.1.1 Players and Entities above Y=250
    21.1.2 Launchpad
    21.1.3 Zero Gravity Dimension
    21.1.4 Local Gravity Dimension

22   Future Plans