



PROJECT SHATTERSTAR



VOLUME 1 OF GUIDE TO THE ONI-VERSE

OXYGEN
NOT INCLUDED

SPACED
OUT!

By-
the stormfather

CHAPTER 13 : Interplanetary Inventory Management



Mid Game



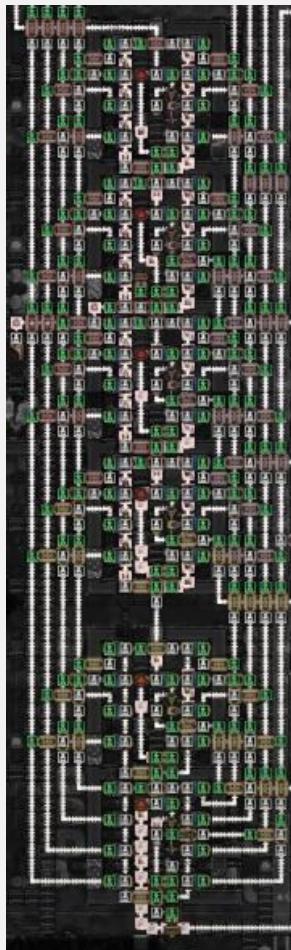
Cycle 0

Cycle 750

STORMLINK^{3.0}

Cycle 800

Cycle ∞



We have payload launchers... but with Stormlink version 3, you can make them smarter.

Highlights :

- We test out our first stormlink system for solids
- We go forward in time to see how it can be expanded
- We discuss the implementation for liquid and Gas
- We dive into the mechanics and automation



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Disclaimer-

Oxygen Not Included is a sandbox game limited only by the player's imagination. I can assure you that no player (including me) has figured out the 'right' way to play the game.... No matter how many hours they may have put into the game.

That's because there is no right way. What you do depends on what you want to achieve. Some love building ridiculous and elaborate builds, while others are more efficient and practical. Both are perfectly acceptable ways to play. What matters is that you enjoy what you do.

The following document is a guide and not a gospel. Like every other player, I have my unique style of play. What I intend to do is to share my playstyle and start a conversation with the community. This document will take you through a real and typical game, showcasing my approach to things. The playthrough will not be perfect. But it will be enlightening and entertaining. I hope my readers will use this series to modify their own unique style rather than copy mine.

Feel free to skip, ignore or modify any of the recommendations given in the series.

All Game art has been taken from the game files and is the property of Klei (if that wasn't obvious enough). I've used them only to make the document more engaging.

While this guide is quite simple, It's not meant to spoon-feed you. You may have to do a bit of additional research if you are a new player, and I'm happy to answer any specific questions.

The easiest way to find me is on Reddit. My handle u/Storm-Father. Please feel free to drop me a message or tag me in a post.

The series will use the following mods. These are quality-of-life mods and do not affect core gameplay

- Wounded go to Med bed
- Blueprints fixed
- Bigger Building Menu
- No 'Long Commutes'
- Suppress Notifications

- Geyser Calculated Average Output tooltip
- Critter Inventory
- Queue for Sinks
- FreeCamera
- MaterialColor
- Show industrial Machinery Tag

Game Coordinates – ‘SNDST-C-360860549-0’

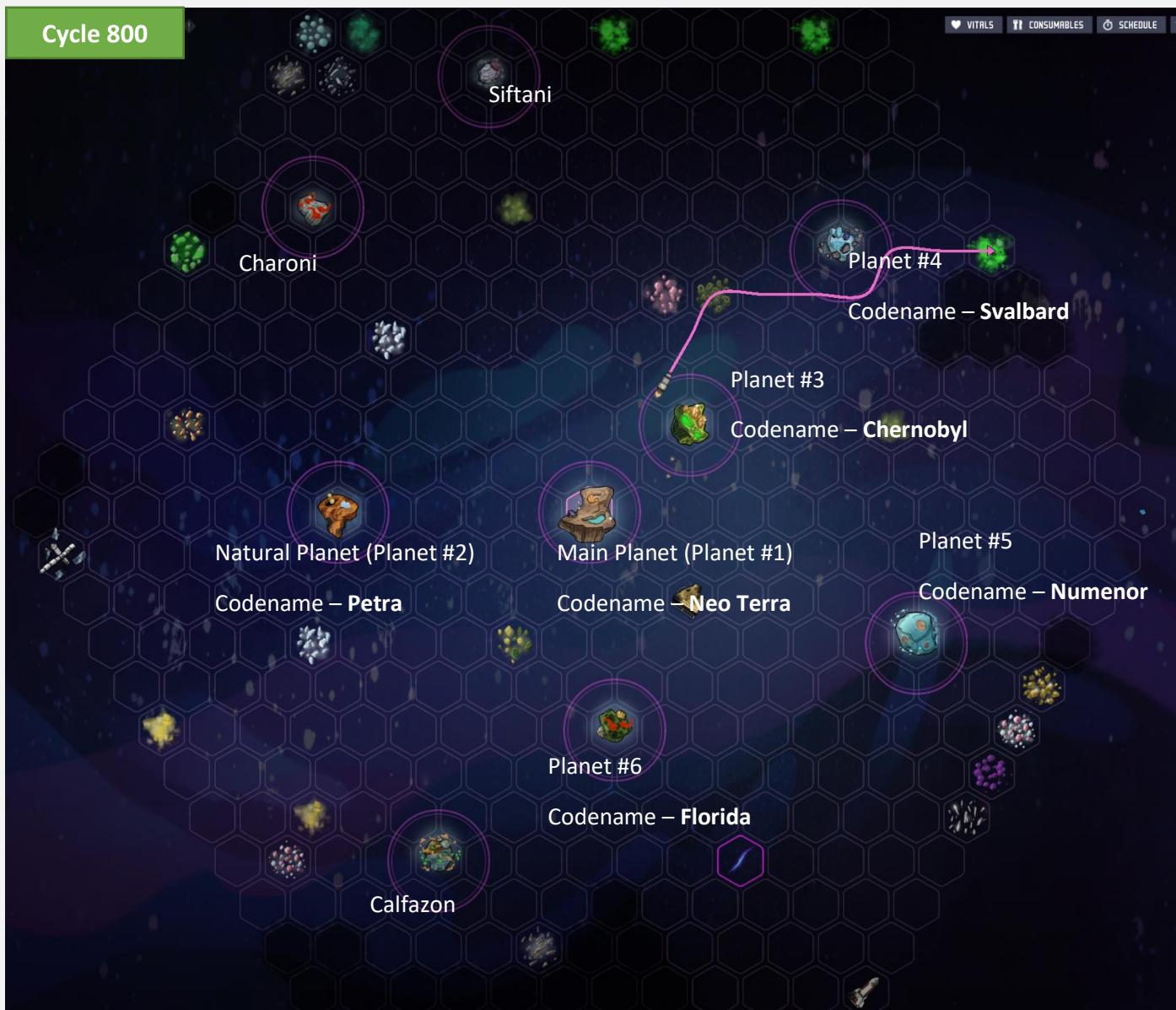


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The Starmap



The layout of the introduction has been changed to accommodate the increase in information that comes from having multiple planets. If you have any suggestions on alternate layouts or additional information, feel free to let me know on Reddit.



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Neo Terra

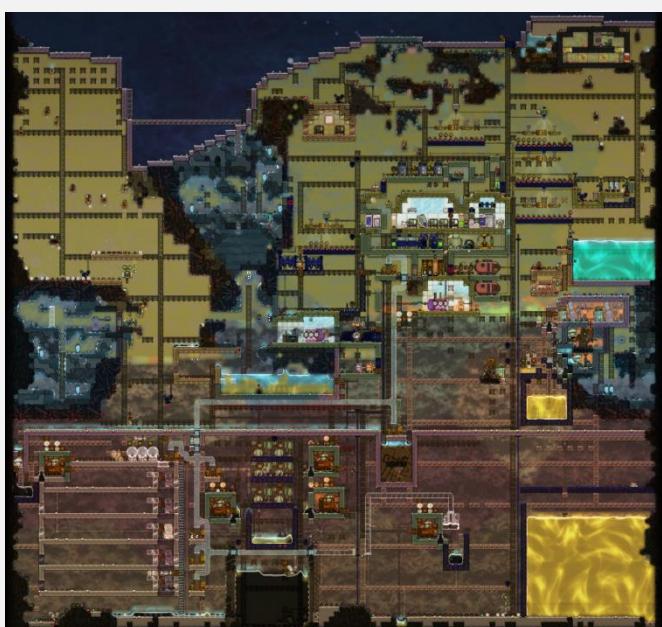


Cycle 750

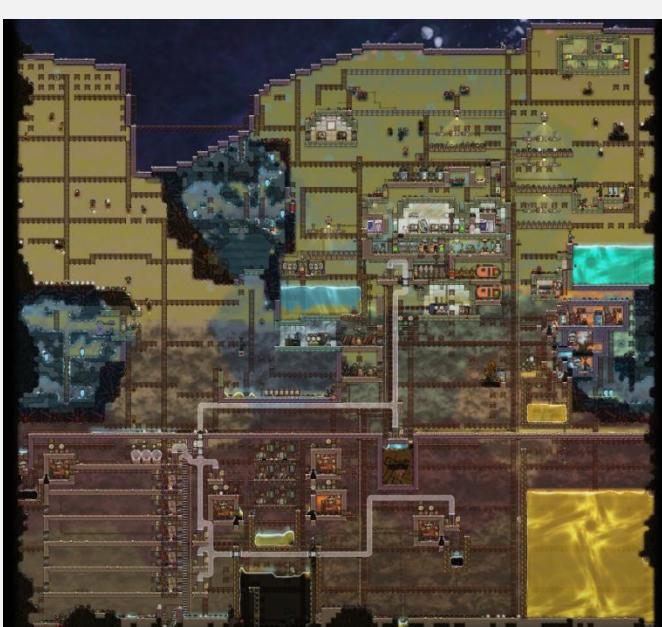


Cycle 800

Petra



Cycle 750



Cycle 800

StormFather



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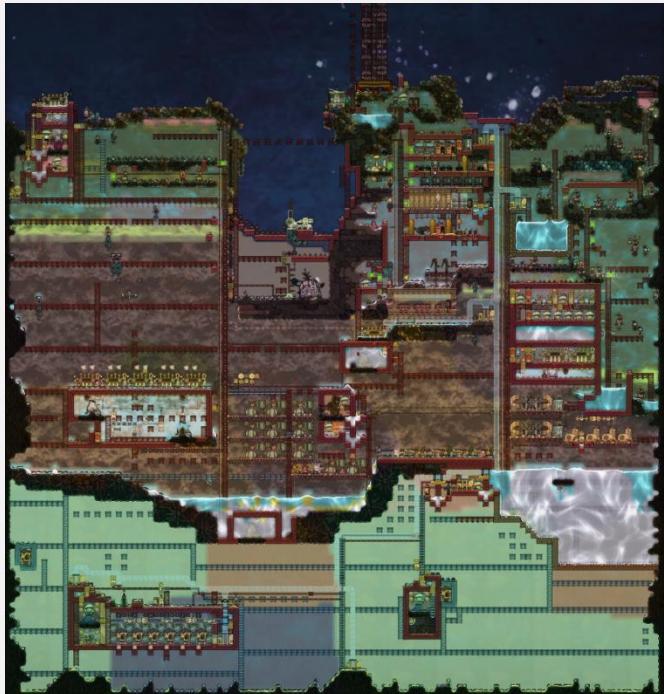


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Chernobyl



Cycle 750

Cycle 800

Svalbard



Cycle 750



Cycle 800



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Numenor



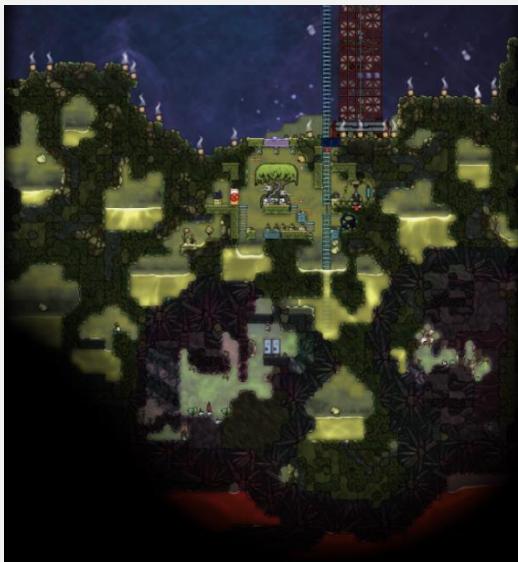
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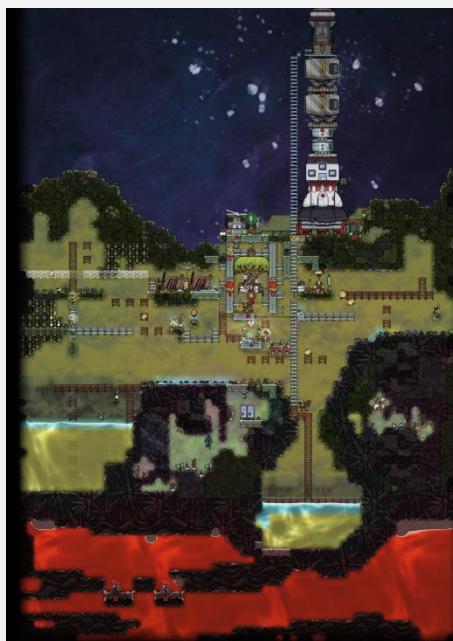
Cycle 800

StormFather

Florida



Cycle 750



Cycle 800



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1) Why Stormlink 3.0

If you look at the screenshots of the planets, it would seem like not much has happened in the last 50 cycles. However, there have been many subtle changes, but I only want to highlight a few, which I'll do at the end of the chapter. Today we're mainly going to discuss my take on Inventory management - Stormlink 3.0.

While moving things automatically across the map has been an important part of ONI for a long time, Spaced Out presents some special challenges, where materials have to be sent across space. The payload launchers we set up in the last chapter will physically move materials to other planets, but we would have to feed them manually. Indeed, I used manual methods to send materials for hundreds of cycles, and there is nothing wrong with it, but automating the process allows us to focus on other tasks at hand.

The goal of Stormlink is simple – Send any material to any planet based on the planet's requirement.

As I've said before, I'm not very good with nor particularly fond of debug mode, meaning I like doing my trials in a live game. So Stormlink has gone through many big and small changes to get to where it is now. While the first trials were conducted by Cycle 850, I didn't actively begin using Stormlink until Cycle 1000 or so. And I added liquid and gas Stormlinks even later. I'm discussing it a bit early for the following reasons:

- I built Stormlink over 500 to 1000 cycles, mainly due to a massive shortage of metal ore and refined metal. Discussing it over so many chapters would dilute the point and would be hard for people to follow along.
- Things move a bit fast over the next few hundred cycles, and I don't want Stormlink discussions to interrupt those.
- Stormlink 3.0 is by far my favorite build, one that I have practically built from scratch over the years, I'm just very excited to share it with you all.



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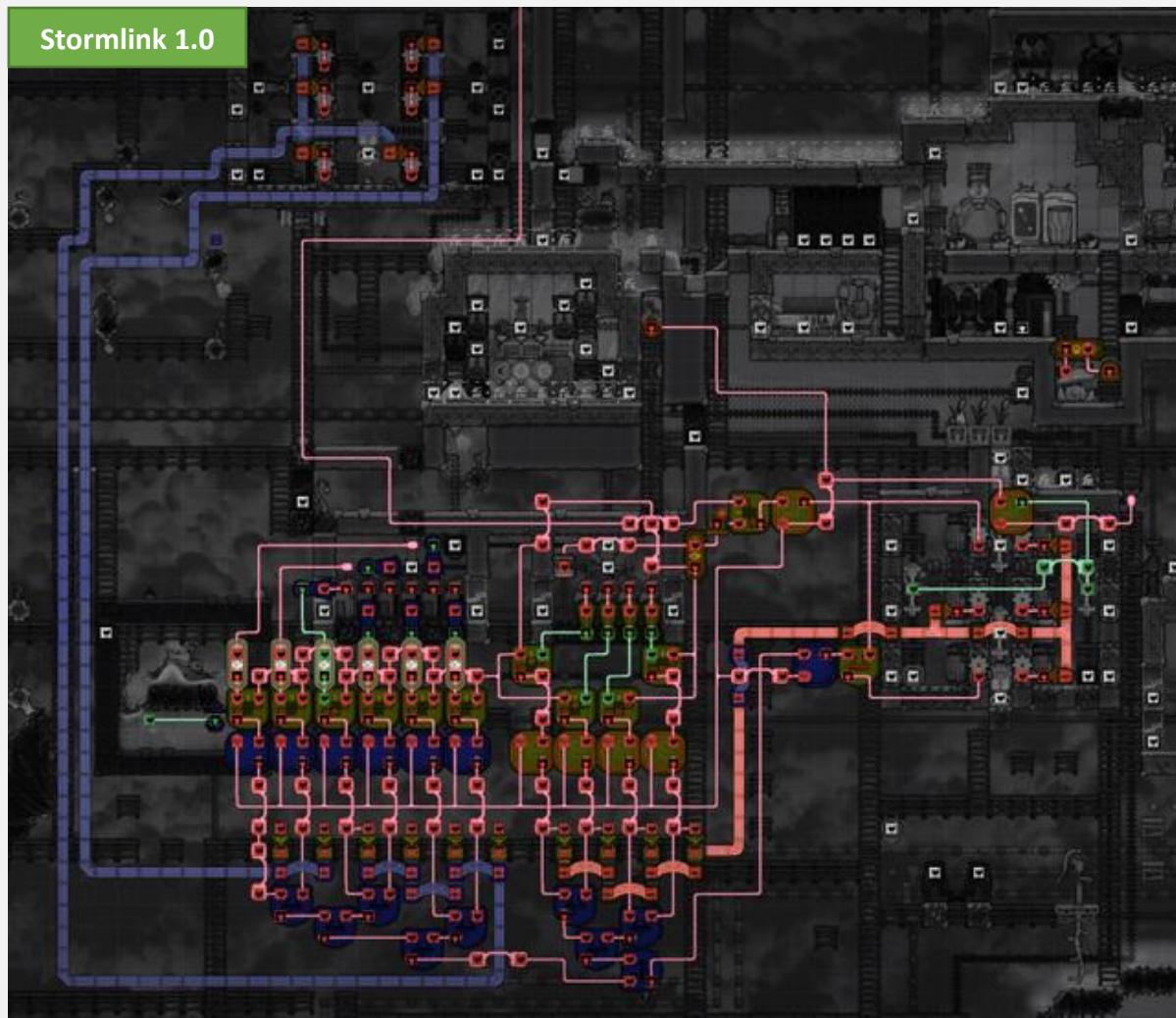
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2) The History of Stormlink

A little history on why it's Stormlink 3.0 before we actually get to it.

The idea of Stormlink is as old as Spaced Out itself. When the game first came out in beta, Automation broadcasters and receivers weren't a thing (these let you send and receive automation signals across planets through space). Stormlink 1.0 was my answer to this problem. It was a complex automation system that used seeds as 'tokens', with each seed corresponding to a different material. It worked very well to automatically move materials via the teleporter, but I had not tested it with the payload launcher yet.



It was a very hard system to build and I absolutely loved it. I had planned to make a full detailed post about it on Reddit, but ONI released broadcasters and receivers before I got to it. I was pretty annoyed at the time, as you can probably guess from my post here:

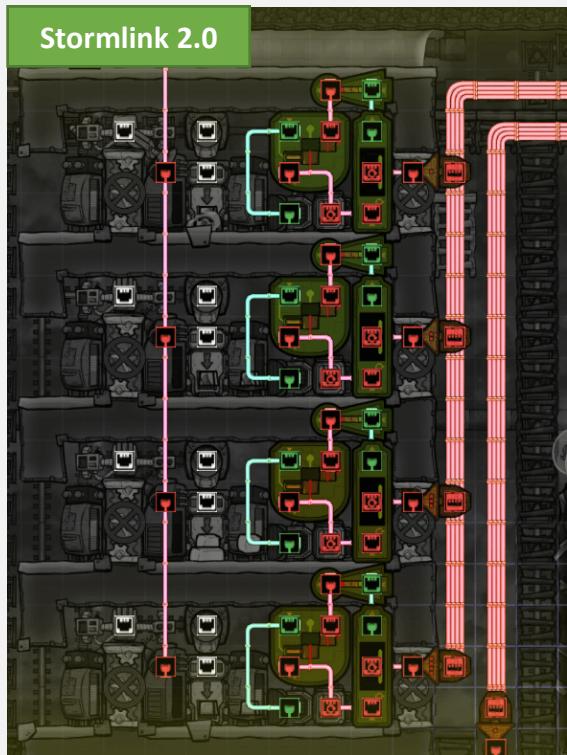


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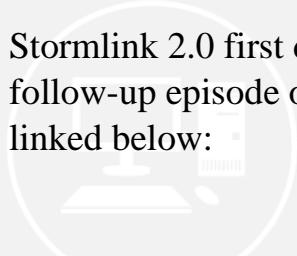
https://www.reddit.com/r/Oxygennotincluded/comments/phm1wv/new_building_in_the_spaced_out_testbranch_just/



But I was able to salvage ideas from it for future builds. And today, I'm glad we have space automation because while Stormlink 1.0 was the OG, scaling it over multiple planets would have been close to impossible.

Stormlink 2.0 was a more practical solution that incorporated broadcasters and receivers for signals, using an improved form of inventory management than 1.0. I won't go into too many details here as I've documented it before.

Stormlink 2.0 first debuted in SGG #20, with a follow-up episode of ANI, both of which are linked below:



https://www.reddit.com/r/Oxygennotincluded/comments/puez9v/the_stormfathers_guide_to_the_galaxy_20_setting/

StormFather

https://www.reddit.com/r/Oxygennotincluded/comments/pqge3m/academy_not_included_4_how_to_make_automatic/

While 2.0 was 'more practical', it still wasn't practical enough. The delivery mechanism was really precise but was hard to scale for the following reasons:

- The material dispensers were great when there was only one target planet but were hard to scale for multiple planets. Indeed, Stormlink 2.0 was never integrated with payload launchers.
- The dispensers took up a lot of space and were not stackable.
- Every material had a separate receiver and broadcaster for each planet, which is not scalable.



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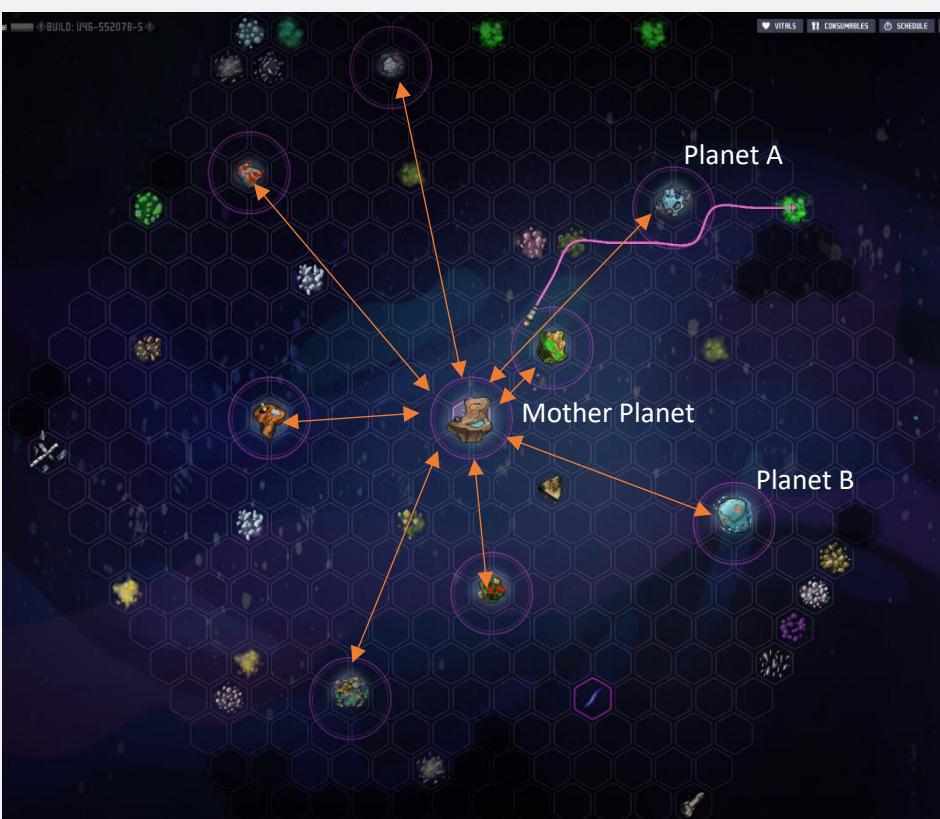
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3) Getting Started –

To make the guide simpler to follow, I will be splitting it into multiple sections, first discussing the sending and receiving pods, before understanding how they work together. After we have covered the basics of solid material transport, I will discuss the principles of liquid and gas transport. Most screenshots I will use to show the system come from some time beyond 2000 cycles and they will be marked as such.

Stormlink relies on a ‘Mother planet’ that serves as a logistics hub. If for example, I need to move material from planet A to Planet B, I can’t move it directly. Planet A will send the material to the mother planet, which will then send it to planet B. Basically the mother planet can send material to all planets, but all planets can only send material to the mother planet. Here, Neo Terra will be the mother planet.



Neo Terra is the obvious choice given the central location and the large amount of space on the planet.

We will be deploying Stormlink on a need basis, so some planets may not get connected even after thousands of cycles, simply because it isn’t required.

The design principles behind my system are as follows:

- Scalability
- Simplicity
- Minimal use of automation
- Option for manual control.



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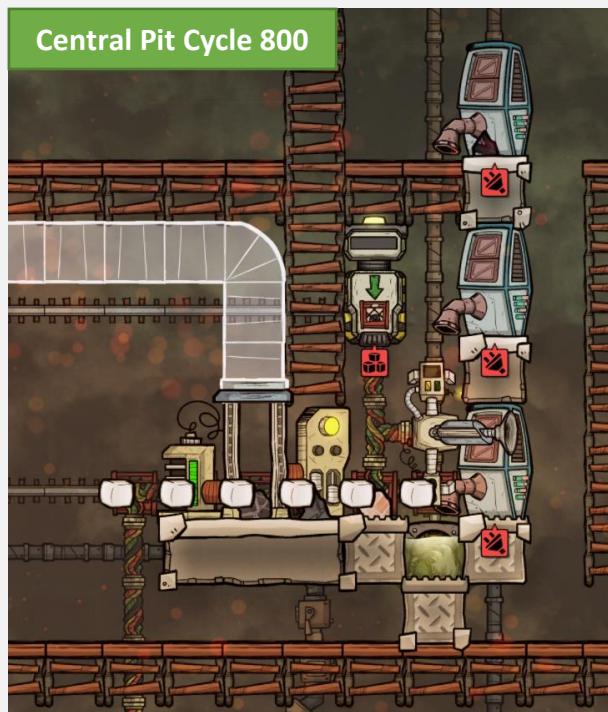
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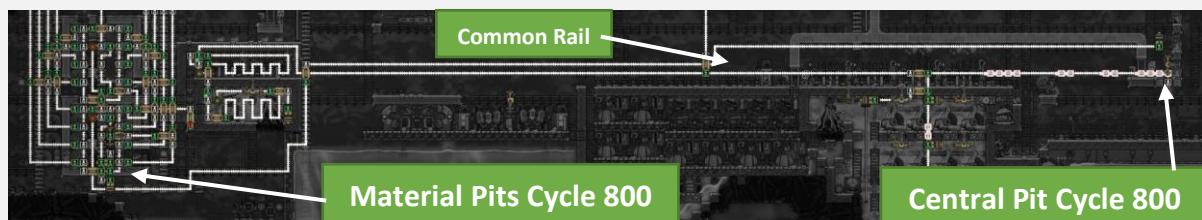
4) Sending Mechanism –

Before we figure out the automation, we need to figure out the mechanics of how we can send material across.

I have often used a ‘central pit’ where I dump all material into one single tile and use multiple conveyor loaders to send them where required. Even here I have a central pit, but sending material to various planets from a single pit gets chaotic. Instead, I use several conveyor loaders to move material from the central pit to a ‘material pit’, which is a single tile that holds a bunch of the same material.



You can use a separate loader for each material, but that would be a lot of work and is not really necessary. A number of materials can share the same conveyor and be separated using the element sensor.



These material pits then act like smaller central pits, in the sense that they can send material into several other conveyor systems as required.



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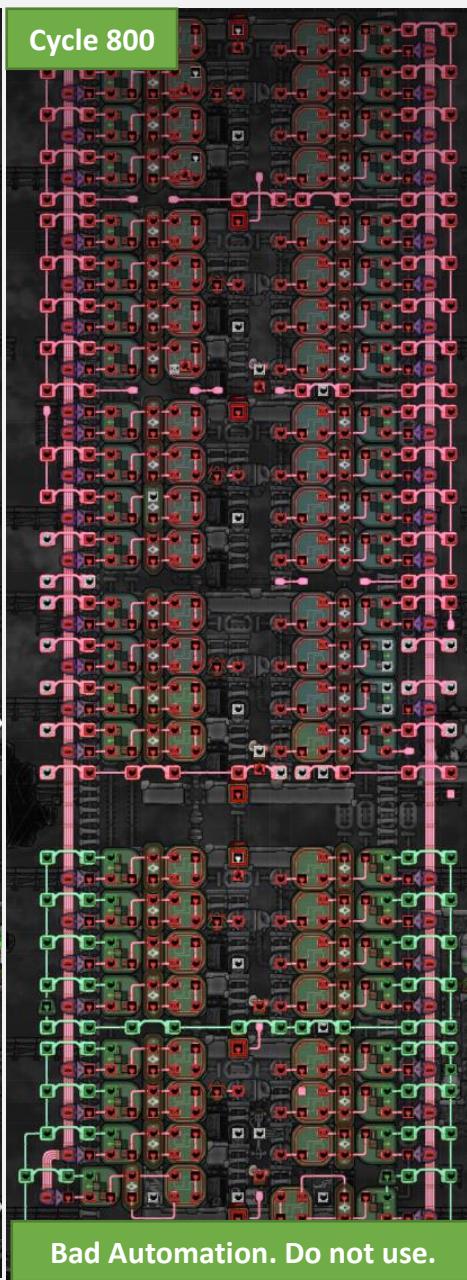
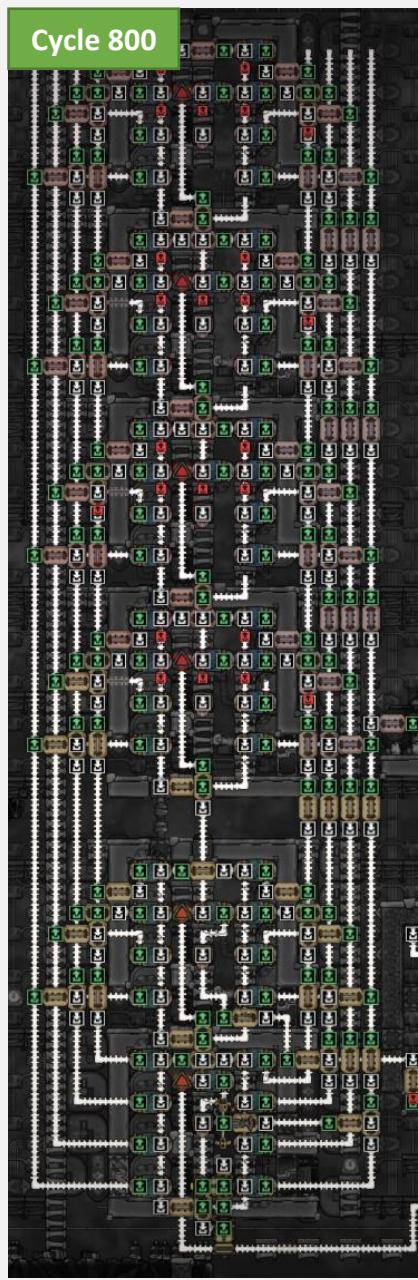


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Here is what it initially looked like. It looks like an intimidating mess, but let's break it down into simpler sections. I'll also now jump to the future to show a better version.



Bad Automation. Do not use.

The Core –

The core of the mechanism serves 2 functions. It allows for a common rail to pass through it, with an element sensor that allows a specific material to be filtered out and added to the pit. The second function is that it has an infinite loop that moves the material in a circle. Here we see a couple of these loops stacked together. The green lines symbolize the common rail and the red symbolizes the loop. Note that we have set the bridges such that these rails are separate and do not join each other in any way.



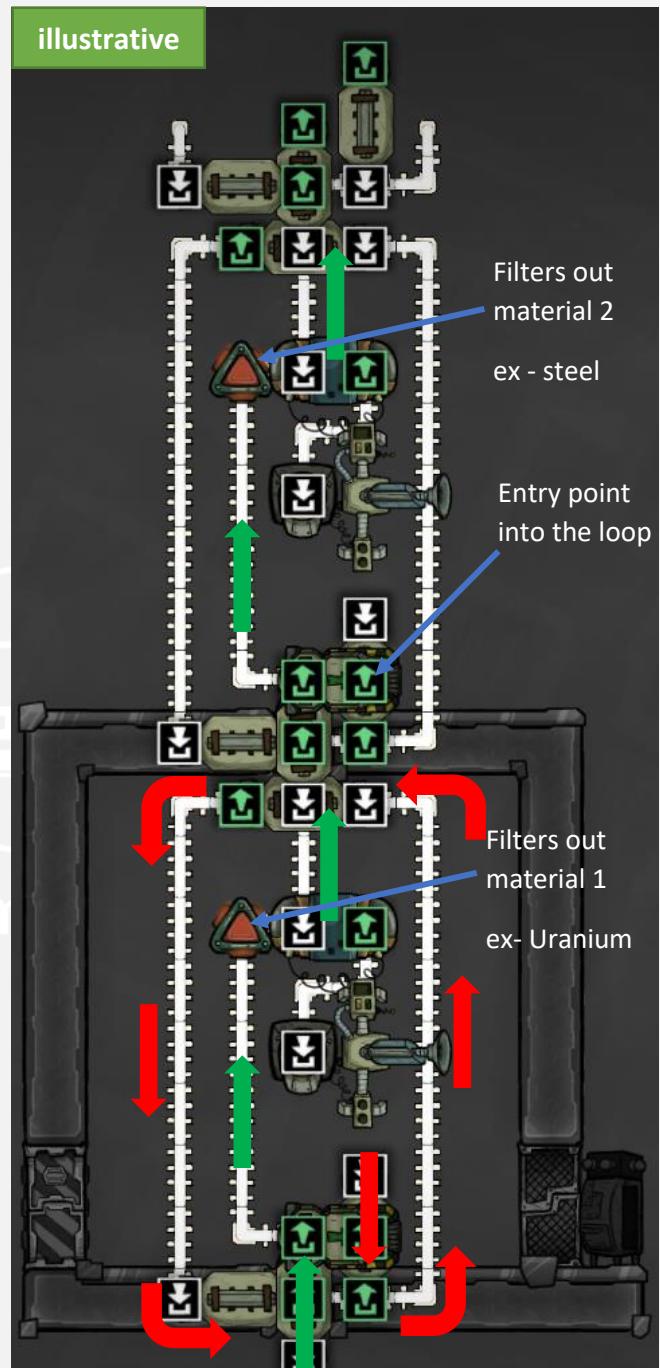
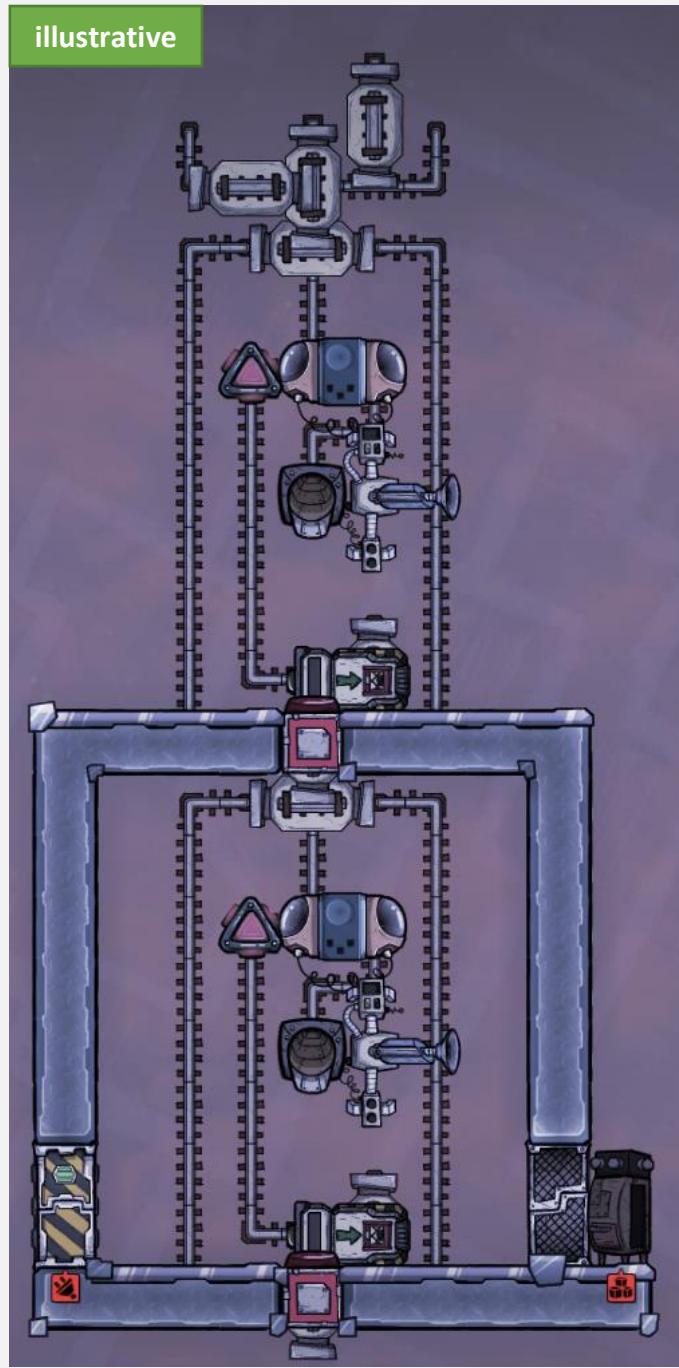
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The input for the common rail comes from a conveyor loader in the common pit and the material for the infinite loop comes from the autosweeper and the conveyor loader in the pod.



The next step is to add 8 exit points to the infinite loop, and these exit points are going to be conveyor shutoffs. The input is on the infinite loop and the output is facing outwards. There are 4 shutoffs on either side.

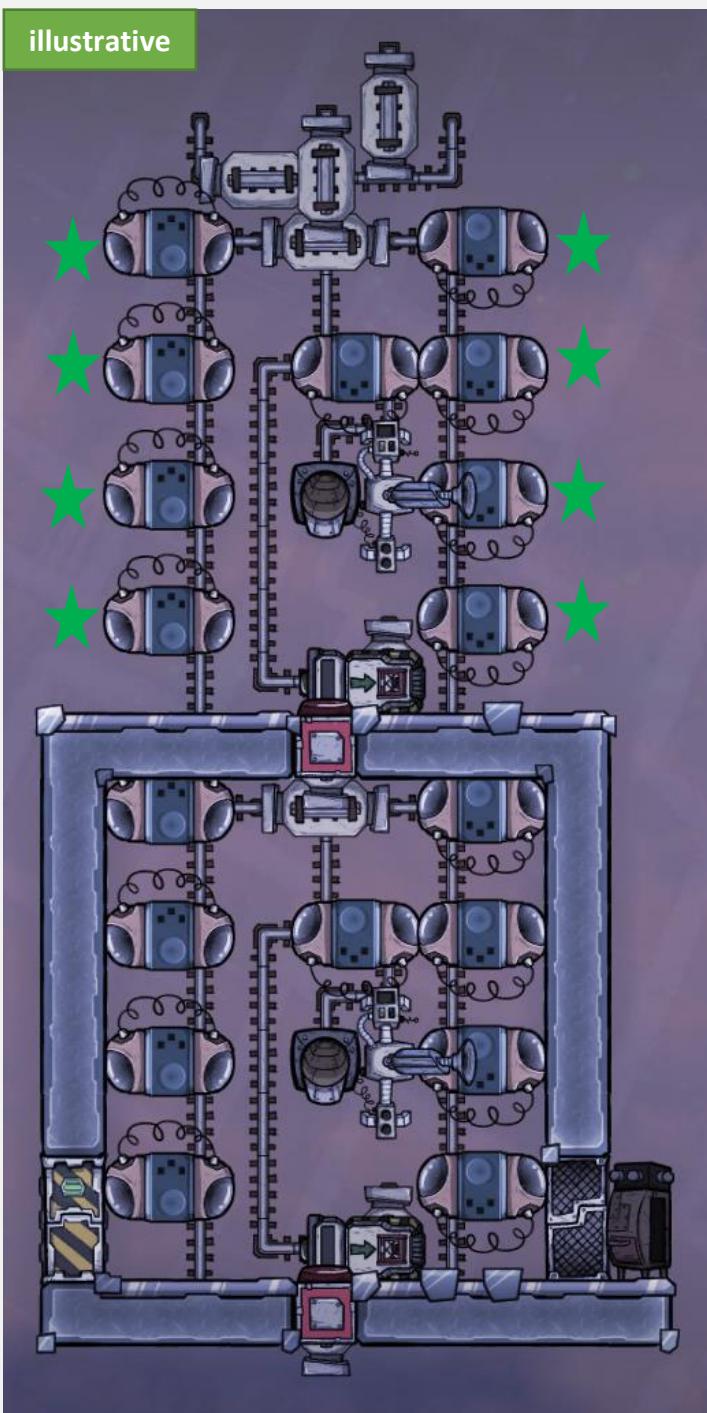


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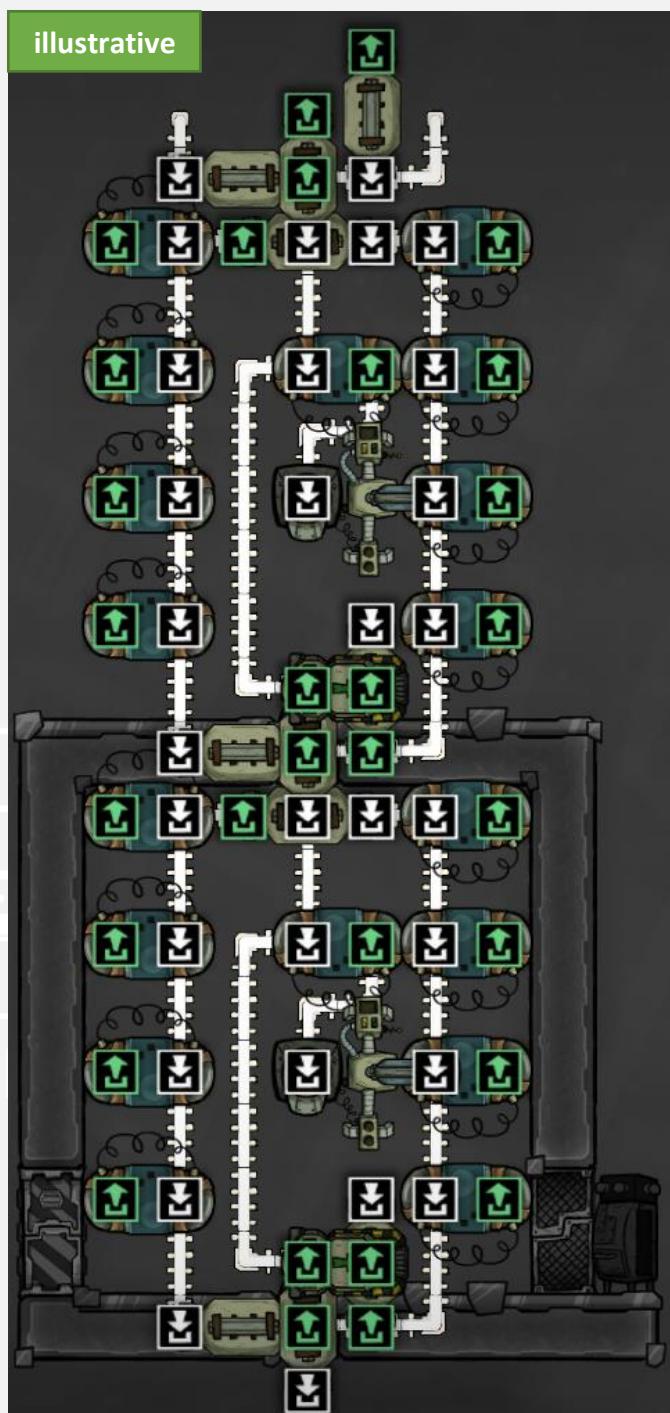
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Illustrative



Illustrative



Next, these 8 shutoffs have to connect with 8 separate conveyor rails, and this bit can get a bit tricky. Bridges are a tricky and useful thing, and you have to be careful to use them correctly here. I have an ANI episode that talks about bridge mechanics, and you should check that out if you want more clarity on how they work.



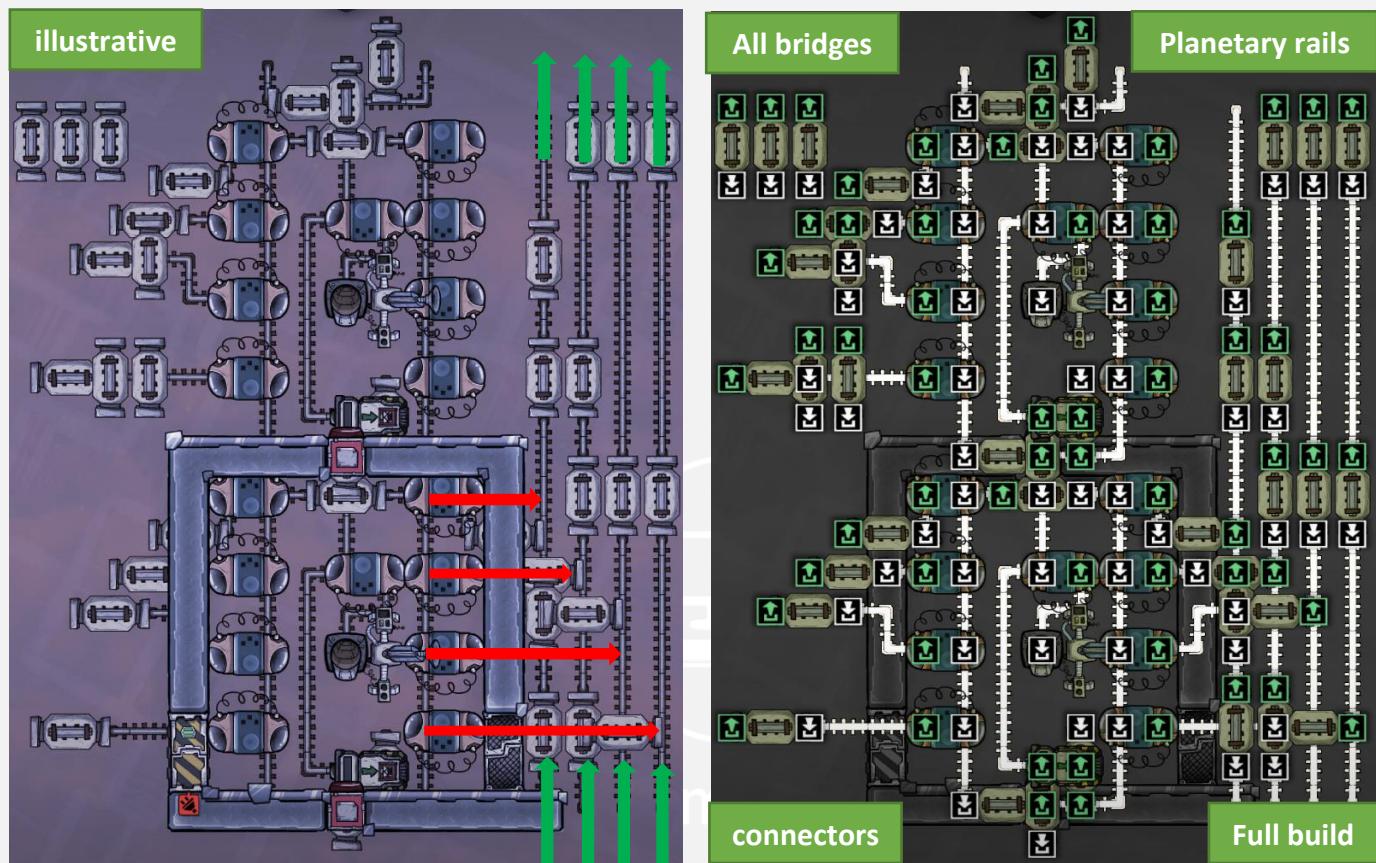
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The concept is simple though. On each side of the pod, there will be 4 separate conveyor rails, which will ultimately end at the 4 interplanetary launchers. The trick is to connect the shutoffs to the rails without crossing wires with any other rail.

In these screenshots, I've shown the rails at various stages of construction so that they are easier to follow and duplicate.



And that's pretty much it. Connect this with power and this build will be physically capable of sending material to the payload launchers. Now we just have to focus on the automation. The 8 rails will ultimately end up at 8 different payload launchers

5) Sending Automation -

Now that we have got the mechanics down, let's focus on the automation. The automation itself is simple, but let's build it and then focus on how it works.

For the sake of simplicity, I have the automation shown separately, with the shutoffs as a positional reference. Each shutoff is controlled by two buffer gates that are connected to an AND gate. One input of the AND gate comes from a ribbon, while the other is connected to a single cycle sensor. The two ribbons will ultimately end at eight automation receivers, with one receiver for each external planet.

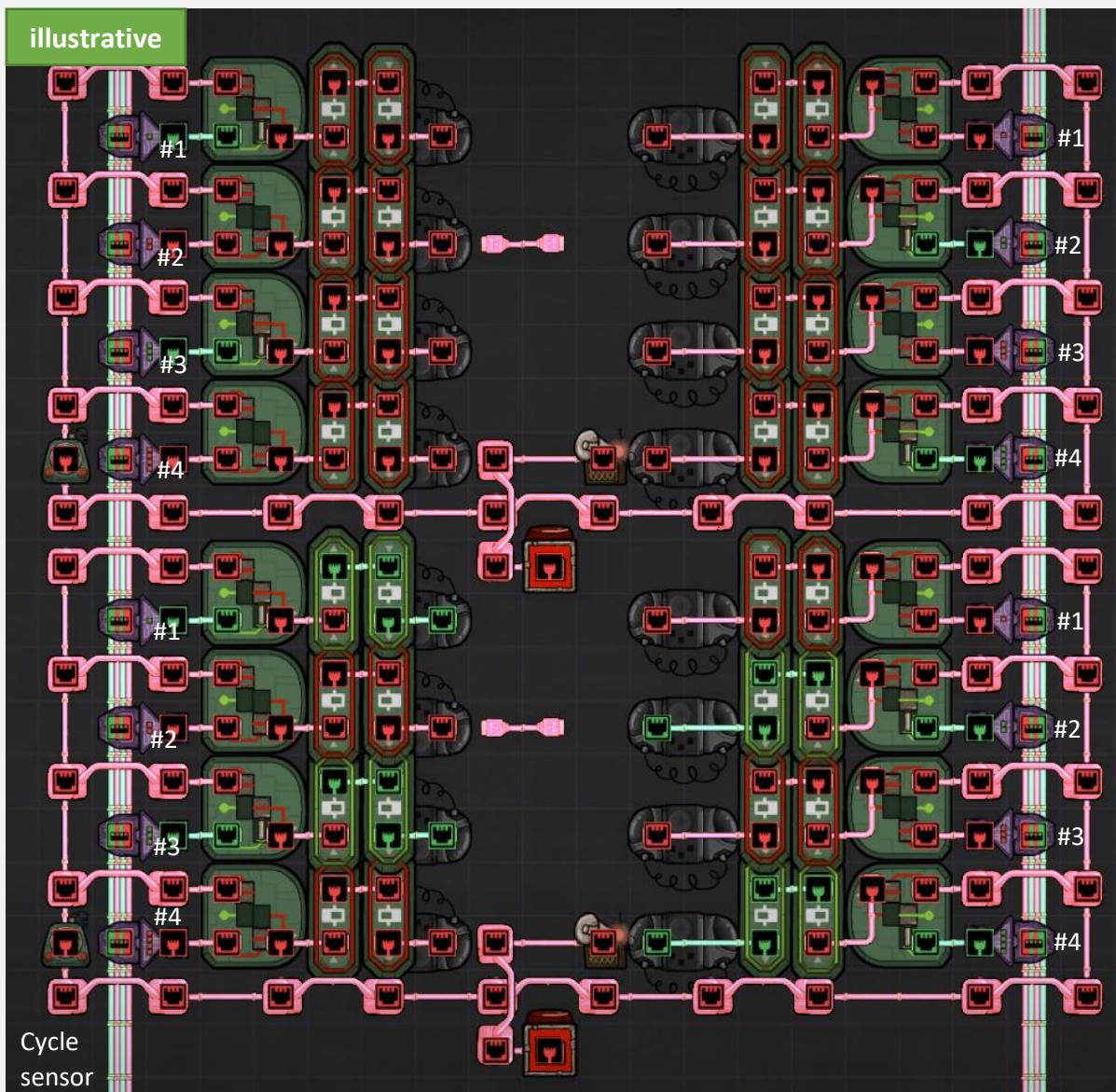


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The weight plate to an automated notifier so that you can be notified if the materials fall below a certain threshold. However, for most of the game, I was extremely short on material, so I never really bothered connecting it. And the bit of automation wire hanging in the air is just to connect the shutoff to the element sensor.

Each ribbon writer must be connected to a separate output, and these outputs should be consistent between pods. If the rails to the payload launcher to the planet Svalbard are set to the first output, the receiver automation should also be connected to the first output.

Now let's see how the whole system works.

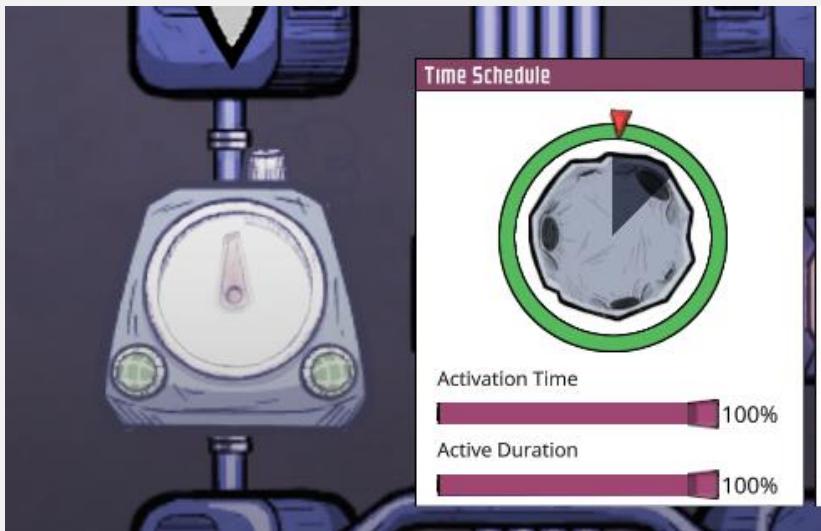


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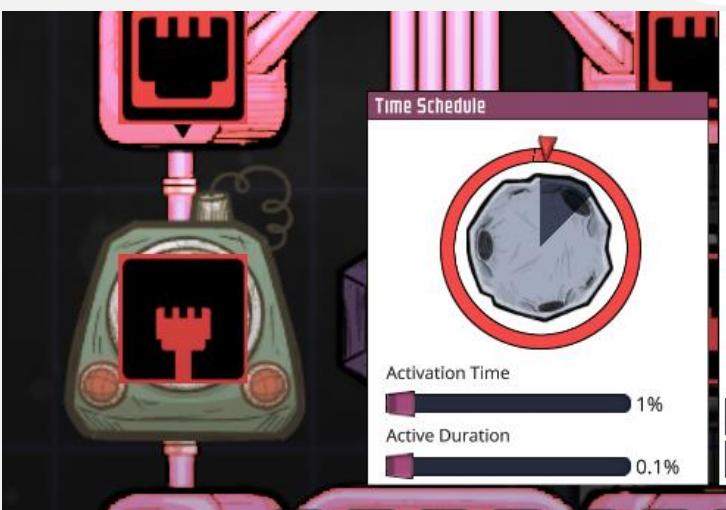
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First, we need to calibrate the cycle sensor, which is the most important part of the build. While broadcasters can transmit automation between planets, it's still a single automation signal. Having a different broadcaster for different materials is not scalable, and I was looking for ways to send multiple signals on the same wire. And that's where the cycle sensor comes in.



As you may know, the cycle sensor is synced to the game's day-night cycle, meaning that every cycle sensor in the game is synced to the game cycle, and by extension, each other. Thus, if we have two cycle sensors on two different planets with the same settings, they will both turn green or red at the same time.



Father

Set the sensor such that the active duration is 0.1 cycles. This can be a bit hard to do, but keep at it. You may have to mess with your mouse sensitivity or your monitor resolution to make it happen, but this is absolutely critical. Doing it once is enough, as you can simply copy-paste the settings to other cycle sensors.

0.1 is not absolutely necessary, but it's what I prefer. In theory, anything under 1% should work, but I have found some issues.

The activation time can be anything, as long as each pod has a different time. No two sending pods should have the same activation time.



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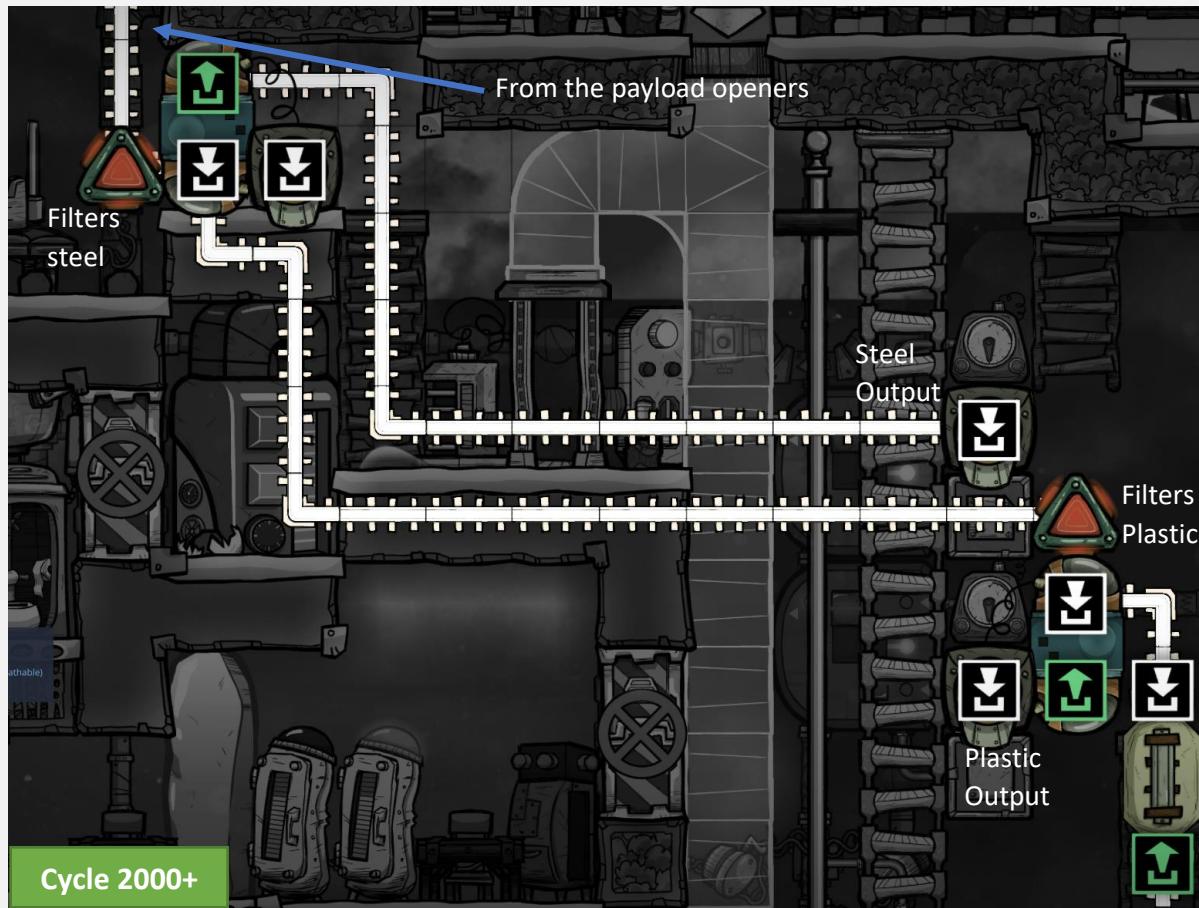
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6) Receiving Mechanism and Automation -

Let's assume some materials have been sent from the main planet. How do you receive them? Physically you just need a payload opener with a few pipes and rails connected. But for Stormlink, you need a mechanism that can tell the system when to start and stop. There are two options: the simple and the permanent. For all practical purposes, the permanent solution is not required; it just looks nicer and has more buffer built into it.

To set up the simple solution, you need to filter out the specific material you want to Stormlink to fall onto a weight plate. This can be done using shutoffs or a central pit with separate loaders for separate materials. One receiver pod should only have one material.



You then need to connect the weight plate to an AND gate, with one input connected to a cycle sensor and the other to the weight plate. The plate should be set to go green when below a certain target weight. The output of the AND gate should connect to a single automation broadcaster. No need for any ribbons here.



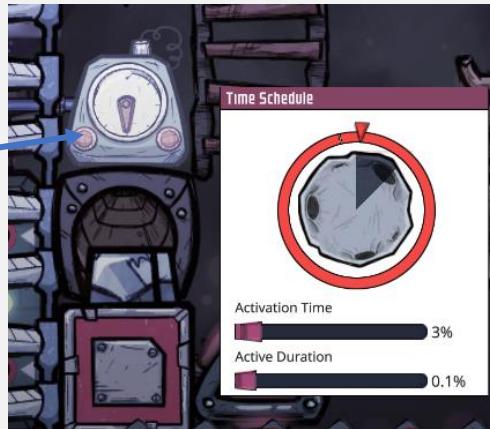
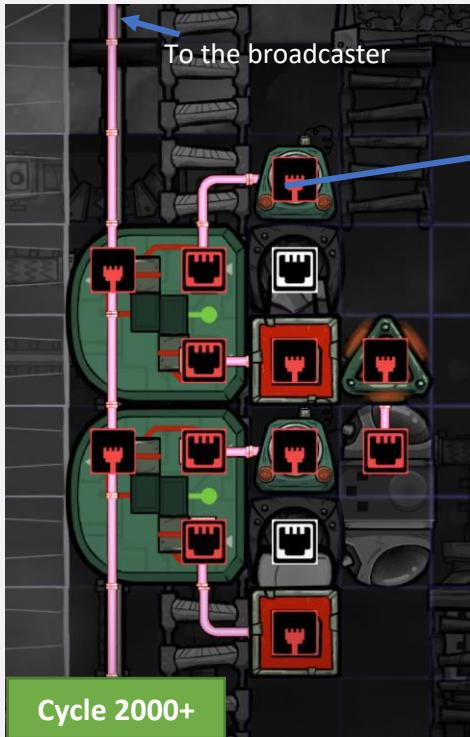
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This pod is set to receive steel. So to calibrate it I copied the same settings used for the steel sender pod on the mother planet.



On the mother planet, every sending pod must have a different cycle sensor setting. I usually start from 1% and keep moving up 1 % as we add more materials (2%, 3% etc)

To calibrate a pod for a certain material, copy the cycle sensor settings from the sending pod for that material and paste them into the receiving pod. Note that you HAVE to use the copy function and manually adjusting for the same settings will not always work.

For a more permanent solution, you can use a mechanism that looks like this. It is built on the same basic principle as the simple solution, with an AND gate, weight plate, and a cycle sensor. The inputs are streamlined into a single rail, with a separate shutoff for each pod. The pod also has a conveyor loader that can be connected to the weight plate if required. This mechanism can be used to send excess materials back to the planet. Only use this for materials that are natively produced on the planet, so that excess material is automatically sent to the home planet. For example, keep the return mechanism active for Iron on a planet like Svalbard, where Iron is produced.



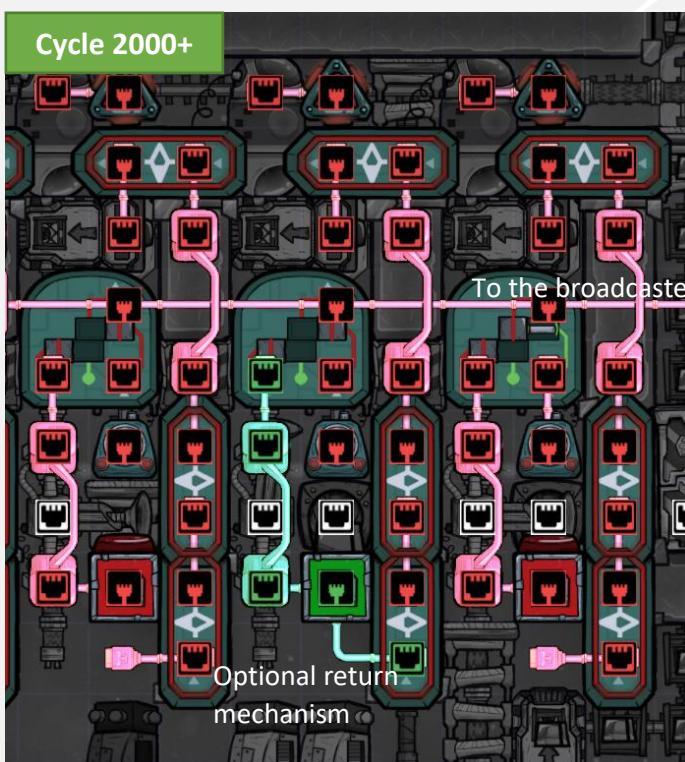
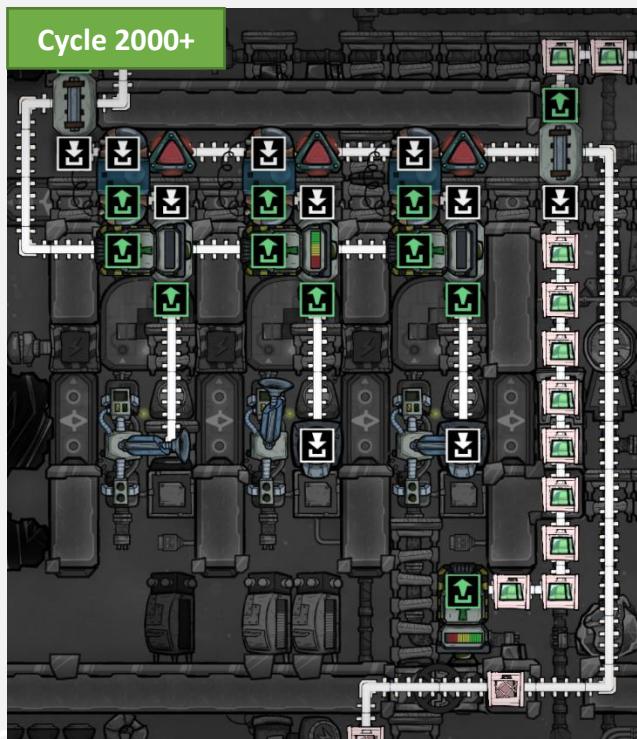
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At the same time, set the Stormlink up such that Neo Terra will never send Iron to Svalbard. This is important; else, the material will get stuck in a permanent loop.

If this is too confusing, you can send everything to your mother planet and request it back when you need it. You can use smart storage bins and a toggle switch to set up a proper return mechanism, but this takes too much power or does not work accurately due to the short duration of the greens signal. It isn't impossible to get it working, but it's certainly not necessary.



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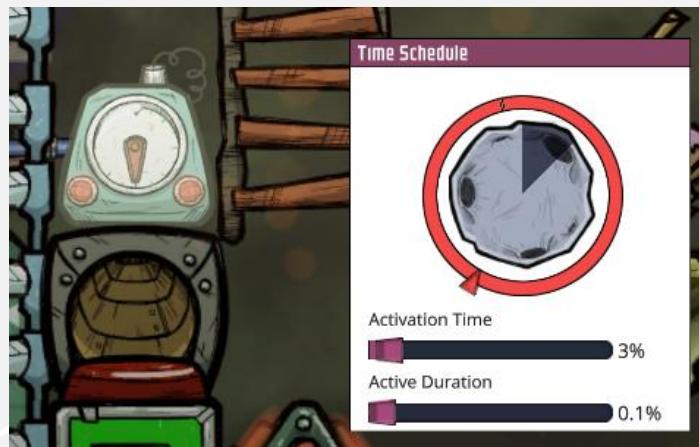
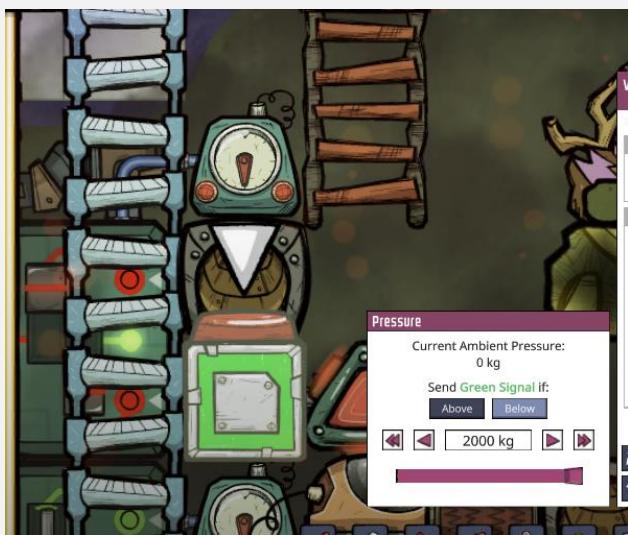
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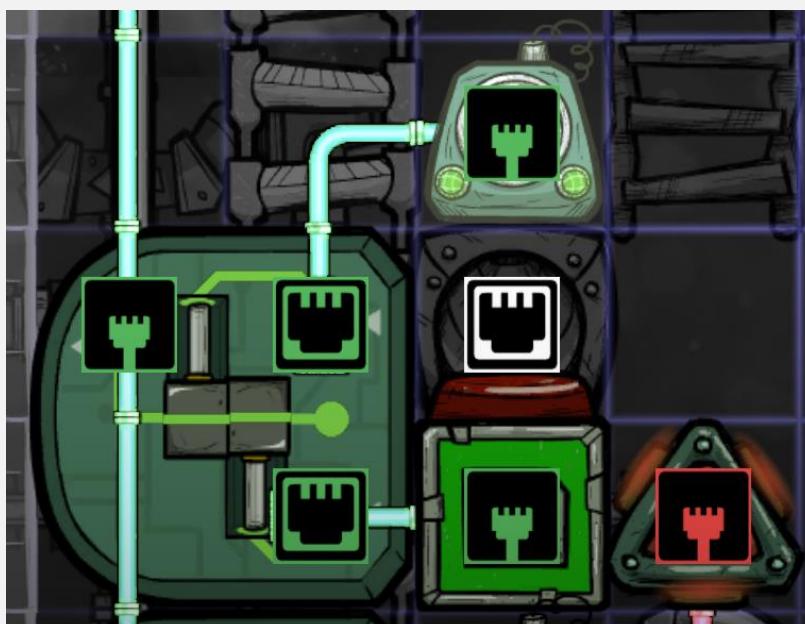
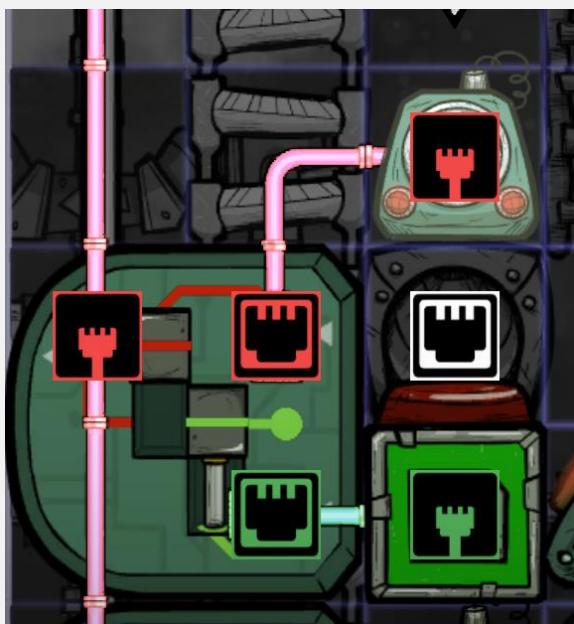
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7) How does Stormlink work

Let's run a scenario in the live game to understand how the system works. Currently, all my steel is produced on Neo Terra, and if I need to use steel on Chernobyl, I would have to send it via rocket or manually intervene to transport it via the payload launcher. Fortunately, we've Stormlinked Chernobyl for Steel, so let's see how that works.



The scales are set to turn green when under 2 tons, which means that there will always be at least a 2-ton buffer on the planet. The light turns green the moment the weight goes below 2 tons. At first, nothing happens because the cycle sensor filter is still red. Steel is set to an activation time of 3%, and as always, an activation duration of 0.1%. At some point during the cycle, the cycle sensor filter will turn green. When both inputs of the AND gate turn green, the planet's automation broadcaster will send out a green automation signal to Neo Terra.





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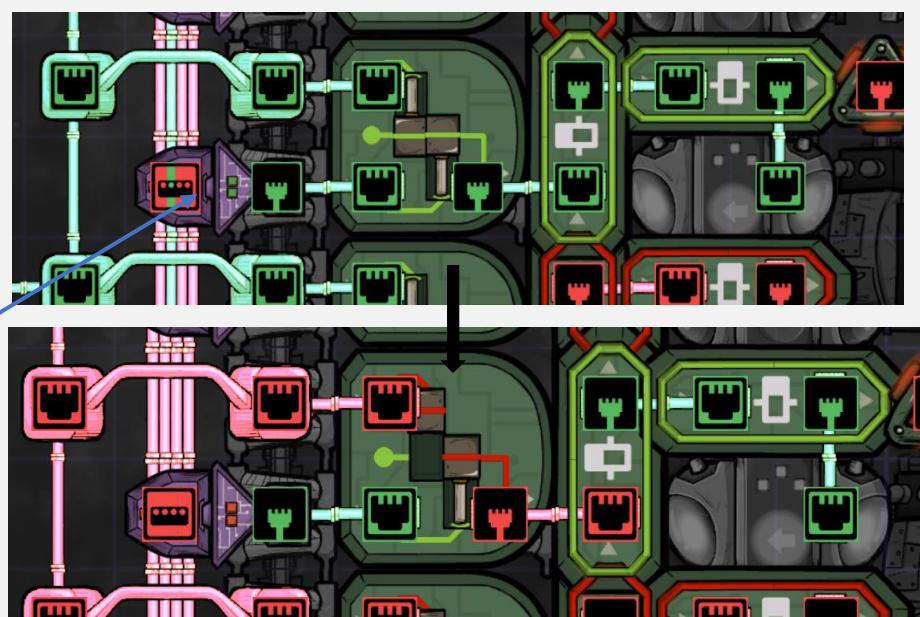
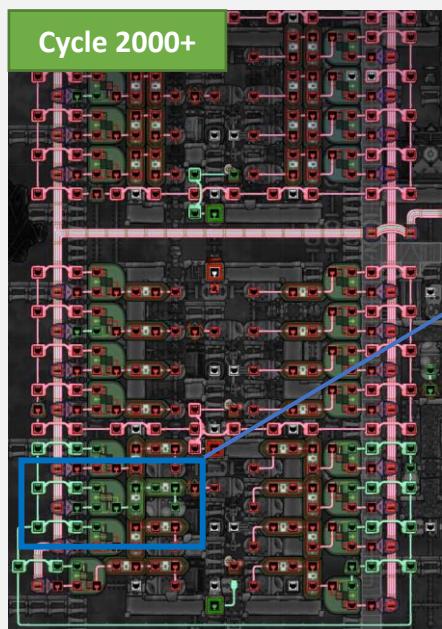
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On Neo Terra, the Chernobyl broadcaster is connected to a receiver that is linked to the sending pod ribbon. As it receives the green signal, it turns one of the 4 wires in the ribbon green (the 2nd one, in this case).

All AND gates connected to the automation wire from the Chernobyl broadcaster will have one of their inputs turn green. However, only one of the cycle sensor filters is also green. This cycle sensor filter has an activation time of 3% and a duration of 0.1%. For 0.1% of a cycle (or 0.6 seconds), both ports of the AND gate turn green, resulting in a green output.





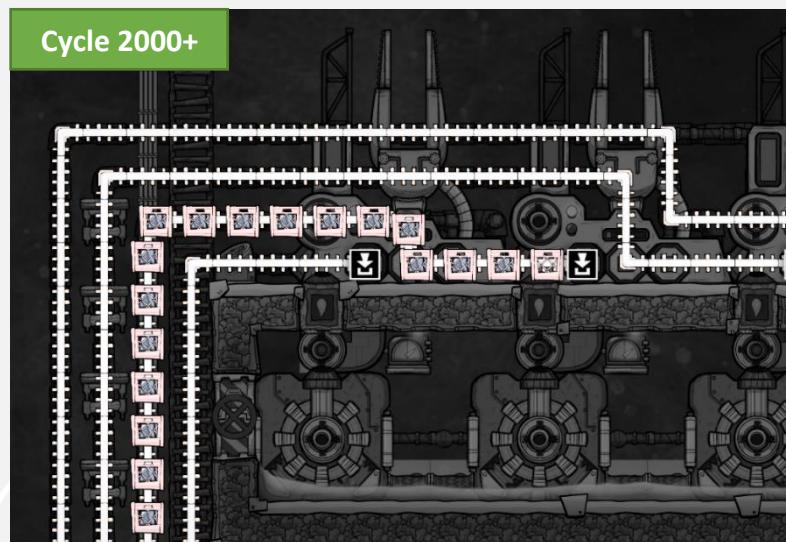
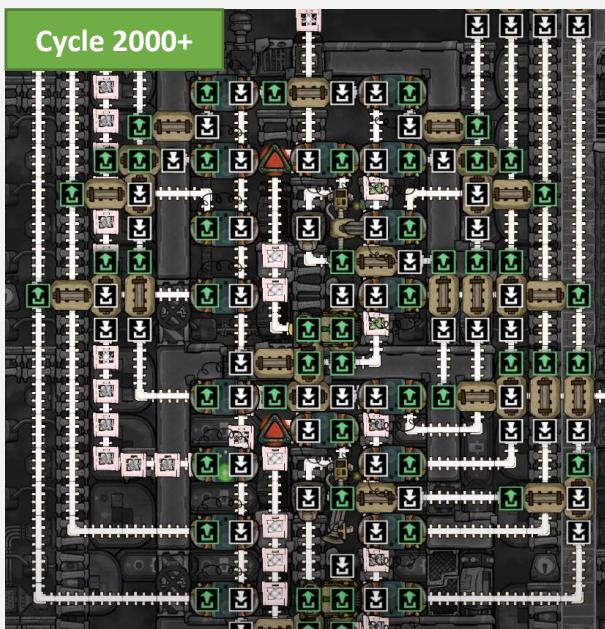
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Both buffer gates are set to 200 seconds, meaning that a small pulse of green is enough to keep the shutoff on for 400 seconds. At 20 kg a second, this amounts to 8,000 kg of steel leaving the infinite loop and travelling up the conveyor rail connected to a rocket set to the planet Chernobyl.



In under a cycle, 8 tons of steel are delivered to Chernobyl without any intervention from my end. The steel then falls onto the scales, causing them to turn red again. Chernobyl now has 8 more tons of steel.

The location is controlled by the 8 automation receivers that turn green, and the material is controlled by which cycle sensor turns green. Together, they can send any material to any planet.

8) The Pros and Cons of Stormlink 3.0

I think the Pros are quite obvious. Any materials that are stormlinked are basically refilled automatically. This is especially important for essentials like oxygen (we'll get to stormlink for liquids and gas soon) as well as food like berry sludge, meaning your colony can live indefinitely.

Another big pro of the way the system is built is that multiple things can be sent to multiple planets simultaneously. For example, you can send 8 tons of coal to Numenor and 8 tons of steel to Chernobyl at the same time if required.



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Also, the number of materials that can be stormlinked is huge as well. I keep the activation duration of my sensors in 1% increments, Meaning that I can stormlink 100 different materials with a single automation wire. Pretty cool.

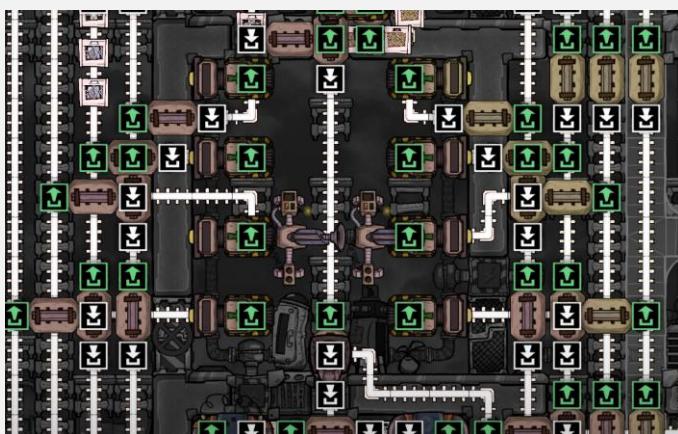
This particular design does have some cons though.

Because of the infinite loop system, you can't send the same material to 2 planets at the same time. For example, if both Chernobyl and Svalbard ask for Steel. Only one of them will get it, with the other one getting steel in the next cycle. This is not a big issue, and I have never had it be a problem. You can use 8 separate loaders, but that would waste 8 tons of material, as the loaders will always be topped up even when they are disabled by automation. So this isn't a con, it's more of a trade-off.

Secondly, because the infinite loop only has 8 outputs, there is no provision to move material anywhere on the planet. For example, if I want to stormlink coal, but I also want an internal network to move coal to a place within the map where it can be converted to refined carbon, it's hard to do that here because there is literally no space to fit in any more rails (I have managed to do it, but's an absolute mess and hard to explain. This can be easily fixed by making larger pods with 10 outputs instead of 8, with 2 outputs for internal use. Or one for internal and one for a dedicated connection with the teleporter. Indeed, the stormlink sending pods I make for liquid and gas has 10 outputs.

Thirdly, in trying to make the pods as compact as possible, I kept space only for 2 buffer gates, which is fine for solids but not liquids and gas (I'll explain why in a bit).

Also, This sending pod cannot be used unless there is a receiver pod on the other side, which is not always the case. I have solved that issue by having a 'manual pod' given below, where I can send specific material via a separate conveyer rail, and get duplicates to load them into storage. This should be the first pod you make before you move on to more complicated things.





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Lastly, the system is complicated, meaning one crossed wire or incorrect rail will send material in the wrong direction. From personal experience here is a non-exhaustive list of issues that could happen.

- If you connect a cycle sensor but forget to calibrate it, it will be green 100% of the time, meaning it will request all the material all the time.
- If you calibrate a cycle sensor incorrectly, you could end up asking for coal every time you need steel.
- If you don't set up your receiver pod properly, the weight plate will never go green, meaning you could end up sending all your berry sludge onto a single planet that doesn't need it.
- If you go on a solar panel building spree, you could cover the sensor by mistake, causing your dupes to almost suffocate to death.
- If you don't pair your physical rails with your automation correctly, you could end up sending coal to a lava planet every time Florida requests for it.



The point is, Don't be discouraged, just be careful. If this level of automation intimidates you, start small with just a single pod for steel or something, and then expand later. I chose to start building pods from the bottom, which was a bad move as a lack of metal ore for rails was a huge problem. I would suggest you build closer to the top.

9) Stormlink for liquids and gasses -

The sending pods for liquids and gases work on the exact same principle as those for solids, but the pods are much larger, with separate pumps instead of shutoffs.

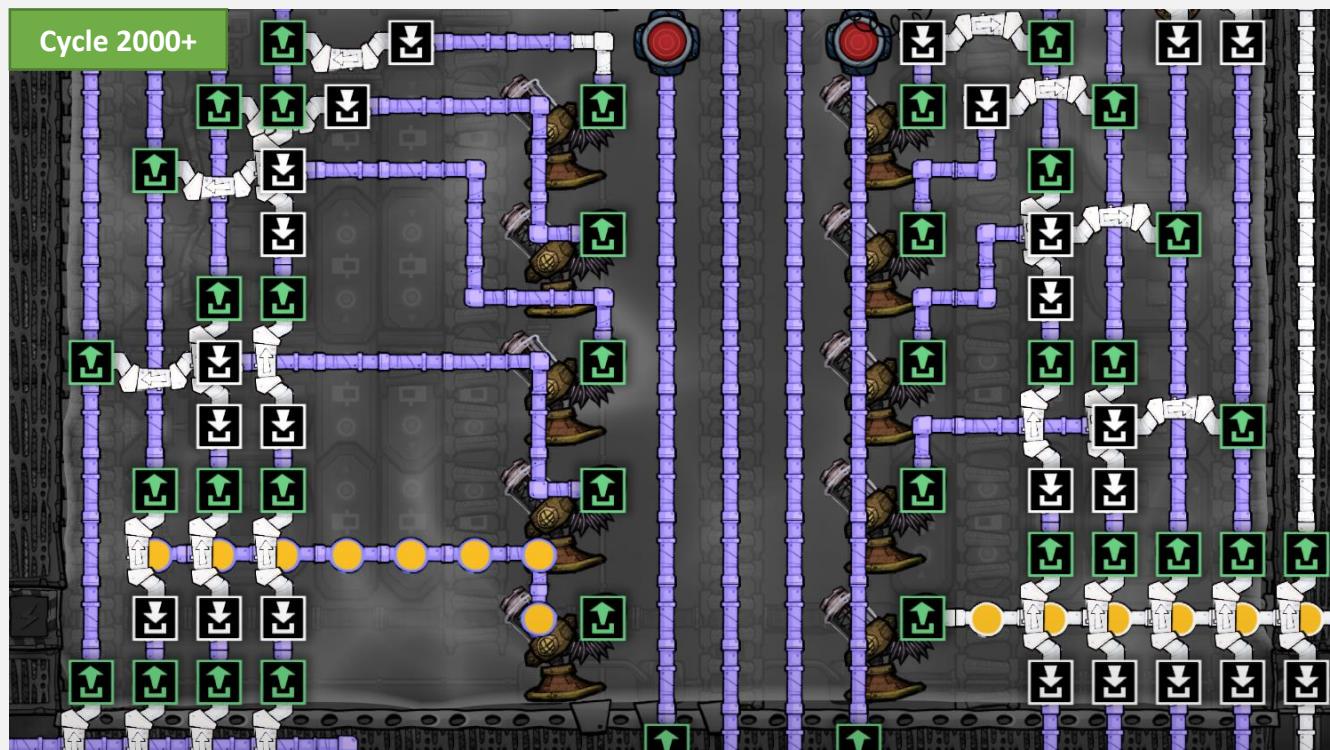
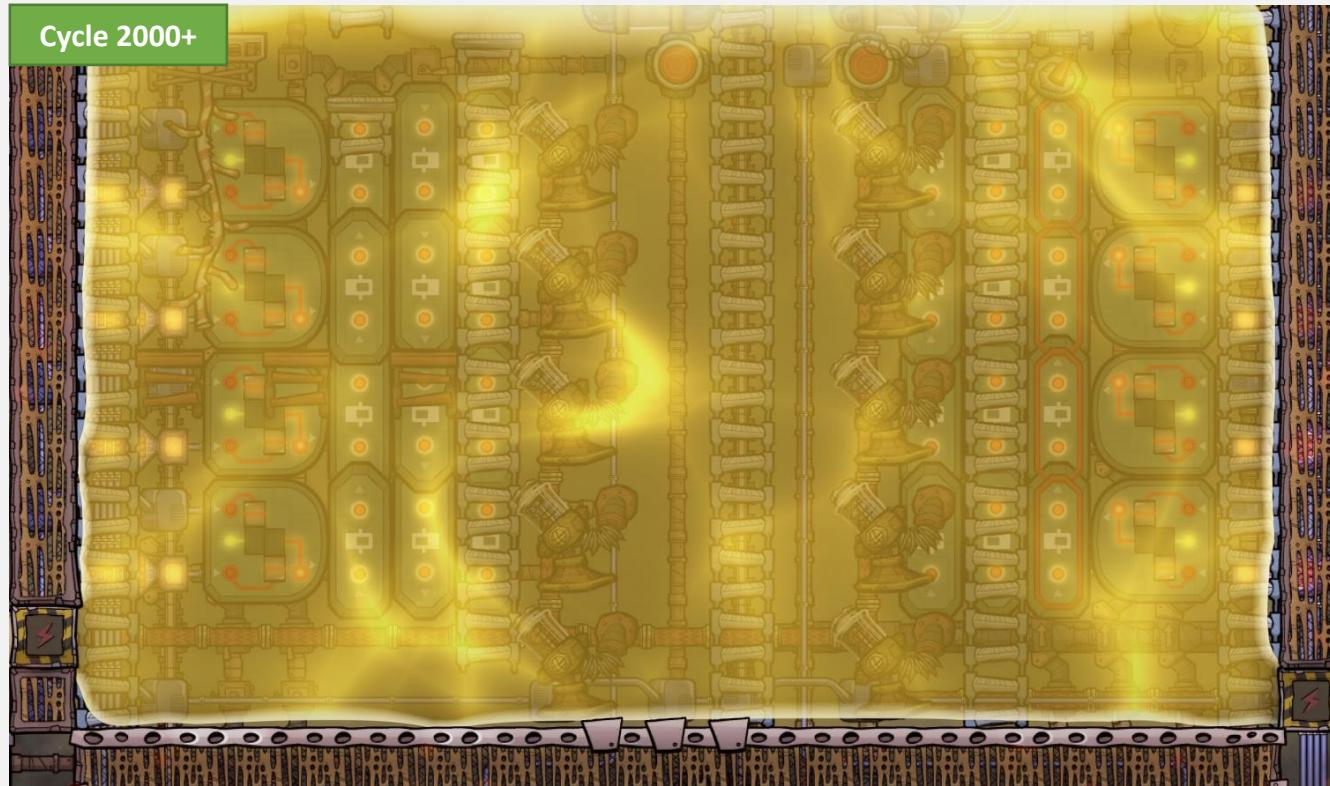


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Both liquids and gases use 3 buffer gates instead of 2, to maximise the output per cycle. 2 gates only allow you to operate for 400 seconds every cycle. 3 gates let you operate for the full 600 seconds.





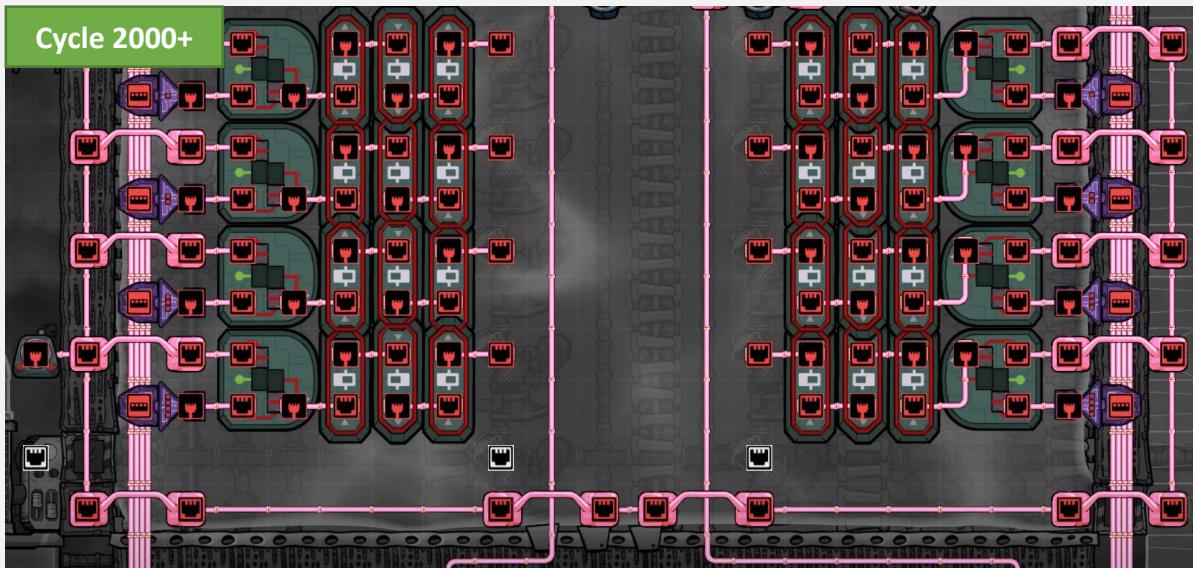
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Gases require two pumps per pipe since one pump can only pump half a kilo per second, whereas the pipe holds one kilo per second. We have a system to add gases and liquids into the reservoirs, but that is a discussion for another time.



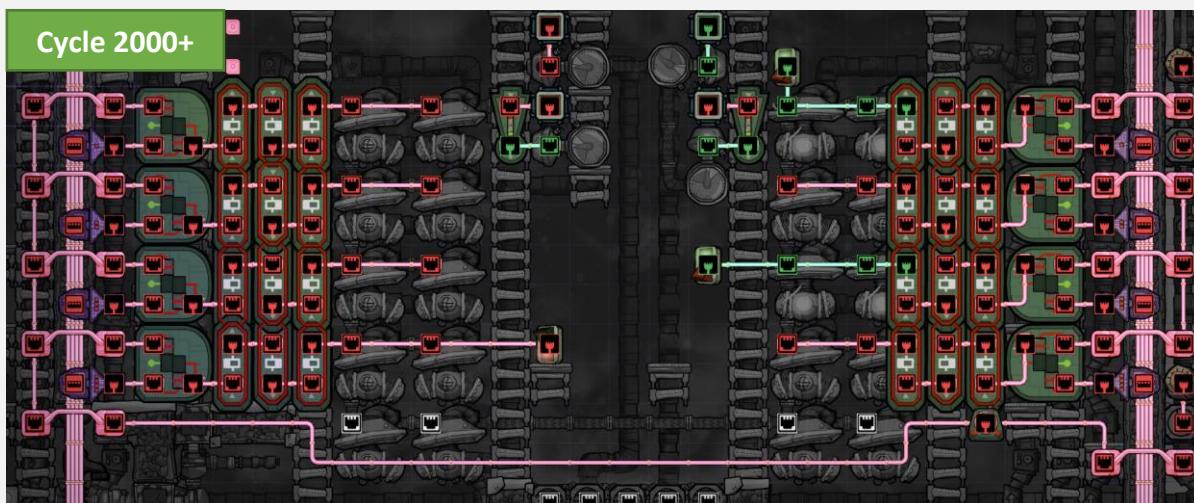


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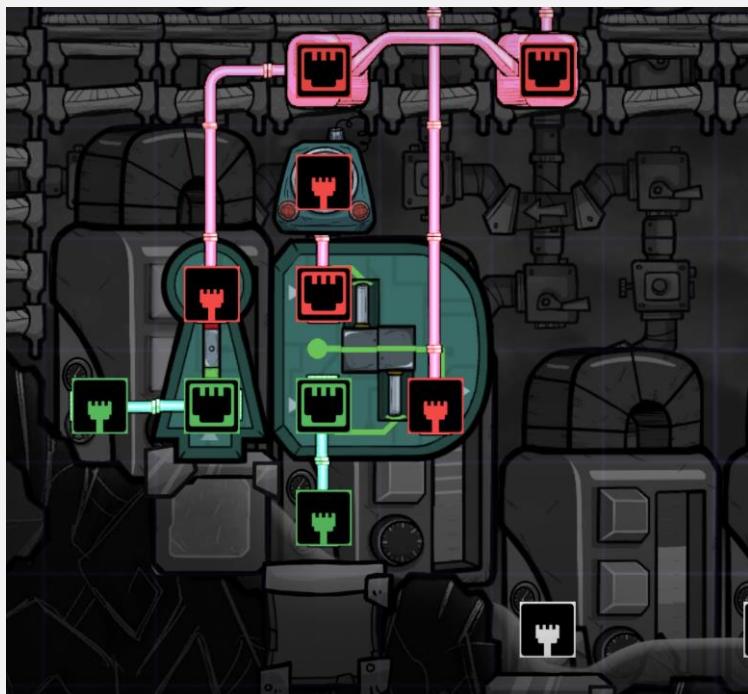
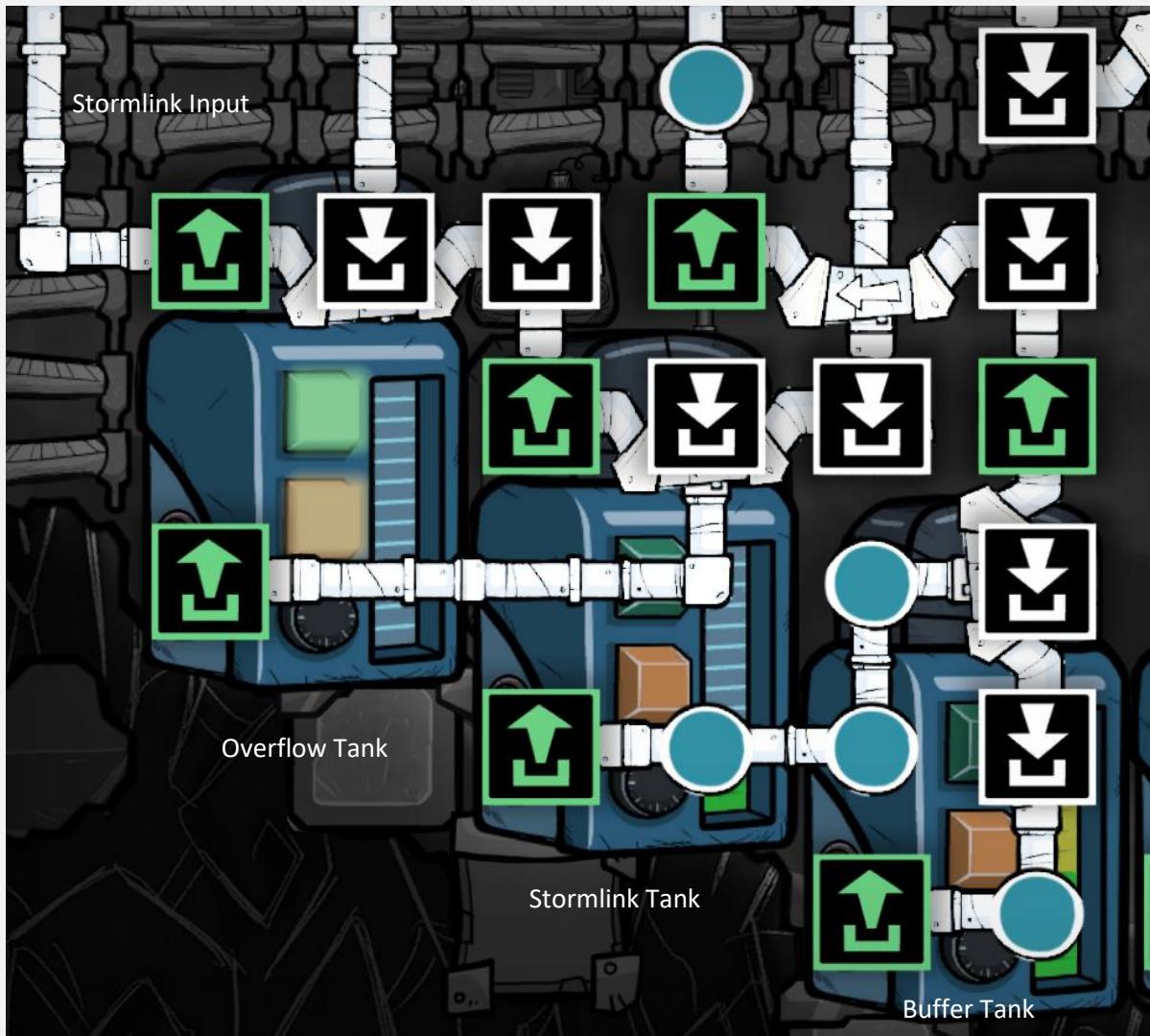
The receivers for liquids and gases are different, though. For liquids, we have to keep an extra spare tank and a return mechanism because, unlike solids, we can't stack all the liquids into a single tile. So, if for any reason we get more liquid than we can store, the entire system will get blocked and locked. The automation and piping are straightforward, but let me know if you want me to elaborate. In any case, I will return to this topic when I discuss progress in later chapters.



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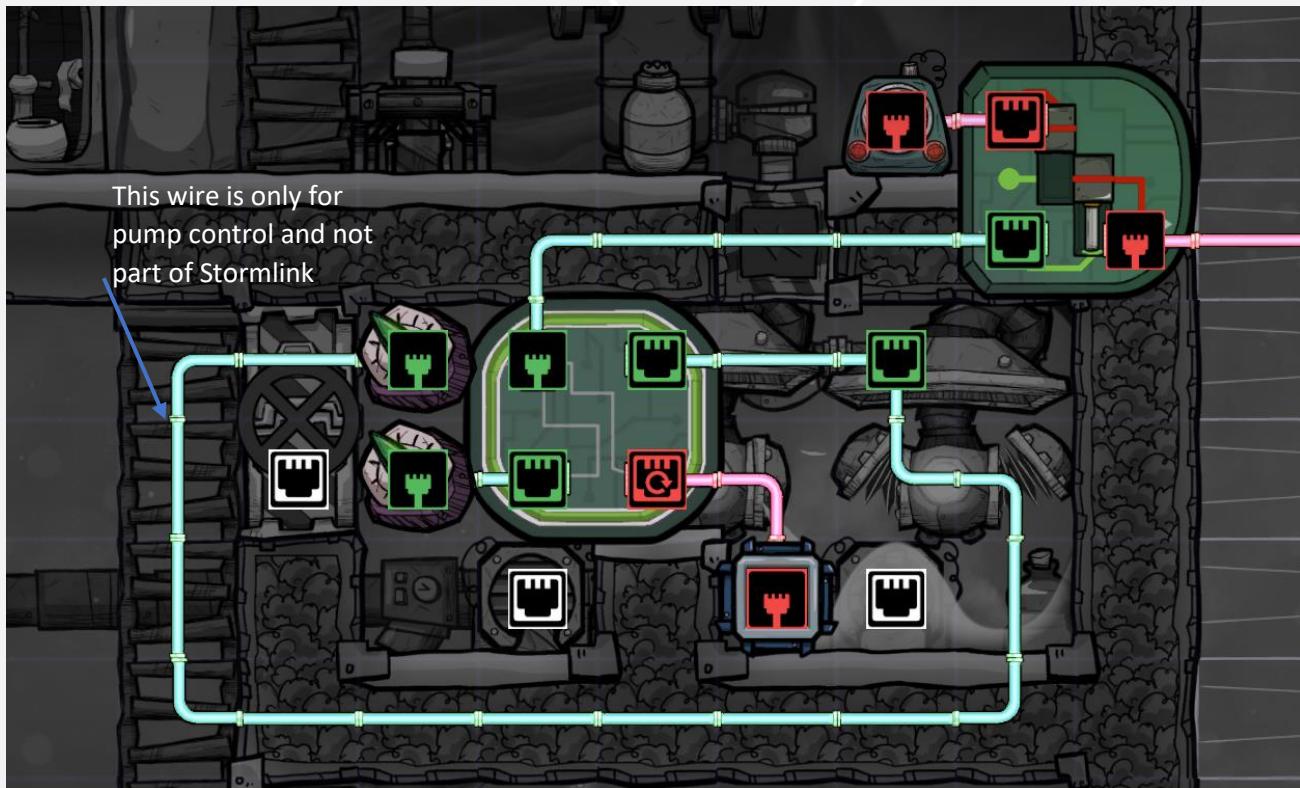
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Gases also use a memory toggle, that turns green when a minimum threshold is reached and red once the maximum is achieved. We also use an ingenious overflow mechanism, if I say so myself.



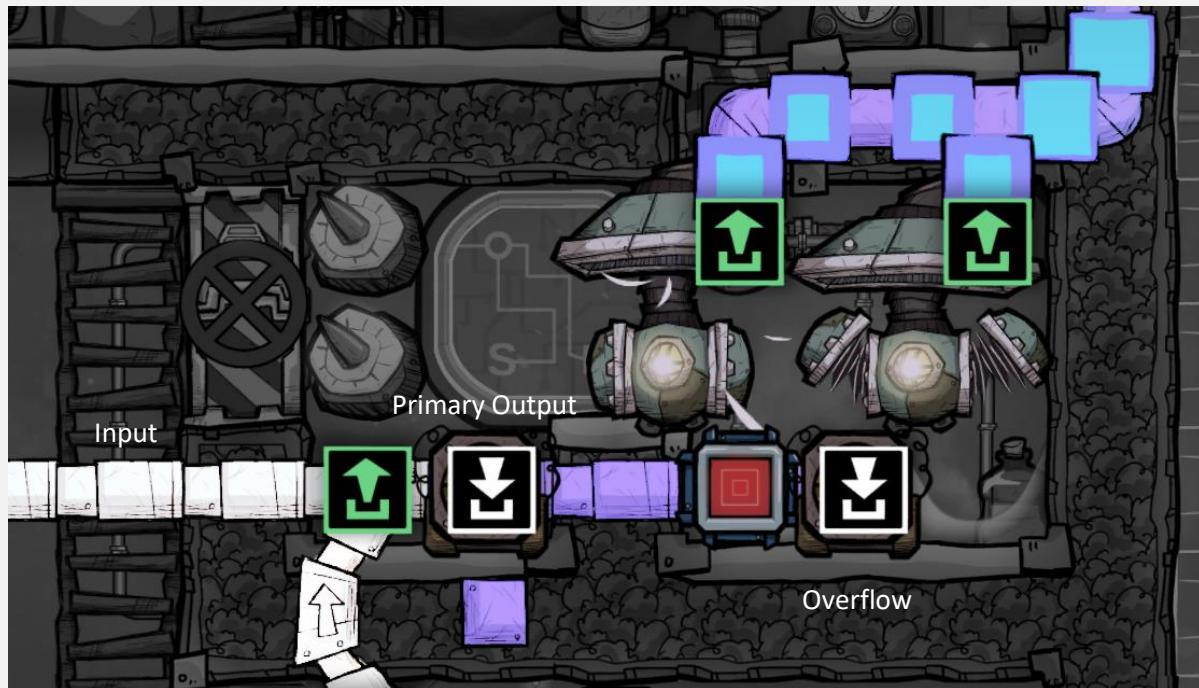


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Basically, the signal turns green when the atmospheric pressure is under a certain threshold, usually 15kg, which triggers Stormlink to send some gas to the planet. Once the gas is received, I use powerless filters to filter out the selected gas and direct it into the gas chamber. The gas first goes to a high-pressure vent that will eject the gas up to a pressure of about 21kg per tile.



Once that limit is reached, the vent will get blocked, and the gas will move onto the second vent that is submerged in a small amount of liquid, which serves as an infinite gas storage system that we have built before. Between these two vents is an element sensor, which turns green and shuts off the Stormlink signal, which will stay red until the pressure falls below 15 kgs again.

I am always open to new ideas, though. If you have any ideas on how I can improve Stormlink as a system, do let me know on Reddit. You can also reach out to me there if you need help in building your own.

10) Base Check-

We made a few improvements on the planets here and there and did a bunch of digging on Florida. One major upgrade is that we added an interplanetary launcher on Chernobyl. The satellite emits a lot of radiation that can be harnessed by Radbolt generators. This takes a lot of power and is not as fast as having a nuclear plant, but it's a readily available and compact solution that I can use to good effect.



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Author's Note –

Thank you for taking the time to check out Project Shatterstar. I hope this helps you to up your game. Each episode will be updated when necessary, so do keep an eye on the change history.

This series is a labour of love and an attempt to create quality written content. It does take up a lot of effort, though, so If you do like the work, please share and recommend it actively. You can also support me directly if you are willing and able.

There is always scope for improvement and new perspectives, so I encourage you to reach out to me if you have any specific thoughts on the work, be it good, bad or ugly. Reddit is the best way to get a hold of me. Do follow me there to keep up to date with the latest on what I do.

Check out the 'Stormfather's Guide to the Galaxy' and 'Academy Not Included', both of which are series that I built on Reddit. SGG is now scrapped, thanks to some complications when Spaced Out came out of Beta. But ANI will continue in some form or another.

Reddit is also the perfect place to point out any errors in the file. Due credit will be given to those who find errors or provide feedback that is incorporated into the file.

To check out any past or future work, or to support or follow me, do check out the following link-

<https://linktr.ee/Stormfather>

Until next time



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Change History –

Date	Version	Change	Credits
13 th May '23	0	New Release	-



StormFather