

STEP 1. Identify Challenges

Read the Future Scene carefully and generate ideas for challenges, concerns, and possible related problems. Choose the 16 most important challenges and write them in the space provided

1	Since the colonists only way to obtain enough sunlight is through orbital mirrors, they may be shattered by floating space debris, this may lead to the colonists being malnourished without proper sunlight.
2	A study by Psychology Today shows that losing loved ones can not only cause psychological distress, but can lead to strained relationships. Given that, many of the Ganymede citizens lost family and friends due to the GanyShuttle flying too close to Jupiter, they may not feel comfortable having conversations with others, this may lead to strained relationships between those who have lost someone and the other citizens.
3	As the National Institute of Health's research shows, people could get very tired after long work hours and not work as productively. Since some citizens don't have the physical fitness needed to work long hours, they may not be able to do the work they must do, this may lead to lack of productivity within the colony in the future.
4	Research shows that radiations impacts the youth the very badly. Keeping this in mind, since the radiation on Ganymede is at such high levels of exposure, the youth of Ganymede may be at risk for one of the hundred illnesses that come as a result of radiation, this may lead to the future generation of Ganymede's growth being disrupted.
5	Research shows that proper temperature is crucial to a proper atmosphere. Since the citizens are ignoring the issue of an improper temperature, they may not tailor it to the temperature they need, this may lead to serious issues with survival from extreme temperatures.
6	Since Ganymede first and colonists coalition have very different views on terraforming, there may be conflicts resulting in the difference of their views, this may lead to social unrest occuring on the colony of Ganymede.
7	Research shows that too much exposure to low gravity can lead to muscle atrophy. Since theworkers of Ganymede are constantly being exposed to low gravity, the colonists may get muscle atrophy as a result, this may lead to limited expansion of Ganymede due to physical problems occuring throughout the workers of Ganymede.
8	Research shows that working non-stop can lead to different physical effects on your body such as body aches and sleep deprivation. Given that, Ganymede First feels that every citizen on Ganymede has to pay their fair share, they may make everybody work non-stop, this may lead to the citizens of Ganymede overworking themselves which could lead to many physical issues in their body.
9	Research shows that big responsibilitys especally for kids can cause stress. Since electons ask for all people aged 12 earth years or older to vote, it may cause stress on the kids, this may lead to them not being able to focus leading to them not getting a good education.
10	As research shows, a regular and healthy sleep cycle leads to a proper circadian rhythm. Since it would be difficult to allow for the solar mirrors to replicate Earth's day and night cycles, the citizens may not have a proper sleep schedule, this may lead to their circadian rhythms being thrown off.

- 11 Research shows that many of the people that suffer from vision loss don't get to see the rest of the world like the people that have proper vision. Given that, many of the citizens of Ganymede suffer from vision loss because of low gravity, they may not be able to see nature and other sights, this may lead to a closed mindset for those citizens.
- 12 Research shows that viruses can spread very quickly in a group of people. Since there is a new virus developing from an unhealthy amount of radiation production, this disease may spread quickly, this may lead to a potentially dangerous virus existing among the citizens, making them ill.
- 13 Since the rotation engineering on Europa failed, it may be clear that the Ganymede colony doesn't have the proper technology to properly rotate the moon, they may not have full control over how much they rotate Ganymede, this may lead to the days on Ganymede being messed up due to too large or too small rotation.
- 14 Research shows that a cooled core can lead to a loss of a magnetosphere. Since the habitants of Ganymede are not doing anything to keep their core cool, the moon may start to lose it's magnetosphere, this may lead to the colony being exposed to Solar Winds which may start to take away the atmosphere of Ganymede.
- 15 Since the exposure levels to nuclear energy are very high on Ganymede, the plants may be severely affected by this harmful energy, this may lead to a lack of food occuring on the planet.
- 16 Since a ship full of future citizens of Ganymede passed away, their families may start to take a dislike for the parites of Ganymede due to how they dealt with the accident, this may lead to social unrest occuring throughout the colony.

STEP 2. Identify the Underlying Problem

Using the challenges listed in Step 1, identify a problem of major importance to the Future Scene situation. Write your Underlying Problem making sure your question clearly explains the action that will be taken and the desired results/goal of that action.

Since the effects of terraforming Ganymede are posing too many risks for the habitability of the colony,

Keeping this in mind, how might we improve the habitability of Ganymede so that the citizens of Ganymede can be safe in the year 2045 and beyond?

STEP 3. Develop Solutions

Generate solution ideas to the Underlying Problem in Step 2. Choose the 16 most effective solutions and write the elaborated ideas in the space provided.

- 1 The Tech Agency will create a wearable watch to calculate the path of colonists and warn them of dangers. This will keep them safe by warning them of dangers before they occur. It will be charged through solar panels and be durable through its hard aluminum case, making it easy for colonists.
- 2 The Intergalactic Terraforming Agency (IGTA) will create artificial gravity, which will reduce the effects of being in low gravity. This will be done by putting "gravity plates" underneath the surface so that it counters the lack of gravity on Ganymede. This solution will be implemented as soon as possible.

3 The United Nations Office for Outer Space Affairs (UNOOSA) will create aerogel shields. These aerogel shields will block out all of the harmful radiation and let in visible light. Aerogel is a substance that is made of 99.6% of air and 0.4% silica. It's translucency is what allows it to block the harmful radiation. This solution will ensure safety and improve the habitability of Ganymede because it will block harmful radiation which was one of the many challenges they were facing on the colony. These will be established on Ganymede immediately for the colony's use.

4 NASA will create a system for daily astronaut scans. These scans will look for any potential upcoming viruses or illnesses and if any are spotted, the results will be sent back to the medical space team on Earth. They will then address the issue and prescribe any preventative medicine so that no one gets sick. They can send the medicine through a portal between Earth and the astronauts. This solution will ensure safety because it can rid of any viruses before it affects anyone.

5 The Colonist Organization will construct a space elevator connected to a space station. This will allow the colonists to carry heavy loads into space with low energy. It will also allow them to launch space ships out of Ganymede's gravitational pull giving them more safety to get to Earth and a lower chance of crashing into Jupiter.

6 The IGTA will create a machine that scans for nuclear energy and captures it using a mouse trap reactor. This will limit the nuclear energy and its effects by trapping it. This solution will be implemented immediately.

7 The National Fitness Program (NFP) will create a holographic fitness program for the astronauts with virtual instructors so that they can have a fitness routine to stay in shape. Research shows that people will perform better when they want to do something so this solution will be more popular among the astronauts as the routine will be fun for them rather than mandatory exercise. This will be implemented in 2050 for all astronauts in the future.

8 The Intergalactic Terraforming Agency (IGTA) will implement The Ganymede Terraforce (GT). The GT is a three step plan to improve the habitability of the colony. The first step is focused on the zero gravity aspect. For this, we will implement gravity plates. The next step is focused on radiation. For this, we will implement aerogel shields for the citizens. We will also produce other products made of aerogel for more protection. The third step is focused on health. For this, we will implement daily checkups for the citizens. AI will be the doctors doing the checkups. This will increase the habitability because it will look at all of the challenges in these areas that Ganymede is facing.

9 The National Observatory of Terraforming (NOT) will create a 3D printing platform for the citizens to print what they may need. This will allow for the citizens to feel safer because they can have what they want/ need. It will be in stations around Ganymede. This solution will be implemented by 2050 latest.

10 The parties of Ganymede First and Colonists' Coalition will partner together to enforce the "Ganymede Clean" Program. It will use hydro and solar power. The water will come from underneath the surface of Ganymede and the sunlight will be received from orbital mirrors, which will be pushed by a light sail. Then, there will be solar panels placed in designated areas for the orbital mirrors. There will be underground dams that use it for hydro power. This will limit the effect of nuclear energy. This will be implemented in one year.

11 Research shows that most people feel safer when with their family or loved ones that they have known for a long time. With travelling to space, this may not be physically possible but it is virtually possible. UNOOSA will create a system for holographic meets with family members and/or friends. These meets can only last a certain amount of time, but it will allow for the citizens to feel safer by talking to their loved ones. This solution will be difficult to implement due to time differences so it should be in action by 2050 and available to all astronauts.

12	The IGTA will create space elevators for citizens of Ganymede so that they can reach nearby outposts that may have necessary materials that Ganymede lacks. This would also allow them to feel safer because if something drastic were to happen to Ganymede, they can travel to somewhere else for temporary shelter. This solution will be implemented in 2048 on Ganymede.
13	The Tech Agency will create weekly spaceship checks to allow for prevention of failures in any system. These checks will search the engine for any potential issues and each astronaut will have 1 job to check on. This solution will be implemented by 2048.
14	The tech agency will create robots that will protect the colonists at all costs. The robots will be durable from titanium and will have a hatch to let one colonist get inside to protect them from extreme heat and other conditions.
15	The IGTA will implement a satellite that mimics the effect of a magnetic field. This will be implemented immediately. This solution will also give power to the wearable watch.
16	NASA will create a space base to recharge the spaceship so that no one worries about a failure or running out of fuel. This space base will be on the Moon and will have a huge amount of fuel sources to recharge the ship. It will be implemented ASAP.

STEP 4. Generate Criteria

Generate criteria to determine which solution idea does the best job of solving the Underlying Problem and/or addressing the Future Scene situation. Select the 5 most important criteria for measuring solution ideas and write them in the spaces provided.

1	Which solution will most improve the habitability of Ganymede in 2045 and beyond?
2	As stated by the colonists, colonizing trying new things in terraforming may not be safe, Which solution will be the safest for the colonists of Ganymede in 2045 and beyond?
3	Because the colonists are going to open a new chapter of Ganymede's story, Which solution will best address an important situation that terraforming Ganymede has created?
4	Because the colonists may be mistreated, Which solution will be the most humane toward the colonists of Ganymede in 2045 and beyond?
5	Because the colonists might want a say in what happens to Ganymede, Which solution will gain the most popularity among the colonists of Ganymede in 2045 and beyond?

STEP 5. Apply Criteria to Solutions

From the solution ideas written in Step 3, select the 8 ideas with the most potential to solve the Underlying Problem and list them on the grid. Use each criterion to rank the solutions on a scale from 1 (poorest) to 8 (best). The numerical ranking for one important criterion may be doubled.

Rank solutions.

							Criteria
#	Solution	1	2	3	4	5	Total

1	The Intergalactic Terraforming Agency (IGTA) will implement The Ganymede Terraforce (GT). The GT is a three step plan to improve the habitability of the colony. The first step is focused on the zero gravity aspect. For this, we will implement gravity plates. The next step is focused on radiation. For this, we will implement aerogel shields for the citizens. We will also produce other products made of aerogel for more protection. The third step is focused on health. For this, we will implement daily checkups for the citizens. AI will be the doctors doing the check-ups. This will increase the habitability because it will look at all of the challenges in these areas that Ganymede is facing.	8 7 6 8 8	37
2	The Tech Agency will create a wearable watch to calculate the path of colonists and warn them of dangers. This will keep them safe by warning them of dangers before they occur. It will be charged through solar panels and be durable through its hard aluminum case, making it easy for colonists.	7 5 8 6 7	33
3	The Intergalactic Terraforming Agency (IGTA) will create artificial gravity, which will reduce the effects of being in low gravity. This will be done by putting "gravity plates" underneath the surface so that it counters the lack of gravity on Ganymede. This solution will be implemented as soon as possible.	5 6 5 4 5	25
4	The United Nations Office for Outer Space Affairs (UNOOSA) will create aerogel shields. These aerogel shields will block out all of the harmful radiation and let in visible light. Aerogel is a substance that is made of 99.6% of air and 0.4% silica. It's translucency is what allows it to block the harmful radiation. This solution will ensure safety and improve the habitability of Ganymede because it will block harmful radiation which was one of the many challenges they were facing on the colony. These will be established on Ganymede immediately for the colony's use.	4 8 3 3 2	20
5	NASA will create a system for daily astronaut scans. These scans will look for any potential upcoming viruses or illnesses and if any are spotted, the results will be sent back to the medical space team on Earth. They will then address the issue and prescribe any preventative medicine so that no one gets sick. They can send the medicine through a portal between Earth and the astronauts. This solution will ensure safety because it can rid of any viruses before it affects anyone.	6 2 4 5 6	23
6	The Colonist Organization will construct a space elevator connected to a space station. This will allow the colonists to carry heavy loads into space with low energy. It will also allow them to launch space ships out of Ganymede's gravitational pull giving them more safety to get to earth and a lower chance of crashing into Jupiter.	3 4 2 7 3	19
7	The IGTA will create a machine that scans for nuclear energy and captures it using a mouse trap reactor. This will limit the nuclear energy and its effects by trapping it. This solution will be implemented immediately.	1 3 7 1 4	16

8	<p>The National Fitness Program (NFP) will create a holographic fitness program for the astronauts with virtual instructors so that they can have a fitness routine to stay in shape. Research shows that people will perform better when they want to do something so this solution will be more popular among the astronauts as the routine will be fun for them rather than mandatory exercise. This will be implemented in 2050 for all astronauts in the future.</p>	<p>2 1 1 2 1</p>	<p>7</p>

STEP 6. Develop Action Plan

Develop your top-scoring solution idea into an Action Plan. Thoroughly explain how the Underlying Problem is solved, how the plan will be implemented, and how the Future Scene will be affected.

(beginning of holographic meeting)

Hello citizens of Ganymede, Ganymede First and Colonists' Coalition. We have looked over your proposals for the future of Ganymede but we decided that there are some things that need to be looked at before we move on. We came up with a final issue that you faced which is: "Since the effects of terraforming Ganymede are posing too many risks for the habitability of the colony, how might we improve the habitability of Ganymede so that the citizens of Ganymede can be safe in the year 2045 and beyond?" After we came up with this issue we evaluated multiple solutions until we came up with our final plan. Let me introduce you to our plan: The Ganymede Terraforce. We will partner with the Intergalactic Terraforming Agency to implement this plan. This plan has three steps:

1. Low Gravity: In order to solve this issue, we will implement the use of gravity plates underneath the surface of Ganymede so that it counters the lack of gravity. This will make the gravity similar to the gravity on Earth which will limit the issues resulting from lack of gravity.

2. Radiation: In order to solve this issue, we will implement aerogel shields. Aerogel is a substance that is made of 99.6% of air and 0.4% silica. Its translucency is what allows it to block the harmful radiation but let in visible light. This will reduce the amount of harmful radiation exposure that the citizens are receiving.

3. Health: In order to assess this issue, we will implement daily check ups led by AI so that we can monitor the citizens' health. After the AI receives the information, they will send it back to a medical team back in Earth so that they can assess the situation and establish medicing and more measures for the citizens to take. This way if there is any outbreak of disease we can handle it immediately.

If you haven't noticed, these are all issues that your colony is facing and by establishing this, we will make sure that it is fixed!

A benefit of this solution is that it assesses all the different problems that your colony faces at once. This will make helping your colony way more efficient. This will also help increase the research done by scientists back at Earth, so that in the future they can try to fix the issue right away. One obstacle that we may face is that when implementing the gravity solution, we may not be able to control how much gravity is put on the citizens. To fix this issue, we will program the gravity plates so that it add the right amount of gravity.

This solution will improve the habitability and will be the safest because we are looking at all of the challenges you face and assessing them. These will also fix those challenges, so you guys aren't at risk anymore and you are safe. This solution addresses an important situation because it will ensure protective measures for Ganymede. This solution is humane and will have the most popularity because it won't harm the citizens and would make them feel comfortable in the planet.

Thank you so much for giving us this wonderful opportunity to help you! Thank you so much!

(end of holographic meeting)

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