# Rules for Space Living

As old-time spacers like to point out, there is a great deal of difference between living in space and space living. Millions live in cozy, protected habitats where the biggest danger is extreme sports rather than the harsh vacuum and radiation just a few meters outside. The people who actually have to deal with "real" space know the difference.

These rules are mostly for old-fashioned space colonization – the kind involving brave people cramming into tiny containers to be hurled across the solar system with a noticeable risk of ending up sick or dead. For modern transport they are mostly inapplicable… until something goes wrong.

## *Space Adaptation*

The transition to the Earth environment to a zero-g environment takes its toll on the human organism. Body fluids move up from the lower body into the upper body, causing swelling and congestion. The lack of gravity confuses the inner ear, causing space-sickness in 70% of all astronauts for the first two days – vertigo, nausea, vomiting and headaches.

### System

Roll a D10 each day. If the result is 7 or less, space sickness persists and the character will act at +2 difficulty (+1 difficulty if given promethazine hydrochloride, a very strong anti-dizziness medication). After space sickness has been mastered it will not return for the duration of the flight, unless a long period of strong accelerations or rotations or occur. The next time a space sickness roll has to be made the difficulty is two less, and so on.

The upper body swelling causes a +1 penalty to dexterity for the first week in space.

## *Zero-G Physical Deterioration*

Over time natural humans in the zero-g environment will begin to suffer bone decalcification and muscle atrophy unless they exercise vigorously. In the early expeditions getting enough training to avoid atrophy while simultaneously having time for doing one's job was a very hard balance.

When Strategic Pharmecuticals created the first low-gravity adaptation plasmid in 2046 this kind of deterioration became a thing of the past. People taking the plasmid are no longer strongly affected by atrophy, and low-gravity life became much easier. It also enabled the great Japanese migration, which otherwise would not have been possible.

### System

To avoid atrophy the character needs to exercise for at least two hours each day, increasing with one hour every six months until a total time of six hours per day. Use of a centrifuge environment with simulated gravity counts as exercise.

Without exercise a character will start losing STR and STA at a rate of one dot (alternating between STR and STA; start with the highest) each month for the first two months. There is no drop the third month, one dot less in the fourth, sixth, ninth and so on (the interval increases with one month per step).

A character whose stats reach zero has become severely deteriorated and will likely not survive returning to Earth. People with no strength have extreme muscle atrophy, while no stamina implies serious bone decalcification. In any case their health will not be good, and heart problems, kidney stones and fractures are very likely.

(this system borrowed from the Deep Space module to Cyberpunk 2020)

Low gravity adaptation plasmids work by reducing the time needed for exercise. A modern plasmid divides it by about six: long-term spacers need about one hour of exercise to keep in shape, not much more than their Earthbound colleagues.

## *Zero-G movement*

Moving in micro or zero gravity is fundamentally different from moving in a gravity environment. Instead of walking characters climb and drift, and a push can send them tumbling helplessly into empty air – or outer space. Pressing a button will move them backwards unless there is something behind, and unscrewing a screw is a tricky operation as the torque tends to twist not just the screwdriver but also rotate the character.

### System

There is a new secondary talent Zero-G movement denoting familiarity with zero-g operations. Characters without the talent suffer +3 difficulty on any skill use involving physical traits.

Normally no rolls are needed with the talent, but the number of dice from a physical skill used in a roll is limited by the level of Zero-G movement, denoting the limitations caused by uncertainty with the microgravity mechanics.

## *Radiation*

Space is filled with radiation from the sun, cosmic rays and the occasional nuclear reactor. On the Earth, the atmosphere and magnetic field provide a shield for humans, but in space there is no such protection. Astronauts will accumulate radiation damage from various sources over time.

### System

Radiation is measured in rads. A dose less than 50 rads is usually harmless. A human on Earth takes around 0.25 rads per year, on Luna around 0.1 per year. In a spaceship or other thin-walled environment the level is 1D6 millirads per hour, or on average 84 millirads per day or 30 rads per year. The background levels in the van Allen radiation belts are a number of times higher, making them unsuitable for manned visits. A properly shielded habitat has a background level of a few rads per year. Contact with an unshielded nuclear reactor such as a NERVA drive contributes 1D10 rads per turn. Solar flares are the most dangerous radiation hazard, producing total radiation exposures on the order of hundreds of rads unless shielded.

Every time a character is exposed to a substantial dose of radiation they should roll a stamina roll with difficulty 7. The radiation level is the acute dose plus half of all previous doses:

| **Dose** | **3+ successes** | **Success** | **Failure** | **Botch** |
|---|---|---|---|---|
| <50 rads | None | None | None | Burns (1) |
| 50-100 rads | None | None | Burns (1) | Burns (3) |

| | | | | |
|---|---|---|---|---|
| 100-250 rads | None | Burns (1) | Burns (3) | Blood |
| 250-500 rads | Burns (2) | Blood | Blood | Intestine |
| 500-2000 | Blood | Intestine | Intestine | Brain |
| 2000-4000 | Intestine | Brain | Brain | Brain |
| 4000+ | Brain | Brain | Brain | Brain |

- **Burns**: Radiation burns. Various degrees of nausea, vomiting, diarrhea, reddening of skin, loss of hair, blisters, depression of immune system. Aggravated damage as marked. STA is decreased by one until the damage has healed, disease resistance and high pain threshold (if any) vanishes.
- **Blood**: Hematopoietic syndrome. Damage to bone marrow causing hemophilia and immune system depression. Beside 4 points of aggravated damage from radiation burns, STA is decreased by 3 (one step per week); if decreased below zero death occurs due to damage to bone marrow.
- **Intestine**: gastrointestinal syndrome. Death usually occurs within days and is associated with bloody diarrhea and destruction of the intestinal mucosa. 5 points of aggravated damage, STA decreased by 4 (one step per day); if decreased below zero death occurs days after exposure.
- **Brain**: Cerebrovascular death. Death occurs within hours from neurological and cardiovascular breakdown. All stats decrease by one per hour after exposure.

Anti-radiation drugs can be used to lower risks. Prophylactic medication gives one automatic success on the Stamina roll.

Long term effects of radiation:

| | |
|---|---|
| 50 rad | Increased cancer risk. |
| 100 rad | Mutations in germ line. Offspring more likely to be deformed or otherwise affected. |
| 200 rad | Minor cancers |
| 300 rad | Cataracts (blindness correctable with surgery) |
| 400 rad | Leukemia. There is a 1/300 chance for leukemia in the next 5-7 years, doubled for every additional 50 rads. |
| 450 rads | Sterility |
| 600 rads | Severe cancers |
| 750 rads | Fatal cancers |

Genetic or neogenetic enhancements can make people more radiation tolerant (a +1 Merit). This makes the effects one level milder for acute and long-term radiation; a tolerant person subjected to 250 rads will merely suffer burns if they succeed with a stamina roll rather than get hematopoietic syndrome. There have been treatments stacking tolerance, but at higher levels the extreme DNA repair tends to cause side-effects.

(Rules based from Cyberpunk 2020, GURPS Space and http://www.orcbs.msu.edu/radiation/radmanual(html)/radman96toc.html .)

## Solar Flares

The chance of a flare occurring increases as time passes. Roll 2D10 each month minus the number of months since last solar flare. A flare will occur on a result less than 2.

For maximum realism, subtract one from the flare roll when near a solar maximum (occurs in 2000, 2011, 2022, 2033, 2044,… with an 11-year period) and add one near a solar minimum (2006 and so on).

A flare lasts 1D10 days, and has a strength determined as below:

| D100 | Strength | Average rads/day |
|---|---|---|
| 01-23 | 1 | 84 |
| 24-42 | 2 | 168 |
| 43-59 | 3 | 252 |
| 60-72 | 4 | 336 |
| 73-83 | 5 | 420 |
| 84-90 | 6 | 504 |
| 91-95 | 7 | 588 |
| 96-98 | 8 | 672 |
| 99 | 9 | 756 |
| 00 | 10 | 840 |

The radiation received per hour is strength D6. Needless to say, survival depends on having a good radiation shielding.

Flares also tend to disrupt space radio communications although laser links work fine.

The current flare detection systems tends to predict likely flares a few hours before they occur, and give at the very least 20 minutes warning (usually more than 2 hours) before the proton storm arrives at Earth. Missions to Mercury have far shorter warning and have to content with more solar weather.

(Rules based from Deep Space, Cyberpunk 2020)

# *Frustration*

The isolation, close quarters and boredom of space is frustrating to normal humans.

## System

Although the effects of being confined to a tiny volume with the same people week after week should ideally be role-played, they might be simulated by rolling random virtue against 6 each week. A failure will increase the difficulty by one next week; a success will restore it to 6.

When a botch occurs, the character has run into trouble:

> Conscience: the character behaves rudely or inappropriately to another character, perhaps stealing the last cookie or locking himself up in the washroom.

Self Control: the character lashes out or does something stupid.

Courage: the character has become depressed and withdraws from others.

The number of ones determines the severity of the outbreak; a single one might imply an unpleasant scene, four ones in a courage roll a suicide attempt.

After the crisis, the new difficulty depends on how well it was handled. If the frustration was successfully vented and the situation resolved with the rest of the crew, the difficulty returns to 6. If things went less well, it will still be higher or the frustrated character might even increase the difficulty for all others. If something unexpected happens, a practical crisis, a change in situation or a landmark is passed, the difficulty also tends to return to 6.

## Suitability

http://members.aol.com/jstuster/boldendeavors/quiz.htm
contained a test that might determine how suitable a character is to long space missions.

Although having players fill out the quiz in character is best, it is possible to estimate the result by the following formula:

(Charisma + 2 * Self Control + Conscience + Courage)*7/5 + 12

plus modifiers based on the Nature and Demeanor of the character:

Bon Vivant –2
Bravo –3
Caregiver +1

Conformist +2
Conniver –1
Curmudgeon –2
Deviant –2
Director –1
Fanatic +2 (might decrease scores for other characters)
Jester +2
Judge +1
Rebel –2
Survivor +2
Autocrat –1
Autist –1
Avant-Garde –1
Competitor –1
Confidant +2
Jobsworth +2
Mediator +3
Optimist +2
Perfectionist –1

Thrill-Seeker –2
Short Fuse –3
Territorial –2
Calm Heart +2
Self Confident +2