



Living on ISS!

The International Space Station (ISS) is a remarkable achievement, involving the efforts of 16 countries around the globe including Canada. It is the largest spacecraft in history and will be launched, one or two pieces at a time, on more than 40 launches using three different launch vehicles. In total, the International Space Station will take almost 5 years for its assembly on-orbit to be complete.

ISS is unique in that it offers astronauts the opportunity to do something quite special; live and work in the weightless environment of space, longer than ever before. Due to fuel and food considerations (among other things), Space Shuttle flights generally last no longer than 2 weeks. On the International Space Station, astronauts will remain in Earth's orbit for up to 6 months at a time, giving them the opportunity to really sink their teeth into some interesting and important research that otherwise, due to short-duration of shuttle flights, they could just never do.

However, microgravity (the apparent absence of the effect of gravity), can present some interesting challenges for astronauts when it comes to living in space. Most "living" activities will take place in the **Habitat Module** (or Hab Module) on ISS. Eating, sleeping, recreation and yes, even going to the bathroom are necessities that astronauts will have to deal with while they are in space.

Let's take some time to explore what it's like for astronauts to live on the International Space Station.

And On Tonight's Menu...

Astronauts have an astonishing array of food items to choose from. The kinds of foods they eat are not mysterious concoctions, but foods prepared here on Earth, many commercially available on grocery store shelves. Most of the food planned for ISS will be *frozen* (i.e. most entrees, vegetable, and dessert items), *refrigerated* (includes fresh and fresh-treated fruits and vegetables, extended shelf-life refrigerated foods, and dairy products) or *thermostabilized* (heat-processed, canned, and stored at room temperature) and will not require the addition of water before consumption. However, many of the beverages will be in the dehydrated form. Other types of food, such as fresh food and natural form food (ready-to-eat foods like peanuts), will also be flown. You can visit <http://www.spacelink.nasa.gov/spacefood> to see the entire ISS Food List.

Astronauts select their menu approximately five months before their flight. The menus are analyzed for nutritional content by a dietitian and recommendations are made to correct any nutrient deficiencies based on the Recommended Dietary Allowances of vitamins and minerals necessary to perform each day in the environment of space.

Once the selection is complete, food is individually packaged and stowed for easy handling in the zero gravity environment of space. Meals are stowed in special pullout drawers, which allow complete viewing of drawer contents. Food and other supplies will be resupplied every 90 days by exchanging the Multi-Purpose Logistics Module (MPLM). The MPLM is a pressurized module carried in space in the Space Shuttle payload bay that is used to transport materials and supplies.

Food Preparation

Astronauts prepare all of their meals in the **galley**, a modular unit inside the Hab Module that contains a water dispenser, a table, an oven, a freezer and 2 refrigerators. When it's time to eat, astronauts select packages of food that need to be warmed, and place them in the air convection oven. Hot and cold water is also available for preparation of foods or beverages.

During a typical meal in space, a meal tray is used to hold food and beverage containers. This tray can be attached to the table. The meal tray becomes the astronaut's dinner plate and enables him or her to choose from several foods at once just like a meal at home.



Conventional eating utensils are used in space. Astronauts use a knife, fork, and spoon. The only unusual eating utensil is a pair of scissors used for cutting open the packages. Eating utensils and food trays are cleaned at the hygiene station with pre-moistened towelettes. When the meal is finished, all the trash is collected into trash bags, and placed into containers to be brought back to Earth for disposal.



The preparation and consumption of a meal would typically involve the following series of steps.

1. Collect meal tray and utensils
2. Display preselected meal on the computer
3. Locate food using location display function
4. Prepare food items for heating
5. Place items to be heated in oven
6. Enter cook control codes and press "start"
7. Rehydrate beverages
8. Place beverages on meal tray
9. Retrieve refrigerated foods
10. Place refrigerated food in meal tray
11. Retrieve items from oven
12. Place heated foods in meal tray
13. Eat
14. Place used containers in trash
15. Clean and stow meal tray and utensils

How DO Astronauts Go To the Bathroom in Space?

The toilet (or **waste collection system**) used in space is very similar to the kind we're accustomed to using here on Earth, although there are some unique features. First of all, in order to remain seated, astronauts must make use of restraints, otherwise they might float away! Secondly, instead of water to flush away solid waste, this toilet relies on air.

When astronauts need to use the toilet, they seat themselves and make use of the various restraining devices (foot loops, thigh restraints etc.). They then activate the air-suction system using a control lever. Air is then sucked downward into the toilet bowl taking solid waste with it. Solid wastes are then compressed and stored onboard, and then later removed.

Where urinating is concerned, astronauts make use of a large tube, connected to the bottom-front of the toilet. This tube also has air flowing through it, which carries the urine into a holding tank.



Anatomically correct "urine funnel adapters" are attached to this tube so both men and women can use the same toilet.



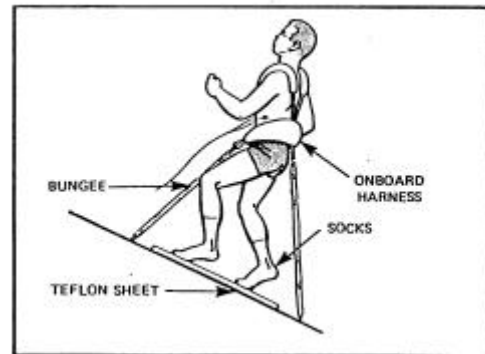
A Daily Routine

Bathing

Keeping yourself clean is as important in space as it is here on Earth. Unlike the Space Shuttle, there is a full body shower unit on ISS. When astronauts want to take a shower, they step into a cylindrical shower stall, and close the door. Astronauts get themselves wet and wash up just like you would on Earth, however, because of weightlessness, the water droplets and soap don't flow downwards into a drain, they float about! Astronauts use a suction device to get rid of the wastewater.

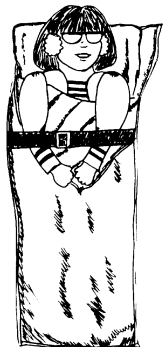
Exercise

Living and working in space requires very little physical exertion. Therefore, astronauts must exercise to stay healthy. Astronauts are required to exercise for 2 hours each day while on the International Space Station. A stationary bicycle and a treadmill are used in order to exercise both the lower and upper body muscles. A series of straps and restraints are used to keep the astronauts secure against the exercise equipment.



Recreation and Sleep

Just as on Earth, recreation and sleep are important to good health in space. Cards and other games, books and writing material are all available. Astronauts are also allowed to choose the music they would like to bring with them into space. For this reason, CD players for music are also provided.



Perhaps one of the most awe-inspiring activity for an astronaut, however, is to simply look out the window at the Earth below. Many astronauts have remarked how they spent many hours looking down on our planet, noticing how beautiful and fragile it looks from space. For this reason, photography is a very popular hobby for astronauts during their "off-duty" time.

Sleeping takes place in a "**personal sleep station**". These are small compartments where an astronaut can finally get some privacy. It's a "personal retreat" area, where astronauts stow and change their clothes and even hang personal pictures. Each sleep station is equipped with a reading lamp, clothes drawers or nets, a kind of shelf or desktop to work on, and a sleeping bag. Sleeping bags (also known as a "sleep restraints") are really nothing more than a cloth bag with a stiff pad on the back. When it's time for bed, astronauts zipper themselves in for a good night's sleep. A sleeping mask and earplugs are also available.

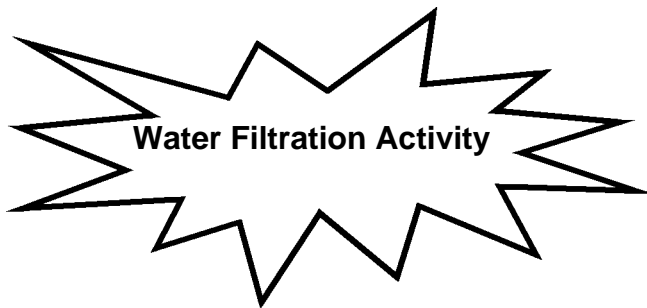


A Water Smart Activity



Since water is a rare commodity in space, astronauts on the International Space Station will be recycling their water. This includes respiration, perspiration, shower and shaving water, and even urine. These wastewaters will be purified and then recycled for drinking and other uses.

Biological treatments are used to purify water on Earth. The microorganisms used in this process destroy contaminants in the water. The International Space Station will use physical and chemical processes to remove contaminants, along with filtration and temperature sterilization to ensure the water is safe to drink.



Note: This experiment only demonstrates a type of water filtration. The experiment will not purify water for drinking purposes.

You will need:

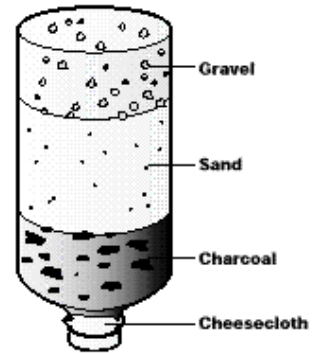
- Clear plastic soda bottle (2-liter)
- Gravel (aquarium)
- Sand
- Aquarium charcoal (activated)
- Cheesecloth (a nylon stocking can be used instead)
- Muddy water
- Rubber bands



Step 1. Cut the bottom off the soda bottle. Cover the mouth with several layers of cheesecloth and secure the cloth with a rubber band. Suspend the bottle upside down with its mouth over a glass to catch the filtered water.

Step 2. Fill the bottle with charcoal to a depth of 5–8 cm. Place 8–10 cm of sand on top of the charcoal. Place 5–8 cm of gravel on top of the sand.

Step 3. Stir the muddy water and pour it into the filter. Watch closely as the water seeps down through the three filtering layers of gravel, sand, and charcoal.



Discussion

1. What happened to the water while it passed through the different layers of the filter?
2. Compare the muddy water to the filtered water. Is there a difference?
3. Would it make a difference if one of the layers had been left out?