

# **Living in Space Object Cart**

## **Brief Summary**

The Living in Space Object cart provides visitors with the opportunity to explore real objects related to human space exploration.

## **Main Teaching Points**

- Space is an environment of extremes, and humans need special clothing, shelter and tools to survive in space.
- Microgravity (as experienced on the space shuttle, ISS, or future space stations) presents logistical challenges for living and working in space.
- Microgravity has significant physiological effects, which are monitored.
- Issues of storage space and weight determine what gets used in space.
- Because of these issues the interior of a space station or space shuttle is very different from your average living room.

## **Set Up**

- Get cart from 2003 Storage Room
- Unlock bottom cupboard.
- Get out objects, put them on top of cart or on lower shelf

## **Suggested ways of presenting touch cart /Operating Tips**

- Try facilitating the cart under the Manned Maneuvering Unit, located by the Astrotots area.
- After the Astronaut on the Surface of Mars show, bring out the cart. The food samples on the cart are similar to what would be used on a long trip to Mars. On their journey to Mars, the astronauts would be in a microgravity environment and would need special equipment similar to what is on the cart to work and live.
- If things get busy, you may choose to put out fewer items on the touch cart
- If you are facing challenges with visitors handling yellow touch items, you can keep them out of reach on the shelf, and bring them out only when you feel comfortable using them.

## **Questions and Answers**

### **Where did the Museum get this stuff?**

The original items are surplus or used items from NASA. NASA gave these items to the Museum to be used for education. The replicas were purchased from a company that makes realistic copies of space items for museums and movies.

### **Why do things float in space?**

The invisible force of gravity at the surface of Earth pulls everything toward it. In orbit, the Earth's gravity still operates, but a spacecraft is traveling forward at such a high rate of speed (over 18,000 miles per hour) that the spacecraft falls continuously, but misses the ground. Astronauts are in freefall, but fall *around* the Earth rather than *into* it. Since the astronaut and all things inside the spacecraft are falling at the same rate, they appear to be floating.

### **Why do we call it microgravity?**

The terms WEIGHTLESSNESS or ZERO G are misleading because gravity still operates. Though the motion of the spacecraft disguises the effects of gravity, it does not cancel gravity.

### **Why does NASA study microgravity?**

"NASA studies microgravity to learn what happens to people and equipment in space. Microgravity affects the human body in several ways. For example, muscles and bones can become weaker without gravity making them work as hard. Astronauts who live on the space station spend months in microgravity. Astronauts who travel to Mars also would spend months in microgravity traveling to and from the Red Planet. NASA must learn about the effects of microgravity to keep astronauts safe and healthy. In addition, many things seem to act differently in microgravity. Fire burns differently. Without the pull of gravity, flames are more round. Crystals grow better. Without gravity, their shapes are more perfect. NASA performs science experiments in microgravity. These experiments help NASA learn things that would be hard or perhaps impossible to learn on Earth." (from nasa.gov)

### **How do astronauts keep things from floating away?**

Small items have Velcro strips on them. Without Velcro, astronauts would waste precious time chasing their food packets and tools all over the spacecraft rather than actually eating or working. By the way, things in space don't float away like air bubbles in an aquarium. Rather, according to Newton's First Law of Motion, they stay put unless a force moves them. Anything already moving will retain its speed and direction of movement until it is actively stopped by an opposing force. On Earth, friction stops small items from sliding, but in microgravity, this kind of friction is absent. In orbit, if an astronaut lets go of a pen, it will be hard to avoid giving it some small amount of motion. A minute later, the pen will have moved all the way across the cabin.

*Demo: Show video of astronauts cavorting and doing stunts in space.*

### **How long do astronauts stay in space?**

On the International Space Station astronauts typically stay up to 6 months. Valeri Polyakov spent 438 days (15 months) on the Russian's MIR space station, a men's record. With the Year in Space Mission, astronaut Scott Kelly holds the record for the longest consecutive

amount of time spent in space by an American astronaut with his 342 day stay on the International Space Station.

### **Is space unhealthy?**

Apparently not. Several astronauts have spent six months or more in space with no lasting problems, provided they get adequate exercise to keep their muscles and bones healthy. Valeri Polyakov, who lived in space for 15 months, could hardly stand up when he first got home because his legs had lost muscle tissue, but he was fine after a month or so back on the ground. Also, as long as we are within Earth's magnetosphere (the belt surrounding Earth above the atmosphere that traps cosmic particles) we are protected from the harmful radiation of space. If we go to Mars someday, we will have to consider this radiation and the effect it will have on our astronauts.

### **I have heard that some things we use every day were invented for use in space. What are some examples?**

- **Virtual reality-** NASA research on tele-robot control led to the 3-D imaging that has found extensive uses in video games, and for very realistic training for doctors and police personnel.
- **Sports training-** Muscle toning and aerobic machines designed to optimize astronaut exercise regimes have been adapted for individual fitness equipment.
- **Scratch resistant lenses-** The process that NASA developed to protect astronaut visors from scratching has been widely applied to camera lenses and eyeglasses.
- **Auto tires-** A type of fiber five times stronger per pound than steel was developed for parachute cord, and has been used in auto tires and seat belts.
- **Medical monitoring-** Technology to monitor astronaut health has been adapted for Earth uses that include: Automated urinalysis, ocular screening, human tissue stimulator, digital imaging of breast tissue, and measuring exhaled gases.
- **Fire suppression-** Scientists have developed micro-misting nozzles that smother a fire but do not drown sensitive computer equipment.
  - *Demo: Take visitors to the NASA websites on research in space:*
  - <https://technology-ksc.ndc.nasa.gov/>
  - <http://www.nasa.gov/exploration/humanresearch/index.html#.VP9NJC7lxmg>

## **Object Descriptions (see separate list)**

### **Fast Facts**

- Human space flight began on April 12, 1961 when Yuri Gagarin orbited Earth. The first American to orbit Earth was John Glenn on Feb. 20, 1962.
- A one-way trip to the moon takes about three days. A one way trip to Mars takes between six and nine months. The Voyager spacecraft took 14 years to make it out of the solar system. At this speed, Voyager would need 184,00 years to reach the nearest star. The fastest spacecraft ever launched, New Horizons, traveled at 36,000 mph for 9 years to reach the Pluto system

## **Background materials (websites, videos, articles, digital collections links)**

- <http://chrishadfield.ca/category/an-astronauts-guide-to-life-in-space/> --Astronaut Chris Hadfield's Guide to life in Space, lots of videos
- [http://www.esa.int/Our\\_Activities/Human\\_Spaceflight/Astronauts/Living\\_in\\_space](http://www.esa.int/Our_Activities/Human_Spaceflight/Astronauts/Living_in_space)
- <http://www.esa.int/esaKIDSen/Livinginspace.html> -- ESA Website for Kids
- <http://www.spacetoday.org/Astronauts/AstronautStories.html> - Astronaut stories and antics
- [http://www.esa.int/Our\\_Activities/Human\\_Spaceflight/Research/About\\_research\\_in\\_space](http://www.esa.int/Our_Activities/Human_Spaceflight/Research/About_research_in_space) -- ESA website re in-space research activities
- <http://www.nasa.gov/astronauts/#.VCHMUGNCwUM> – NASA Astronaut site
- <http://spaceflight.nasa.gov/living/index.html> - NASA living in space page