Background information for teachers

Ideas for discussion

Habitat considerations

Radiation is a major challenge to life on Earth. Some creative ideas for avoiding radiation are available in the Aerospace Digital Library: www.adl.gatech.edu/research/tff/radiation_shield.html

Some solutions to the problem of radiation, for example water, have many advantages in a habitat design: water can act as a radiation shield and can also be emotionally soothing to humans and house organisms like fish. Currently, living organisms are not incorporated in current space habitat designs because the time and space required to maintain the organisms is greater than the benefit they bring to missions close to Earth. For longer missions at a greater distance from Earth, living organisms like fish and plants may be essential for success. They will have the benefit of reducing the mass that needs to be launched to space, because humans can produce their own food in space. Furthermore, tending gardens or animals would be emotionally beneficial for the crew.

Once deployed, inflatable habitats provide a large volume, allowing for the construction of large habitats. However, they are not as resistant to micrometeorite impacts and are therefore proposed for use in craters, caves or protected areas where the risk of micrometeorite impact is low. Craters and caves reduce the risk of micrometeorite impact by reducing the possible directions of impact: on a flat surface, micrometeorites can come from any angle, whereas in a crater the possible directions are reduced and in a cave the risk is virtually zero. However, living in a cave is not ideal for human psychology.

Local dirt (regolith) can be used to cover a habitat on the ground and thus protect it against radiation, thermal effects and micrometeorites.

Life in space

A day on Mars is slightly longer than that on Earth: 24 hours and 37 minutes. Day length on the Moon, however, is much longer than on Earth: at the Moon's equator, each day and each night are about 14 Earth days long.

On the Moon or Mars, sleep will most likely be similar to sleeping on Earth. For information about how crews sleep in microgravity (e.g. while travelling to the Moon or Mars), see the NASA website: http://spaceflight.nasa.gov/living/spacesleep

Long duration crews need to be picked so that the personalities are compatible. This will minimise (but not eliminate) the chances of conflict during the mission. The estimated travel time to the Moon is about three days. The estimated travel time to Mars is 8-9 months. A Mars mission will last at least 16-18 months, plus time on the planet. Compare this to a normal classroom where the children are not selected, and although they spend much less time together, there are often students who are in constant conflict.

Microgravity affects the human body, causing muscle loss (including in the heart) and bone loss. In turn, bone loss may lead to kidney stones: the minerals that cause kidneys stones are the same as those involved in bone construction, and astronauts are at high risk of kidney stones due to bone dissolution in space. Therefore countermeasures are needed to keep crews healthy, such as exercise devices in orbit, pharmaceuticals to reduce bone loss and radiation impact, or special suits, such as the lower body negative pressure suit to reduce cardiovascular deconditioning.

Terminology

Microgravity is what is experienced in a space station orbiting a planet. The International Space Station (ISS), for example, is still under the influence of Earth's gravity causing it to continuously fall around (rather than towards) Earth. There is a nice explanation on the website of NASA's Glen Resarch Center: www.nasa.gov/centers/glenn/shuttlestation/station/microgex.html

Zero gravity is what is experienced in deep space far outside our Solar System and away from the gravitational pull of any planet, star, or other celestial body.