

Hi this is Steve Nerlich from Cheap Astronomy [www.cheapastro.com](http://www.cheapastro.com) and this is *A Day on the ISS*.

First – a quick preamble. Here at Cheap Astronomy we acknowledge that people go to the toilet in space and we acknowledge that there is some clever infrastructure which allows that to take place. That's really all that needs to be said on the subject - thank you.

Now sleeping in space - that's interesting. A day on the International Space Station generally involves 16 sun rises, but is nonetheless timed to fit a 24 hour cycle since this seems to be hard-wired into the average human brain. The ISS crew aim to sleep for 8 hours, using sleeping bags to stop their arms and legs flailing about, attached to a hook on the wall to stop themselves being suctioned up to one of the air conditioning inlet ducts. And when I say wall, the terms wall, floor and ceiling are just arbitrary surfaces when you are in microgravity.

What is important is that you position your face near an air conditioning outlet duct. Warm air rises on Earth because its lower density means it is quickly displaced upwards by colder denser air since the whole of Earth's atmosphere is being compressed downwards by gravity. However, in microgravity warm air just occupies whatever space it occupies. So, you need to sleep in front of a fan to avoid becoming immersed in a bubble of your own exhaled carbon dioxide.

When you awake, washing and brushing your teeth are also a little problematic. Astronauts can wash with soap and water, what they can't do is rinse. Splashing fresh water onto their face just puts more water onto their face, since there's nothing to make it fall down into a basin. The solution is two wash cloths, one to wipe the soap on and off and another to wipe the water on and off. Astronauts can also clean their teeth in space but the last thing they want to do is spit out, since this will just leave an unsightly glob of fluoridated saliva hanging in the air. The solution is – suction or swallow.

Without needing to dwell on its various sources, as much fluid as possible is recycled on the station. However, standard distillation techniques involving heating fluid to extract purified steam, leaving the remaining detritus behind – also doesn't work in microgravity. If you heat water in microgravity it will turn into steam, but the steam won't rise. It will just hang around with all the same detritus it hung around with when it was in a fluid state.

The solution is to spin the distiller fast enough to create an artificial gravity field so that the yucky stuff sticks to the sides and purified steam accumulates in the centre where it can be extracted through an appropriate filtration system.

As well as being used for drinking and washing, water is an important source of breathable oxygen on the station. Using electricity supplied by the station's huge solar arrays, water can be electrolysed into hydrogen and oxygen. The hydrogen is vented into space and the oxygen is added to the station's internal atmosphere.

The station's internal atmosphere is maintained at the atmospheric pressure of Earth at sea level, also known as 1 Atmosphere. The air mix also approximates that of Earth's being 78% nitrogen and 21% oxygen. There is little need to humidify the air, since in microgravity there is nothing to drain fluid away from an astronaut's head and an excess of fluid in the linings of their sinuses leaves astronauts with the feeling of a constant head cold – also known as the 'space sniffles'.

The astronaut's day is around 16 hours long with meal breaks and maybe an hour's recreation time – but at least they don't have to commute to work. Two hours of exercise is also required, during which time they can at least listen to... well, some cheap podcasts maybe?

Exercise in microgravity is all about working against resistance, as a way of simulating the effect of gravity on muscles and bones. For example, astronauts may run on a treadmill wearing a compression harness which offers a degree of resistance for them to push against. In the absence of such exertions, the conservative metabolism of the human body is likely to start reclaiming calcium from bones, leading to a type of osteoporosis, and will allow unused muscles to shrink in size, strength and flexibility.

But, even with this mandatory two hours per day training regime, six months is currently the acceptable limit for an extended stay in space – at least for those astronauts wishing to return to a mobile and active life on the gravitationally-intense environment of the Earth's surface.

If you are you into extreme sports, few things can match an EVA – often inappropriately named a space walk, since something astronauts find almost immediately unnecessary in space are their legs.

One of the key purposes of a space suit is to prevent your blood from boiling while out in space, not because of any temperature change, but because its atmospheric pressure that is keeping gases dissolved in your blood, dissolved in your blood. Remove that pressure, and those gases will return to a gaseous state forming obstructive bubbles in your circulatory system – which will, after a short but excruciatingly painful period, kill you.

However, if you try to space walk with 1 atmosphere of pressure in your space suit you will be floating around like a Michelin Man, struggling to bend an knee, elbow or finger joint. The solution is to adapt to a breathing atmosphere of 100% oxygen, which can be maintained at a much lower pressure, allowing you to move more effectively in your suit – but still allowing you to absorb sufficient oxygen through your lungs to stay alive.

The pressure maintained in a space suit is about 30% of 1 atmosphere – which is about the same as the top of Mt Everest. Kind of like reverse scuba diving, an astronaut has to decompress before getting into a space suit, otherwise the nitrogen in their blood will bubble out and give them the bends.

If the need is urgent, this can be done within two and a half hours. Alternatively, if there's more time to play with, an astronaut can just 'camp 'out' in the airlock the night before their EVA.

Conducting the complex mechanical tasks undertaken by astronauts during a spacewalk has been likened to trying to change a tyre while on roller-skates, wearing two pairs of ski gloves and a backpack. However, the development of footholds, mechanical assist devices and even robots is making such work – if not easier – at least more efficient.

Anyway, after a day like this, astronauts can look forward to nothing so much as hooking themselves up to the wall again for a well deserved rest.

Many thanks for listening. This is Steve Nerlich from Cheap Astronomy, [www.cheapastro.com](http://www.cheapastro.com). Cheap Astronomy offers an educational website helping you conserve more than just angular momentum. No ads, no profit, just good science. Bye.