Let's Sleep On It

Up in space, it isn't always easy to get to sleep. There are constantly buzzing machines, temperature extremes, sunsets and sunrises every 90 minutes, crowded quarters, and changes in schedules, to say nothing of the mere excitement of being in orbit. All of these distractions could make it difficult for an astronaut to get some shuteye. Many of the challenges have been taken into consideration, however, and with a little diligence and creativity, sleeping isn't quite as difficult as it might seem.

Crew members of the International Space Station (ISS) have designated sleeping areas. Two of the three astronauts sleep in the Zvezda living quarters. (*See the NASAexplores article on Zvezda, "Make Room For One More Astronaut,"* http://nasaexplores.com/lessons/01-086/index.html .) A third sleeps in the portable sleep unit called the Temporary Sleep Station. The Space Shuttle crew has a variety of options for sleeping, depending on the specifics of the mission. They can sleep in their seats, in sleeping bags, in bunks, or by attaching themselves to the orbiter walls.

Astronaut Jeff Williams said one of the fun parts of flying on the Space Shuttle was being able to pick a new position for sleeping each night. "You can sleep anywhere in space, as long as you have a place to tie off your sleeping bag," Williams says. I've slept head first, feet first, and upside down."

Sleep compartments are like mini-van seats. They're put in place when needed, and removed when there's no call for their services. The sleep compartment provides sleeping space for four people. Bunks are about 1.8 meters (6 feet) long and .75 meters (30 inches) wide. Each bed is a padded board with a fireproof sleeping bag attached to it, and has perforations for ventilation. In Earth's gravity, your body sinks into a mattress, but because of the near weightlessness of space, the hard bed board feels soft.

The hard mattresses weren't that difficult to get used to, Williams says. The challenging part was getting used to sleeping back at home. "Without gravity, the bed is light, and you really don't feel the weight of the blankets," he says. "But back on Earth, it felt like the bed was pushing hard against me."

To sleep, astronauts climb in and zip themselves inside, leaving their arms outside. A double zipper permits the bag to be opened and closed from the bottom to the top of the bag. They fasten straps that circle the waist. Compartments have a light for reading and side panels that can be shut for privacy. The sleep compartment holds just four people, but three more sleeping bags can be attached vertically to the storage locker area so that seven astronauts have a place to doze. Each sleeping bag has a support pad with a number of adjustable Velcro straps and restraints for maximum comfort and function. Springs above the straps help compensate for rolling and turning movement. Williams notes that astronauts learn quickly to keep those straps under control. "Each strap has metal rings so they can be adjusted," he says. "If they're left floating around, the metal rings hit the walls and jingle. That noise is extremely disrupting to your sleep!"

Many photos of sleeping astronauts show them sleeping with their arms floating upwards. "That's the natural position for the human body's arms in microgravity, when the muscles are totally relaxed," Williams says. "You can try this for yourself. The next time you're in a swimming pool, relax completely and watch how your arms float up. You're simulating microgravity conditions just like the Neutral Buoyancy Laboratory we work in as we prepare to go to space."

Staying anchored at bedtime is tough, but the real challenges are getting to sleep and staying asleep. Sleep is controlled by circadian rhythms—the body's natural clock. The brain's hypothalamus signals the body to produce melatonin, a hormone that encourages sleep, and about 8 hours later, another hormone, cortisol, which promotes wakefulness. Circadian rhythms also influence bodily functions like body temperature, hormone production, heart rate, and urine production. Normally, circadian rhythms produce cycles that last approximately 24 hours, which are triggered by exposure to daylight, but in space, daylight comes and goes every 90 minutes instead of 24 hours. That can really throw a person's internal clock off balance.

"When the circadian rhythms are disrupted, you lose sense of what time it is," Williams it's morning or nighttime, and you don't know when it's time for bed. You have to rely on your watch and your flight schedule to tell you what time it is and what you should be doing."

Besides being inconvenient, working outside your body's natural rhythms means you won't function at your best. With this in mind, NASA sometimes shifts the astronauts' sleep/wake cycles before their launch so that their schedule will match the crucial period of a mission. To accomplish this, astronauts are exposed to high intensity light at specific times for several days before liftoff. By the time the shuttle is ready to leave Earth, the astronauts are acclimated to the new routine. Once in space, biological clocks might need to be adjusted again closer to landing time. By requiring crew members to wake up a bit earlier each day, they'll gradually return to the time frame needed at landing.

Before the Shuttle launch, Williams and his crewmates had to adjust their sleep schedule so that they'd be wide awake and alert for their early-morning liftoff. "To change our cycles, we started waking up at 11 p.m., and going to bed at 2 p.m.," says Williams. "Gradually, we switched to the schedule we needed. It's hard to do that, though. You can't just go to bed early, because it's difficult to go to sleep when you're not tired. It's much easier, though, to stay up late and adjust your schedule that way. But just about any child who has tried to get back onto a sleep schedule after Summer vacation knows what I'm talking about."

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