NASA lighting effects study seeks circadian solution for astronauts

December 14 2016

Crewmembers on the International Space Station (ISS) can experience sunrises and sunsets in rapid succession—about 16 "sunsets" per day because the space station circles Earth once every 90 minutes.

Most people function regularly on a 24-hour cycle known as a circadian rhythm. However the space station environment creates a departure from the cycle of light and dark astronauts are used to at home. A high workload, the need to work 'nightshifts', the excitement of spaceflight, plus the unusual environment can disrupt astronauts' circadian clocks. These factors can combine to disrupt sleep, which can in turn effect performance.

Being wide awake when they should be sleeping is in fact a long-standing challenge among ISS crewmembers. Studies of astronauts who flew between 2001-2011 on the space shuttle and 2006-2011 on the station showed that astronauts slept considerably less in space than they did on Earth. About ¾ of them reported using sleep promoting pills during their 6-month missions. Use of caffeine is also commonplace among ISS astronauts to fight off the daytime drowsies.

But NASA is seeking a better way to solve the problem. The secret lies in light itself. It's known that the blue-enriched light emitted by our laptops can keep us awake at night. A new NASA study will investigate how to use that for the benefit of humankind, and not just on the ISS.

This light study—known as the Lighting Effects study—coincides with a lighting 'makeover' on the space station. The fluorescent lights on the station are being replaced with a new system of solid-state light-emitting diodes (LEDs). Not only are the LEDs more energy-efficient and safer, they can literally shed all sorts of light on the study topic.

Brigham and Women's Hospital's Dr. Steven Lockley and Thomas Jefferson University's Dr. George Brainard are the co-principal investigators of the Lighting Effects study. Lockley explains: "Light has a number of effects on our sleep and circadian rhythms; is a natural stimulant and can improve alertness and performance, and also help reset the 24-hour clock when it gets out of sync. The human eye contains a light-sensitive protein called melanopsin, different from the rods and cones that we use to see, which detects light in the eye and mediates these effect. Melanopsin is most sensitive to short-wavelength blue light and so by increasing or decreasing the proportion of these blue wavelengths in white light, we can enhance alertness, or promote sleep, respectively."

Lockley says, "NASA has developed a multi-LED lighting system to take advantage of these light effects. The system can provide millions of different light spectra. We're not making the ISS into a disco, but we are going to use three different light settings. We'll use a general light setting that provides a good light to see by during normal work, a higher-intensity blue light enriched setting that elevates alertness and can better shift the circadian clock when needed, and a lower-intensity blue wavelength-depleted 'pre-sleep' setting to calm the brain and promote sleep. We will be studying the impact of these lights in future missions."

Results of this study are expected to help define guidelines for lighting protocols during future ISS and human space missions. Study results should make it clear exactly when and how to use these various settings of light intensity and spectrum. These results could also lead to Earth-based benefits such as helping manage sleep patterns for shift workers, or even developing treatments for sleep disorders or jet lag.

Provided by NASA

Citation: NASA lighting effects study seeks circadian solution for astronauts (2016, December 14) retrieved 25 April 2024 from https://phys.org/news/2016-12-nasa-effects-circadian-solution-astronauts.html