Acronym: Sleep-Wake Actigraphy and Light Exposure During Spaceflight - Short

Title: Sleep-Short

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Developer(s): Johnson Space Center, Human Research Program, Houston, TX

Sponsoring Agency: National Aeronautics and Space Administration (NASA)

Increment(s) Assigned: 11, 13, 14, 15, 16, 17, 18

Mission Assigned: STS-104/7A. STS-109/HST, STS-111/UF2, STS-112/9A, STS-113/11A, STS-107 STS-114/LF1, STS-121/ULF1.1, STS-115/12A, Soyuz TMA-1/5S Odissea, STS-116/12A.1, STS-118/13A.1, STS-120/10A, STS-122/1E, STS-123/1J/A, STS-124/1J, STS125/HST

Brief Research Summary (PAO): Sleep-Wake Actigraphy and Light Exposure During Spaceflight - Short (Sleep-Short) will examine the effects of spaceflight on the sleep of the astronauts during space shuttle missions. Advancing state-of-the-art technology for monitoring, diagnosing and assessing treatment of sleep patterns is vital to treating insomnia on Earth and in space.

Research Summary:

- Previous research on Space Shuttle crewmembers has shown that sleep is disrupted on orbit.
- A wrist-worn Actiwatch will record the activity of the crewmembers and the ambient light to which they are exposed.
- The crewmembers' subjective evaluation of their sleep and alertness, recorded in a daily log book, will also be investigated.

Detailed Research Description: The success and effectiveness of manned spaceflight depends on the ability of crewmembers to maintain a high level of cognitive performance and vigilance while operating and monitoring sophisticated instrumentation. Astronauts during short space flights, however, commonly experience sleep disruption and may experience misalignment of circadian phase during spaceflight. Both of these conditions are associated with insomnia, and impairment of alertness and cognitive performance.

Relatively little is known of the prevalence or cause of spaceflight induced insomnia in short duration

missions. This experiment will use state of the art ambulatory technology to monitor sleep-wake activity patterns and light exposure in crewmembers aboard the Space Shuttle. Subjects will wear a small, light-weight activity and light recording device (Actiwatch) for the entire duration of their mission. The sleep-wake activity and light exposure patterns obtained in-flight will be compared with baseline data collected on Earth before and after spaceflight. The data collected should help us better understand the effects of spaceflight on sleep as well as aid in the development of effective countermeasures for short duration spaceflight.

Project Type: Payload

Images and Captions:

This image shows an Actiwatch Activity Monitor next to a ruler to demonstrate the size of the Actiwatch. Image courtesy of NASA, Johnson Space Center.

NASA Image: S104E5114 - Astronaut, Janet Kavandi on STS-104 wearing an Actiwatch on her right wrist for recording activities.

Operations Location: Sortie

Brief Research Operations:

- The crewmembers will wear Actiwatches (that will record wrist activity, allowing estimation of sleep duration and also records the light exposure of the crewmember).
- Crewmembers will complete daily sleep logs.

Operational Requirements: Short-duration (Space Shuttle) crewmembers are needed as subjects for the experiment. This is on a volunteer basis, obtaining as many volunteers as possible until the Space Shuttle program is retired. Baseline data for each subject must be collected for two weeks between L-120 (launch minus 120 days) and L-75 and from L-11 through L-0. Recovery in sleep patterns after spaceflight will be assessed from R+0 (return plus 0 days) through R+7.

Operational Protocols: Crewmembers will don Actiwatches as soon as possible upon entry into orbit (FD1) and wear the Actiwatches continuously throughout the flight. Sleep logs will be completed each day within 15 minutes of awakening. On the last day of the mission, crewmembers will doff and stow the Actiwatches.

Category: Human Research and Countermeasure Development for Exploration

Subcategory: Human Behavior and Performance

Space Applications: The information derived from this study will help to better understand the effects of spaceflight on sleep-wake cycles. The countermeasures that will be developed will improve sleep cycles during missions which in turn will help maintain alertness and lessen fatigue of the Space Shuttle astronauts.

Earth Applications: A better understanding of insomnia is relevant to the millions of people on Earth who suffer nightly from insomnia. The advancement of state of the art technology for monitoring, diagnosing, and assessing treatment effectiveness is vital to the continued treatment of insomnia on Earth. This work could have benefit the health, productivity and safety of groups with a high prevalence of insomnia, such as shift workers and the elderly.

Manifest Status: Ongoing

Availability: Operated on Space Shuttle

Supporting Organization: Exploration Systems Mission Directorate (ESMD)

Previous Missions: STS-104/7A. STS-109/HST, STS-111/UF2, STS-112/9A, STS-113/11A, STS-107 STS-114/LF1, STS-121/ULF1.1, STS-115/12A, Soyuz TMA-1/5S Odissea, STS-116/12A.1, STS-118/13A.1, STS-120/10A, STS-122/1E, STS-123/1J/A, STS-124/1J, STS125/HST

Results: Analysis is ongoing.

Results Publications: Analysis is ongoing.

Related Publications:

Dijk D, Neri DF, Wyatt JK, Ronda JM, Riel E, Ritz-De Ceccoa A, Hughes RJ, Elliott AR, Prisk GK, West JB, Czeisler CA. Sleep, performance, circadian rhythms, and light-dark cycles during two space shuttle flights. American Journal of Physiology Regulatory Integrative Comparative Physiology. 2001 ;281:R1647-R1664.

Monk TH, Buysse DJ, Billy BD, DeGrazia JM. Using nine 2-h delays to achieve a 6-h advance disrupts sleep, alertness, and circadian rhythm. Aviation Space and Environmental Medicine. 2004 ;75:1049-1057.

Mallis MM, DeRoshia CW. Circadian Rhythms, Sleep, and Performance in Space. Aviation, Space, and Environmental Medicine. 2005 ;76(6 Suppl): B94-107.

Monk TH, Buysse DJ, Billy BJ. Using daily 30-min phase advances to achieve a 6-hour advance: Circadian rhythm, sleep, and alertness. Aviation Space and Environmental Medicine. 2006 ;77(7): 677-686.

Web Sites: Sleep Medicine at Harvard Medical School
International Space Station Medical Project (ISSMP)

Related Payload(s): Sleep-Long