LIFE SCIENCE PROGRAMS FOR NEEMO 5

Spaceflight presents many risks to crew health, well-being and performance, many of which are still poorly understood or mitigated. A purpose of NEEMO 5 is to conduct a number of life sciences projects designed to help understand and mitigate deliterious responses encountered in space that place crew members at increased risk for discomfort, injury, or death. Life Sciences projects that will be conducted during NEEMO 5 include:

Actiwatch – The purpose of this project is to assess sleep latency and sleep efficiency using the Actiwatch® - a device that records sleep and wake activity. The crew will wear the watch on their non-dominant hand while keeping a record of their activities, including sleep.

Bacterial Detection – The objective of this study is to analyze daily swab samples from various areas of the habitat with an automated real-time monitor of bacterial endotoxin. These results will be correlated with advanced microbial analysis of the same samples in a laboratory following the mission.

In-suit Doppler – This objective will evaluate the hardware developed to monitor crewmembers after EVA (Extra Vehicular Activity in space, or what we call excursions when diving outside Aquarius) for nitrogen bubble formation and provide an early warning for the possibility for decompression sickness. Crewmembers will be asked to wear the device immediately after returning from a dive (the device cannot be worn in the water), and wear it for 2-4 hours.

Physiologic Monitoring – The purpose of this objective is to evaluate the usefulness of wireless medical monitoring devices inside a metal-walled habitat, and procedures that rely on such devices. The monitoring devices consist of non-invasive sensors that attach to the torso and wirelessly transmit data to a laptop.

Clinical Nutritional Assessment – The objective of this project is to assess the impact of the NEEMO analog on dietary intake and nutritional status, and provide preliminary information on interactions between nutritional status and immune function. Two key areas are hypothesized as being affected by this environment: stress-induced alterations in energy and protein utilization, and pressure-induced changes in bone and calcium metabolism. This is a modified version of the Clinical Nutritional Assessment Profile performed on station crewmembers.

Oto-acoustic Emissions – This study has two purposes. The first is to evaluate oto-acoustic hearing assessments as a screening tool to assess vulnerability to barometric pressure related hearing loss. Oto-acoustic emissions are an objective, noise-tolerant technique and so are well suited for use in operational environments. The second is to validate the procedures and verify the repeatability of self-administered tests in an operational setting. These data are important for completing the planned oto-acoustic emissions measurements on ISS successfully.

Portable Ultrasound – This objective will evaluate the effectiveness of the SonoSite (portable ultrasound device) as a diagnostic tool for crewmembers in remote environments with minimal ultrasound training. This device will be used in a simulated medical event, during which time the crewmembers will communicate real-time with physicians in the ExPOC.

Habitability Assessment – The objective of this activity is to evaluate the Aquarius from the human factors and habitability perspective as an isolated, confined analog for ISS, and to determine the human factors and habitability requirements for such an isolated and confined analog, and identify potential enhancement for the next generation habitat.

Magic Windows – This project will gather information about current displays and determine additional needs and identify usability issues through a small survey and possibly test of a procedure (medical or maintenance task) with a head mounted display and normal procedure format.

STARx - This is a software application developed for portable, hand-held devices (i.e. Palm) that is intended for use by astronauts as a therapeutic monitoring tool while on board the shuttle and for use during ISS missions. Crewmembers will be asked to evaluate the functionality and user-friendliness of STARx and ARES ™ software using the Palm PDA handheld computer.

Latent Viral Shedding in Small Isolated Groups – The purpose of this project is to study the effects of social and work stresses on viral shedding and immune function within the social context of the Aquarius habitat, and to compare those results with data from groups isolated in other extreme environments. Investigators will attempt to determine if subjects undergoing stress in a ground-based analog of space flight have the patterns of viral reactivation seen in astronauts.

Wound Healing – This project will evaluate the procedures written for the digital still camera used on orbit (the DCS 760) and the ability to interpret data transmitted images from the ExPOC. The images will track the healing process of wounds incurred by crewmembers during nominal EVA/dive activities.