NURP Supports NASA Extreme Environment Mission Operations (NEEMO)

What is NEEMO?

The NASA Extreme Environment Mission Operations (NEEMO) program is a NOAA-NASA partnership designed to prepare astronauts for long-duration space habitation. NASA astronauts live and work onboard the National Undersea Research Program's (NURP) Aquarius (see box below), an undersea lab that rests on the Florida Keys National Marine Sanctuary (FKNMS) seafloor 62 feet below the ocean's surface.

Similar in size to the International Space Station (ISS) living module, Aquarius provides the physical isolation, operational complexity, Zvezda, the International Space Station module communication networks and science where astronauts live and work. .

objectives typical of an outer space mission. Additionally, habitation onboard Aquarius requires an absolute reliance on one's immediate life support systems, posing the potential dangers associated with space habitation. The facility is supported by a 10-meter buoy on the surface that provides power, life support, and communications to the aquanauts.

The mission control base on Key Largo supports missions with 24-hour video, audio and life-support systems monitoring. NEEMO missions host live-links with the ISS and the Johnson Space Center's Exploration Planning and

Operations Center (ExPOC) control room, Aquarius, the world's only operational underwater
simulating the interaction between astronaut and habitat, situated on the FKNMS seafloor.
control room on space flights.
A quarius is currently the only operational, offshore underwater habitat in the world, typically used by
m arine scientists to study coral reefs and coastal ocean processes. Aquarius is owned by NOAA,
o perated by the University of North Carolina at Wilmington, and funded by NOAA's Undersea Research
P rogram (NURP). Its unique design allows scientists to live and work on the seafloor for extended
p eriods using a special technique called saturation diving, which dramatically increases the time divers
can spe nd working in the ocean's depths. A buoy on the surface provides the Aquarius with power, life
support and communications capabilities.
NEEMO missions on board Aquarius
Through NEEMO, NURP has enabled NASA to further develop space flight training procedures; expand crew and mission control communication techniques; and evaluate methods that address the physiological issues and potential medical problems associated with lengthy space missions.
Living in Aquarius for up to two weeks, astronauts work alongside experts from NURP's National Undersea Research Center at UNC Wilmington to conduct a variety of training and evaluation missions.
Astronauts simulating gall bladder removal
To train for medical emergencies in space, onboard Aquarius.

astronauts have practiced telementoring, a method where physicians on Earth guide non-physicians in space to perform the necessary medical procedures. In the training exercise, a surgeon in Canada guided Aquarius aquanauts to perform the emergency removal of a gallbladder. All diagnostic and surgical tasks were performed on a pair of highly complex surgical dummies. Astronauts are able to practice for space walks with US Navy EX-14 hard-hat dive suits, which offer limited mobility and a slightly negative buoyancy. Water drag notwithstanding, walking Testing the ability to manipulate equipment underwater in these suits provides an experience while wearing EX-14 system diving suits. very similar to walking on the moon. Wearing the suits while constructing structures underwater can serve as an analog for extra-vehicular assembly in space. Remotely operated vehicles (ROVs) equipped with video cameras and manipulator arms may one day be employed to find locations suitable for human habitation on other planets. During NEEMO missions, astronauts have practiced operating ROVs underwater, which simulates manipulating the flight of ROVs in space. Maneuvering an ROV tethered from a boat serves as an analog for ROV manipulation in

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