

NASA: Working in Extreme Environments on Earth



Exploration of the lunar and Martian surfaces and space poses great challenges to humans. One of the challenges is the extreme environments that astronauts will encounter. To simulate these environments, NASA engineers and scientists use comparable locations – the desert

and ocean – on Earth to prepare for upcoming exploration missions.

In addition to preparing for the future, NASA scientists use Antarctica, another of Earth's extreme environments, to study the past.

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NEEMO

The NASA Extreme Environment Mission Operations project, known as NEEMO, sends groups of astronauts, engineers, doctors and professional divers to live in an underwater habitat for up to three weeks at a time. The aquanauts live in Aquarius, the world's only undersea laboratory, located 3.5 miles off the coast of Key Largo, Fla.

Aquarius provides NASA a convincing analog to space exploration. Much like space, the undersea world is a hostile, alien place for humans to live. NEEMO crew members experience some of the same tasks and challenges underwater as they would in space. For example, working in space and underwater environments requires extensive planning and sophisticated equipment.

While underwater, NEEMO participants are able to simulate living on a spacecraft such as the International Space Station or to test extravehicular activity for future missions to the moon and Mars. The aquanauts have also tested techniques for communication, navigation, the use of remote-controlled robots on the lunar surface, and telemedicine.

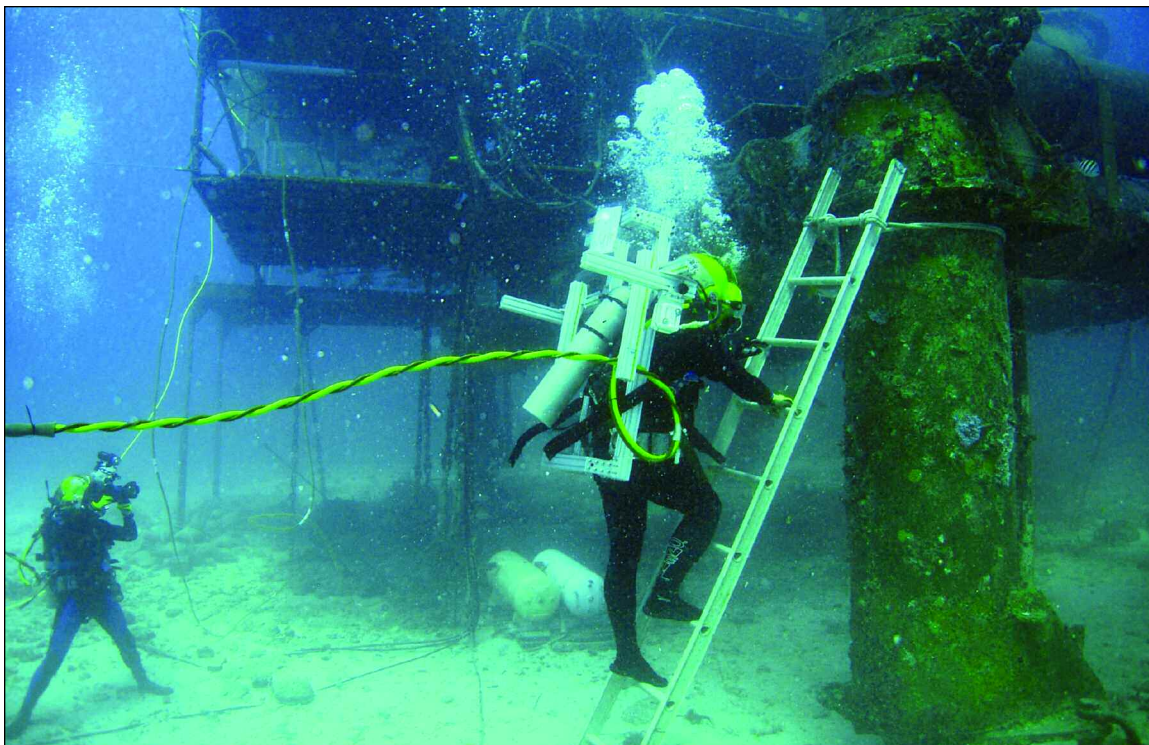
Aquarius is owned by the National Oceanic and Atmospheric Administration (NOAA) and managed by the University of North Carolina at Wilmington (UNCW). The laboratory is located in the Florida Keys National Marine Sanctuary and is on the ocean floor next to deep coral reefs 62 feet below the surface.



The Aquarius system has three elements: a life-support buoy at the surface, the habitat module and a base plate that secures the habitat to the ocean floor. The Aquarius habitat has about 400 square feet of living and laboratory space.

NASA sent its first set of NEEMO aquanauts to Aquarius in October 2001. The crew size varies from three to four, with UNCW engineers providing support.

For more information about NEEMO, please visit: <http://www.nasa.gov/neemo>



Desert RATS

NASA's Desert Research and Technology Studies (RATS) team studies, tests and evaluates the use of extravehicular equipment for use during future lunar and Martian exploration. This research takes place in various high desert locations near Flagstaff, Ariz.

The field research and developmental prototypes provide a knowledge base that will help scientists and engineers design, build and operate better equipment for space exploration as well as help establish requirements for concept of operations and procedures. The program also strengthens networks between NASA, industry and academia including providing public educational outreach opportunities.

Though far from the moon and Mars, the arid Arizona landscape provides the optimal testbed because its rough terrain and extreme temperature swings simulate conditions that may be encountered during lunar and Martian exploration.

Spacesuit equipment, robots, rover and logistics support vehicles, surface mapping and navigation techniques, and power and communication systems are some items that the Desert RATS team has evaluated in the field.

The Desert RATS team includes engineers and scientists from Johnson Space Center, Kennedy Space Center, Glenn Research Center and Ames Research Center. NASA also works with experts from Oceanering Sea and Space Systems, Hamilton Sundstrand, ILC/Dover, Carnegie Institute, Raytheon, the University Space Research Association and Virginia Commonwealth University.

For more information on Desert RATS, please visit: <http://science.ksc.nasa.gov/d-rats/>



Antarctic Meteorite Program

The U.S. Antarctic Meteorite Program is a collaborative effort by NASA, the National Science Foundation (NSF) and the Smithsonian Institution. The objective is to collect and study Antarctic meteorite samples that contain valuable information about the formation of the solar system.

Meteorites are important to science because they formed in the early days of the solar system, and some could contain materials that were present before the solar system formed. The meteorites recovered in Antarctica provide scientists a good window into the past because they have been preserved in ice, basically unscathed from weathering and not contaminated from pollutants.

The three government agencies play large roles in the program. The NSF provides support for field research and collection. NASA and the Smithsonian Institution provide classification, storage and distribution of Antarctic meteorites. All three agencies sponsor research on these valuable specimens.

After the meteorites are recovered, they are taken to the Meteorite Curation Facility at Johnson Space Center, where they are processed in the controlled atmosphere cabinets formerly used to process lunar samples. Also at JSC, the meteorite samples are chipped, sawed, weighed and photographed in nitrogen cabinets without exposure to the air or to any cooling fluids.

Since 1976, United States scientists have found more than 15,000 meteorites in Antarctica, including a large number of lunar and Martian samples. Scientists from other countries have collected more than 23,000 meteorites in the frozen landscape of Antarctica.

*For more information on the U.S. Antarctic Meteorite Program, please visit:
<http://curator.jsc.nasa.gov/antmet/program.cfm>*



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