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SPACE APPLICATIONS IN A MANNED UNDERWATER RESEARCH STATION

Abstract

CalamarPark is an independent "initiative for studies on aquanautics" and develops a new generation of modular, manned underwater habitats with the goal to establish an International Underwater Research Station. The design will offer an extendable living environment based on different human factor concepts very much like a similar structure in LEO or on the lunar surface. The concept is based on extensive analysis of previous similar projects and is designed to offer better features than the NEEMO missions station, Aquarius Reef Base, and at a lower price.

The Underwater Research Station offers unique opportunities for the space sector, such as:

- The full amount of stressors of an isolated confined environment (ICE) in an extreme environment (EE) without being able to return the surface immediately
- Possibility to test different interior design models, configuration of technical equipment and group dynamic concepts
- Representation of NASA technological readiness (TRL) levels 5/6 conditions of an in-situ relevant environment for technology test.
- Simulation of lunar microgravity outside the habitat, concerning movement sequences (human and machinery) and sediment dynamics
- Advanced conditions to test even exceptional technology approaches for extended periods, e.g., life support systems, bioreactors, interior design, insulation materials etc.
- A mobile module will allow deployment in different locations as well as in training pools (like Blue Abyss, Nemo 33 or Deepspot) and marine environments
- Modular concept allows attachment of external modules or customized structures resembling actual space structures
- Technology transfers from/to the space sector, with anticipated trade-offs to other industries
- Direct proximity or even involvement of interested citizens to space related activities

The architecture of the mobile module is designed to be transportable in three freight containers by road. The main structure is built on a barge base and uses a modular approach with standardized docking collars that allow external modules to be easily attached. It can be constructed in two phases on the water surface and be towed for longer distances due to its hydrodynamic hull shape. The structure is easily lowered onto the site and can adapt to various seabed conditions using adjustable piles. It can also

resurface easily using variable ballast systems and can remain on the water surface for maintenance if needed. The structure offers large spaces for long-term accommodations, with separate spaces for working, living, and socializing. Additionally, the structure is designed for long-term financial sustainability through interdisciplinary mission programs.