

IAF SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS

(A7)

Science Goals and Drivers for Future Exoplanet, Space Astronomy, Physics, and Outer Solar System
Science Missions (2)

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CUBESUB- A SUBMERSIBLE CONCEPT FOR UNDERWATER PLANETARY EXPLORATION

Abstract

Many of the underwater environments on Earth remain difficult to explore, due to their harsh environmental conditions and being hard to reach. The exploration of these places and the methodologies used could prove important first steps towards the exploration of the purported ocean worlds of our solar system such as Europa, Enceladus, Ceres, and perhaps even Charon. This paper introduces the CubeSub concept and presents the first steps of its development. The CubeSub is a modular submersible based on subsystems and components originally designed for the CubeSat form factor. The CubeSub's main objective is to provide a submersible test bed for technology development and investigation of remote operational procedures in analog environments. It aims to be cheap, readily available and easy to use. The already well-established CubeSat framework offers a foundation for the CubeSub to build upon, and offers a substantial amount of already existing technology and industry competence; with its modular design it can easily be modified and augmented to suit the different needs of the users for a given mission. The CubeSub was developed by a team of interns at NASA's Ames Research Center, using rapid prototyping technologies such as 3D-printing and laser cutting, and uses commercial off-the-shelf components such as Arduino microcontrollers and sensors. The submersible's main functions are to gather information about water's properties, such as temperature, pressure, and depth, as well as to take pictures and videos from underneath the water and send it back to a surface device/computer. The prototype also demonstrated viability of inter-module wireless communication. The CubeSub team at Ames is trying to combine the CubeSats and small submersibles and bringing that into a new area of underwater planetary exploration. CubeSats are based on miniaturization of electronics to explore low cost platforms. The CubeSub concept will allow us to explore areas that would otherwise be too costly or risky to access.