

SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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PLANETARY PROTECTION AND THE SEARCH FOR LIFE ON THE ICY MOONS OF THE SOLAR SYSTEM: A TECHNOLOGY ROADMAP

Abstract

The search for extraterrestrial life, both extant and extinct, is becoming increasingly intriguing. From the discovery of seasonal liquid water on the surface of Mars, to the discovery of saline subsurface oceans on the Jovian moons of Europa and Ganymede, we find environments that may harbor potential extraterrestrial ecosystems. In addition, the discovery of hydrothermal activity on the Saturnian moon, Enceladus, has gained a lot of attention, and it has become a prime candidate for extraterrestrial life within our solar system.

With upcoming campaigns such as the ESA JUICE mission (Jupiter ICy Moon Explorer), and Mars 2020 coming closer into contact with potential extraterrestrial ecosystems, the chances of these missions contaminating a world beyond our own increases.

Further still, in the event of a sample return such as the proposed LIFE mission to Enceladus, the chances of bringing undesirable life back to Earth also increase. Clearly, planetary protection is becoming increasingly relevant.

This study supports the idea that there are three main rationales in planetary protection: scientific, societal and ethical. The scientific implications relate to the preservation of the scientific integrity of samples collected, bio signatures, or possible life observed. The societal implications relate to the potential hazards of contamination here on Earth. Finally, the ethical considerations relate to first contact on Earth as well as to the potential effects that humans will have on extraterrestrial life and ecosystems beyond Earth.

This paper is the culmination of 6 months of Astrobiology related research by a team of 20 M.Sc. students from 14 countries at the International Space University in Strasbourg, France. We have studied interdisciplinary aspects of the past, present and future of the search for life, with a focus on planetary protection. Finally, suggestions for a technology roadmap applicable to planetary protection in the context of future missions to the icy moons of the outer Solar System are presented.