

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

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SEEDS: FINDING LIFE ON EUROPA, DESIGN AND PROCEDURES TO AVOID CONTAMINATION  
DURING THE MISSION

**Abstract**

The human willingness to discover life beyond Earth has pushed the space exploration to the ends of the solar system. However, the conditions required to the appearance of life might be not so far from Earth. Europa is a moon of Jupiter that has a giant ocean under its iced surface and an internal activity creating water vapor plumes, and is therefore one of the best candidates for hosting life in the solar system. On the occasion of the fourteenth edition of the SpacE Exploration and Development Systems (SEEDS Program), a collaboration between ISAE-SUPAERO, Politecnico di Torino and the University of Leicester has developed a preliminary design for an exploration mission of Europa's Ocean.

The exploration of a celestial body that has a high probability to contain life requires to take care of contamination more than usual. Indeed, besides the classical procedures applied on a space object

classified in the fourth category of the planetary protection (like Mars), additional procedures must be considered regarding the fact that a submarine probe will be sent inside the ocean. Unlike a rover landing on Mars, a failure of the mission leading to a loss of control of the submarine could cause its sinking and destruction, implying that all its constitutive materials could damage potential life in its environment.

The paper focuses on all the procedures applied to the mission to avoid any serious contamination of the subsurface environment by the probe. This goes from the microbial decontamination of every single part of the explorer, to the submarine design to avoid any contamination potentially dangerous for life, such as radioisotope for electrical generation, in case of loss of the system or one of the subsystems. The article also considers the tests that must be performed on Europa's surface before sending the submarine under water, and finally the system disposal after the end of the mission.