

# Planetary Protection and Life beyond Earth

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## ABSTRACT

In planetary exploration and the search for life beyond Earth, the unique capabilities provided by human explorers will be advantageous to science only if the biological contamination associated with human presence is understood and controlled. The practice of preventing cross-contamination between the Earth and other planetary bodies is called planetary protection. NASA has a planetary protection policy in place for solar system exploration missions, and compliance with it is mandatory. Thus, planetary protection must be incorporated in mission planning and development from the beginning. NASA's planetary protection policy is intended to prevent "forward contamination", contamination of other solar system bodies by Earth microbes and organic materials, and "backward contamination", contamination of Earth by potential alien life.

**Keywords:** Planetary protection, Earth, NASA

## INTRODUCTION

As NASA's space exploration program expands to encompass human as well as robotic planetary missions, planetary protection will become a more complicated enterprise. For missions or subsystems requiring a basic level microbial reduction and cleaning without complete or penetrating microbial reduction, physical cleaning of exposed surfaces using alcohol wipes is an effective method for achieving the required cleanliness. This is also part of the typical intake procedure to bring items into a cleanroom environment. Hardware that is maintained in a cleanroom environment may be assumed to have lower levels of biological burden than that in uncontrolled environments: conservative 'specification values' for both surface and encapsulated bio burden are provided in planetary protection documentation, that may be assumed as the bio burden on hardware if an overestimate of bio burden is not problematic. The idea of planetary protection already emerged during the formation of the space program in the United States. The International Astronautical Federation (IAF) first took a look at the problem in 1956, a year before Sputnik. Later, during the 1960s, the International Council of Scientific Unions established the Committee on Space Research (COSPAR). Despite its position as a consultative body of the United Nations only, this multidisciplinary committee has been able to determine the standards upon which national practices has been based for over the past 40 years.

At the same time, the UN had created the Committee on the Peaceful Uses of Outer Space (UNCOPUOS). This committee has played a vital role in the development of space law as a respected field of international law, and has eventually led to a first legal basis for planetary protection. The first reference to the concept was included in the "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space". This UN resolution, however, did not contain any specific mention of biological contamination. COSPAR in the meantime adopted resolution 26, which provided the first international standards for planetary quarantine. Any cleaning effort must be supported by an effective biological assay procedure that verifies the subsequent level of microbial reduction. The required cleanliness and biological burden is achieved by the effect of mechanically removing contaminants using a solvent such as ethanol or isopropanol. Physical cleaning is typically sufficient for Mars missions that do not focus on life-detection or the exploration of Mars special regions, and the method may be augmented by reduction to the encapsulated bio burden of components by other methods (e.g. manufacturing processes, contamination control bake-outs, or targeted DHMR or autoclaving) if total bio burden is limiting.

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**Received date:** May 05, 2021, **Accepted date:** May 20, 2021, **Published date:** May 27, 2021

**Citation:** Janhunen P (2021) Planetary Protection and Life beyond Earth. *Astrobiology Outreach*. 9: e228.

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