

To what degree are spacecraft clean and free of terrestrial microbes?

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All space flight missions involved with life detection and/or sample return procedures stress the importance of avoiding contamination of critical spacecraft hardware components with terrestrial organisms, their remains, or organic matter. The COSPAR, an international committee representing all space-faring nations, is committed to the development, maintenance, and promulgation of planetary protection knowledge and policy. The ultimate goal of planetary protection guidelines is the preservation of the pristine environments in our solar system and beyond. Fulfillment of planetary protection requirements entails reduction and monitoring of the terrestrial biological burden of spacecraft throughout the assembly process.

Our studies using NASA's culture-based techniques have found species of *Bacillus* to be dominant on spacecraft and assembly facility surfaces, while molecular microbial community analyses have revealed the presence of many Gram-positive and Gram-negative bacteria, actinomycetes, and fungi some of which are cultivable and others, non-cultivable. In addition, studies have shown that the microbial populations within spacecraft assembly facilities are largely influenced by both their surrounding ecosystems and inherent physical cleaning activities. A number of novel bacterial species that exhibit elevated resistances to desiccation, H₂O₂, UV, and γ -radiation (*Bacillus* species; *Acinetobacter radioresistens*; *Aureobasidium pullulans*) have been isolated, some repeatedly, from various spacecraft and assembly facility surfaces.

Accurate validation of the abundance and types of problematic microbes on surfaces could lead to improved cleaning and sterilization technologies. Further, in order to meet demanding assembly schedules for planetary spacecraft, a more rapid and sensitive assay could replace or augment current time-consuming conventional microbial assay techniques. In addition, rapid microbial monitoring technologies would be invaluable for detection of contamination events aboard the International Space Station.