Considerations for Future Exploration

Since 1967, a policy has been in place to control contamination of planets from both terrestrial organisms and organic constituents. The policy, implemented by the National Aeronautics and Space Administration, lays out a framework of guidelines for implementing future missions. The purpose of the planetary protection policy is to preserve conditions for future biological and organic exploration of planets and other solar system objects and to protect Earth and its biosphere from potential contamination by extraterrestrial sources.

During the course of structuring an active program to explore our solar system, it has become increasingly apparent that planetary protection factors will have a significant impact on future missions design, cost and complexity. For the Viking Project, facilities were developed to enable the Project to meet sterilization requirements and parts were evaluated, selected and controlled in a manner that satisfied sterilization requirements. Today there are new spacecraft materials in use that will require special screening to ensure compatibility with sterilization processes.

Recently, the Mars Exploration Rover Project heightened awareness to the concern of disrupting scientific findings by material imported from Earth. As the science focus for the next decade of Mars exploration involves increasingly complex life-detection experiments, flight projects must find ways to improve the inadvertent contamination of planets. Such contamination would tend to corrupt any data obtained and confuse the investigations.

The microbial load on the hardware must be limited during manufacturing and building processes, and controlled during assembly, test and launch operations by adopting strict clean room standards including personnel and operations procedures, re-cleaning to maintain cleanliness during pre-launch processing of hardware with appropriate fluids, and possible terminal sterilization. Dry-heat sterilization is currently the only acceptable method for terminal sterilization, and future projects requiring terminal sterilization must integrate it into system-level planning early enough to render it indiscernible to them.

For other missions, one must examine the hazards of accidental impact and all other events that may release organisms. Various constraints on flight trajectories, orbital altitudes and dwell times must be considered and implemented during the design phase of the mission.

A failure to implement planetary protection early can be very costly in terms of understanding the origins and evolution of life. One of the lessons learned from the Viking Project is that planetary protection issues can be recognized and defined very early in a projects life. Since the requirements may extend into almost every phase of a mission, it is highly desirable to embed them into other technical requirements such as those controlling parts qualification or vibration.