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# INVESTIGATION ON DECONTAMINATION DESIGN AND CONTROL SYSTEM FOR SPACECRAFT

**Abstract**

Spacecraft, an on-orbit platform for science utilization, usually supports multiple payloads for a long period of time. Effective contamination control is essential for the success of most aerospace programs, because the presence of contamination can affect science experiments and degrade the performance of spacecraft hardware. The contamination sources were divided into three series: the steady space environment, the alternative space environment and the spacecraft itself. The MISSE (Materials International Space Station Experiment) was performed on the International Space Station (ISS). The contamination levels of exposed hardware and materials specimens were confirmed by the returned material samples from MISSE flight experiment. The elemental composition of the contaminant layer was examined to be silicon, carbon, oxygen, and traces of selenium and magnesium. The effect of exposure time, thruster plume, thermal-cycling and configuration location (ram-facing surface or wake-facing surface) on the levels of induced contamination were studied and discussed in detail. To guarantee the contaminants under control, a decontamination design and control system was proposed in this paper. The system composed of six parts: determination of contamination control target, analysis of space environment, identification of contamination resources, simulation investigation, modification of spacecraft and contamination verification. Each subsystem with contamination-sensitive surfaces should be assigned a specific contamination quantity according to the overall contamination control target. For simulation investigation, the design parameters of spacecraft (such as configuration, materials, propellant and so on) were all input data. The contamination control should be confirmed whether it is on target, or flexible modification had to be executed to the configuration design of spacecraft. The contamination control system was not only closely bound up the design process, but also the manufacturing, assembly, integration, testing, launching, and on-orbit process. Contamination minimization studies, to support the spacecraft design and operational planning for those sources identified to present a significant contamination threat, were also discussed in this paper. Considering the spacecraft configuration, vacuum exposed materials, plume models (based on the flight experiments and laboratory tests), venting (propellant purging, active vacuum vent), exposure time, thermal cycling, suggestions and recommendations for contamination control methods were given in this paper.