Extended Abstract
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Electrodynamic Dust Shield for Space Applications

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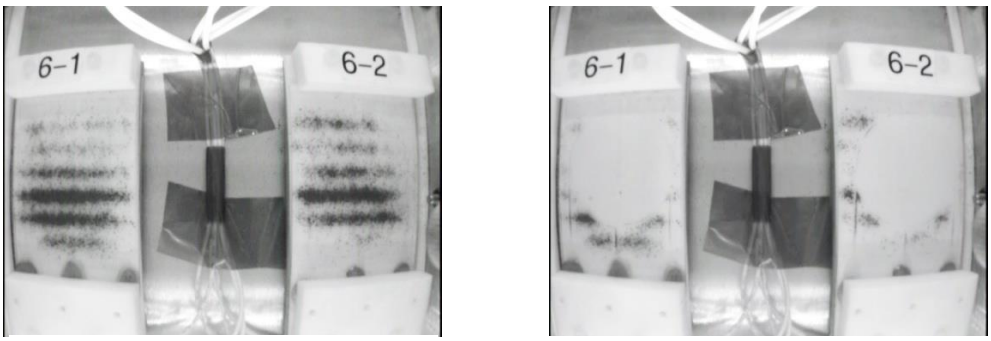
ABSTRACT

The International Space Exploration Coordination Group (ISECG) has chosen dust mitigation technology as a Global Exploration Roadmap (GER) critical technology need in order to reduce life cycle cost and risk, and increase the probability of mission success. NASA has also included Particulate Contamination Prevention and Mitigation as a cross-cutting technology to be developed for contamination prevention, cleaning and protection. This technology has been highlighted due to the detrimental effect of dust on both human and robotic missions. During manned Apollo missions, dust caused issues with both equipment and crew. Contamination of equipment caused many issues including incorrect instrument readings and increased temperatures due to masking of thermal radiators. The astronauts were directly affected by dust that covered space suits, obscured face shields and later propagated to the cabin and into the crew's eyes and lungs. Robotic missions on Mars were affected when solar panels were obscured by dust thereby reducing the effectiveness of the solar panels.

The Electrostatics and Surface Physics Lab in Swamp Works at the Kennedy Space Center has been developing an Electrodynamic Dust Shield (EDS) to remove dust from multiple surfaces, including glass shields and thermal radiators. This technology has been tested in lab environments and has evolved over several years. Tests of the technology include reduced gravity flights (one-sixth g) in which Apollo Lunar dust samples were successfully removed from glass shields while under vacuum (10^{-6} kPa).



Before EDS Activation *After EDS Activation*

Figure 1. Reduced gravity flight: Apollo 16 sample dust removal at 10^{-6} kPa and g/6.

Further development of the technology is underway to reduce the size of the EDS as well as to perform material and component testing outside of the International Space Station (ISS) on the Materials on International Space Station Experiment – X (MISSE-X). This experiment is designed to verify that the EDS can withstand the harsh environment of space and will look to closely replicate the solar environment experienced on the moon. A second flight opportunity exists to provide an EDS to several companies as part of NASA's Lunar CATALYST program. The current mission concept would fly the EDS on the footpad of one of the Lunar CATALYST vehicles. To determine the effectiveness of the EDS system, image analysis will be performed on the footpad before, during and after EDS activation. If successful in these test flights, the Technology Readiness Level (TRL) of the EDS will be raised to a sufficient level to be used in the protection of mission equipment for future NASA and commercial missions to the moon, asteroids, and Mars.