

Electrodynamic Dust Shield for Lunar/ISS Experiment Project

Center Independent Research & Developments: KSC IRAD Program | Science Mission Directorate (SMD)



ABSTRACT

The Electrostatics and Surface Physics Laboratory at Kennedy Space Center is developing a dust mitigation experiment and testing it on the lunar surface and on the International Space Station (ISS). The Electrodynamic Dust Shield (EDS) clears dust off surfaces and prevents accumulation by using a pattern of electrodes to generate a non-uniform electric field over the surface being protected. The EDS experiment will repel dust off materials such as painted Kapton and glass to demonstrate applications for thermal radiators, camera lenses, solar panels, and other hardware and equipment.

ANTICIPATED BENEFITS

To NASA funded missions:

The EDS is considered the best non-contact active dust mitigation technology for space applications. Other technologies, such as piezoelectric-based vibrating membranes are not as effective at removing fine dust.

Dust control and removal from surfaces is of crucial importance for robotic missions to and asteroid, Mars, and the moon. Dust removal is needed for equipment to operate and for solar panels and radiators to operate efficiently. Controlled dust motion is required to bring regolith for sampling and to deliver regolith to science instruments.

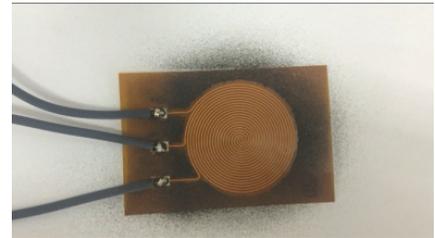
To NASA unfunded & planned missions:

Benefits as mentioned above.

To other government agencies:

Benefits as mentioned above.

To the commercial space industry:

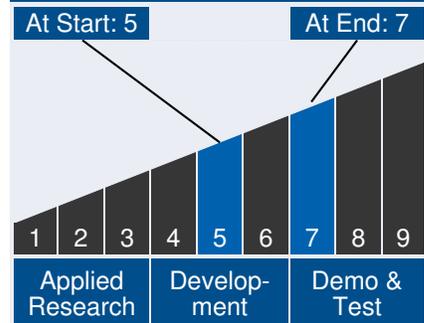


Copper-on-Kapton shield shown after expelling dust.

Table of Contents

Abstract	1
Anticipated Benefits	1
Technology Maturity	1
Detailed Description	2
Management Team	2
Technology Areas	2
U.S. Locations Working on this Project	3
Image Gallery	4
Details for Technology 1	4

Technology Maturity



Electrodynamic Dust Shield for Lunar/ISS Experiment Project

Center Independent Research & Developments: KSC IRAD Program | Science Mission Directorate (SMD)



Dust removal from optical systems for U.S. commercial space industry. Equipment operating in dusty environments such as the lunar or Martian surfaces.

To the nation:

For private industry, dust and pollen removal from large solar panel arrays or other equipment in dusty environments such as mining.

DETAILED DESCRIPTION

The EDS uses a pattern of electrodes to generate a "wavelike" electric field that pushes dust off surfaces. Dust particles in the vicinity of the EDS electrodes experience a dielectrophoretic force generated by the non-uniform electric field around the electrode grid. This dielectrophoretic force depends on the square of the electrostatic potential difference between adjacent electrodes and the inverse cube of the electrode geometric parameters, such as electrode separation. Thus, for a given force, a decrease in the electrode separation results in a substantial decrease in the voltage required to operate the EDS.

Two configurations will be tested: (1) copper electrodes on Kapton film adhered to an aluminum panel to simulate dust expulsion on thermal radiators and (2) transparent indium tin oxide electrodes on a glass panel to simulate use on optical equipment (i.e., camera lenses). Configurations 1 and 2 will be tested on ISS. Configuration 2 will also be mounted to the footpad of a commercial lander and tested on the lunar surface.

Management Team

Project Manager:

- Nancy Zeitlin

Principal Investigator:

- Carlos Calle

Co-Investigators:

- Michael Hogue
- Michael Johansen
- Paul Mackey

Technology Areas

Primary Technology Area:

Dust Prevention & Mitigation (TA 7.6.3)

Other Technology Areas:

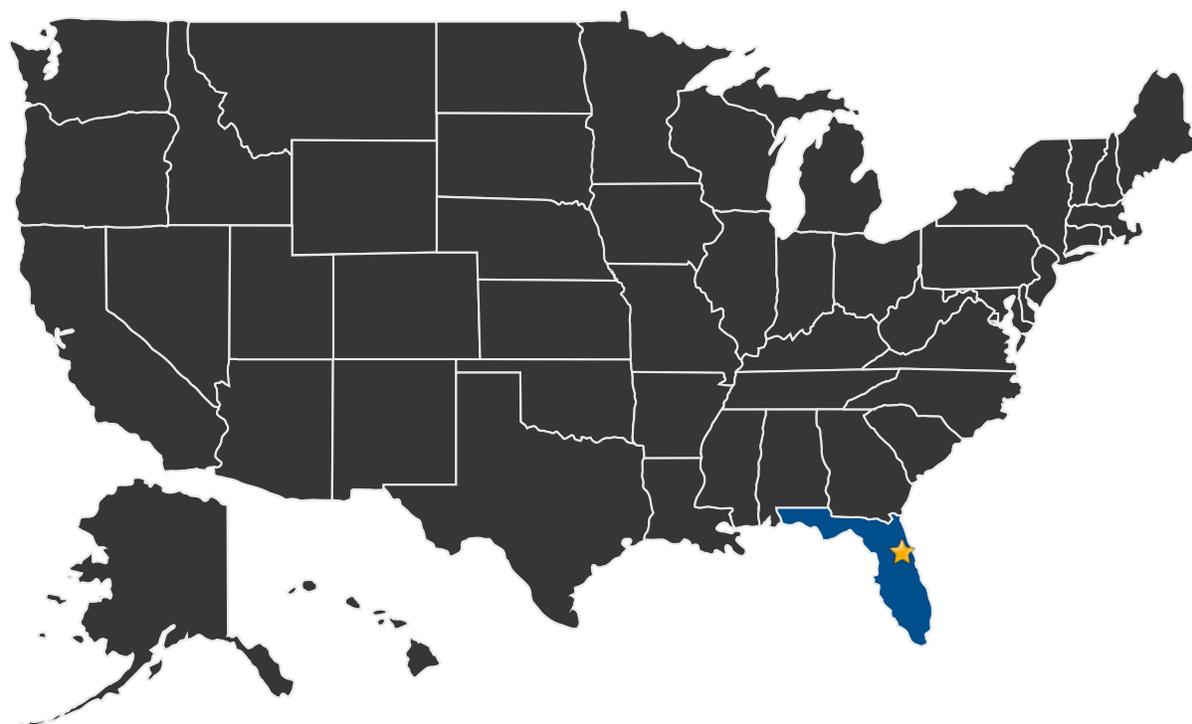
- EVA Mobility (TA 7.3.1)

Electrodynamic Dust Shield for Lunar/ISS Experiment Project

Center Independent Research & Developments: KSC IRAD Program | Science Mission Directorate (SMD)



U.S. LOCATIONS WORKING ON THIS PROJECT



■ U.S. States With Work ★ **Lead Center:**
Kennedy Space Center

Other Organizations Performing Work:

- Engineering Services Contract

Electrodynamic Dust Shield for Lunar/ISS Experiment Project

Center Independent Research & Developments: KSC IRAD Program | Science Mission Directorate (SMD)



IMAGE GALLERY



Copper-on-Kapton shield shown before operation, covered in dust.



Early Prototype of EDS Lunar Experiment shown with Glass Shield and Solar Cells.

DETAILS FOR TECHNOLOGY 1

Technology Title

Electrodynamic Dust Shield

Technology Description

This technology is categorized as a hardware system for other applications

The Electrodynamic Dust Shield (EDS) clears dust off surfaces and prevents accumulation by using a pattern of electrodes to generate a non-uniform electric field over the surface being protected.

Capabilities Provided

Dust mitigation.

Potential Applications

Thermal radiators, solar panels, camera lenses, and other hardware needing protection from dust.