

# LSIC Dust Mitigation Focus Group 9/21/2023



Nathan Jimenez

[Nathan.Jimenez@NASA.gov](mailto:Nathan.Jimenez@NASA.gov)

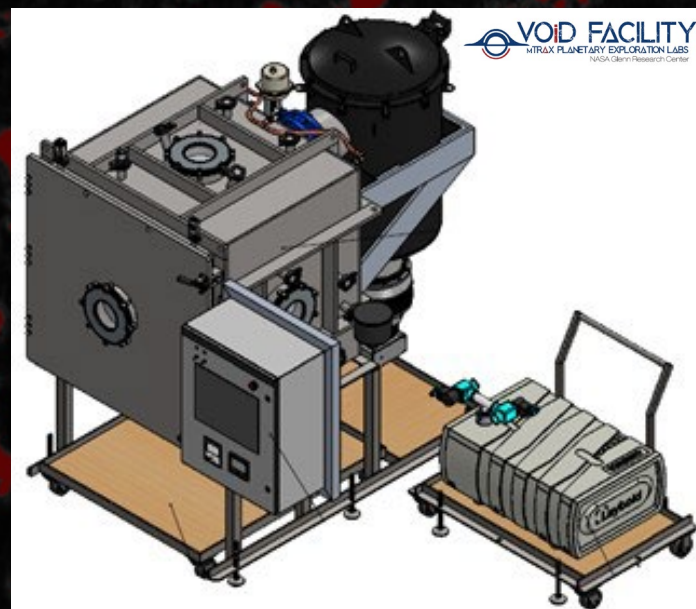
Dust Mitigation Research  
NASA Glenn Research Center



# Dust Test Rigs

## Uniform Dust Deposition System (UDDS)

## Vacuum Operations in Dust (VOID) Rig



Name	Value	Unit
Internal Working Dimensions	35 W X 35 D X 32.5 H (89 X 89 X 82.5)	in (cm)
Working Temperature	-180 to +150 (-290 to +300)	°C (°F)
Vacuum Level	10 <sup>-6</sup>	Torr

- System to deposit dust uniformly and repeatably in a dry (ambient pressure and temperature) environment.
- Developed technique to analyze dust coverage with machine learning software.

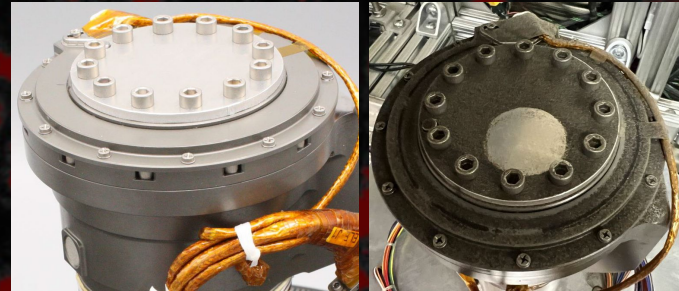
- Dirty Thermal Vacuum Chamber (DTVAC) providing accessible testing for large component or subsystem testing.
- Currently being installed / commissioned, targeting operation in early summer 2024



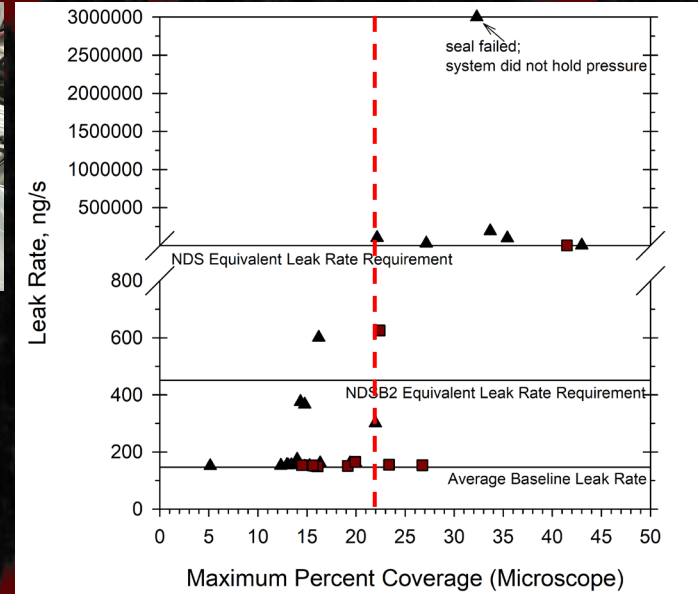
# Dust Projects

## HLS Dusty Seals

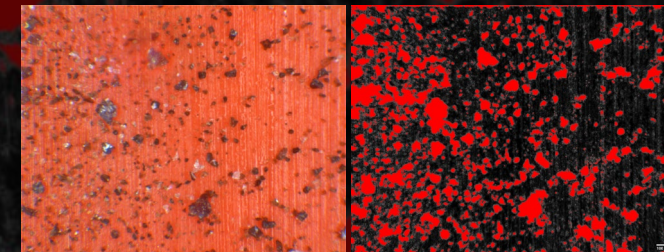
- Several studies in the UDDS have been completed, including:
  - Environmental seal characterization and cleaning study (HLS Dusty Seals)
  - Surface cleaning method study (DM Slide)
  - Cryogenic fluid connection dust tolerance testing (Cryomag ECI)
  - Actuator lifecycle testing (COLDArm)
  - Magnetic gear dust intrusion testing (MDECE)



COLDArm Actuator Lifecycle Dust Testing for Endurance A



HLS Dusty Seals Leak Rates for Subscale NDS Seals with JSC-1A Lunar Simulant



Dusted Contaminated NDS Seal, Left: Micrograph, Right: Segmented Image



Cryomag ECI Dust I

Substrate Materials	Cleaning Method	Cleaning Efficiency: 1-5 (5 = very clean)		Surface Damage: 1-5 (5 = no damage)	
		Efficiency	Damage	Efficiency	Damage
Silicone O-ring	Kimtech Wipe	2	4	4	3
	Terry Cloth	3	3	3	3
	Microfiber Cloth	4	4	3	3
	Kapton Tape-silicon adhesive	3	2	3	2
	Kapton Tape-acrylic adhesive	4	4	4	2
	CyberClean Pliable Cleaner	3	3	3	3
	Teflon Bristle Brush	2	5	3	3
	Post-Test Substrate	4	4	4	3
6061 Aluminum	Kimtech Wipe	4	3	3	3
	Terry Cloth	2	3	3	3
	Microfiber Cloth	3	3	3	3
	Kapton Tape-silicon adhesive	4	1	4	1
	Kapton Tape-acrylic adhesive	4	1	4	1
	CyberClean Pliable Cleaner	4	2	3	5
	Teflon Bristle Brush	3	5	4	4
	Post-Test Substrate	4	3	3	3
Orthofabric	Kimtech Wipe	4	2	4	4
	Terry Cloth	1	2	3	3
	Microfiber Cloth	4	2	3	3
	Kapton Tape-silicon adhesive	3	3	4	1
	Kapton Tape-acrylic adhesive	4	1	5	1
	CyberClean Pliable Cleaner	3	5	5	3
	Teflon Bristle Brush	3	5	5	2
	Post-Test Substrate	4	2	3	3
FEP Sheet	Kimtech Wipe	4	3	4	4
	Terry Cloth	3	3	4	3
	Microfiber Cloth	4	3	4	3
	Kapton Tape-silicon adhesive	4	1	5	1
	Kapton Tape-acrylic adhesive	4	1	5	1
	CyberClean Pliable Cleaner	3	5	5	2
	Teflon Bristle Brush	3	5	5	2
	Post-Test Substrate	4	3	4	4
Quartz Glass	Kimtech Wipe	4	4	4	4
	Terry Cloth	3	4	4	4
	Microfiber Cloth	4	4	4	4
	Kapton Tape-silicon adhesive	4	1	4	1
	Kapton Tape-acrylic adhesive	4	1	4	1
	CyberClean Pliable Cleaner	3	3	3	3
	Teflon Bristle Brush	4	4	4	4
	Post-Test Substrate	4	4	4	4
Aluminized Mylar	Kimtech Wipe	4	3	4	4
	Terry Cloth	2	3	4	4
	Microfiber Cloth	4	4	4	4
	Kapton Tape-silicon adhesive	4	2	4	2
	Kapton Tape-acrylic adhesive	4	2	4	2
	CyberClean Pliable Cleaner	3	3	3	3
	Teflon Bristle Brush	4	3	4	4
	Post-Test Substrate	4	3	4	4
AZ-93 Thermal Radiator	Kimtech Wipe	4	4	4	4
	Terry Cloth	4	4	4	4
	Microfiber Cloth	4	4	4	4
	Kapton Tape-silicon adhesive	4	2	4	2
	Kapton Tape-acrylic adhesive	4	2	4	2
	CyberClean Pliable Cleaner	3	3	3	3
	Teflon Bristle Brush	4	4	4	4
	Post-Test Substrate	4	4	4	4

DM Slide Cleaning Method Study