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Launch and Deployment of the Misse-6 Payload: State of Utah Space Environment & Contamination Study

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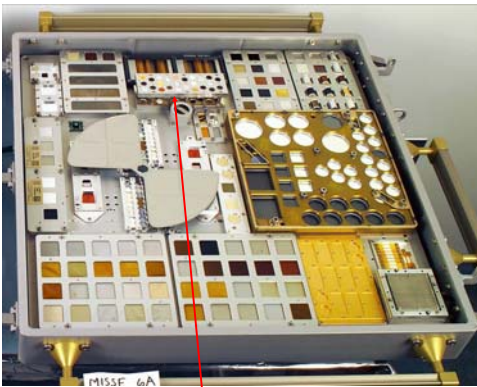
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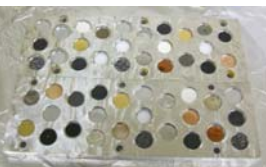
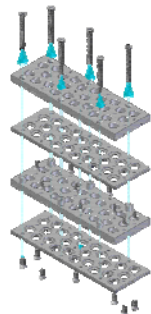


Ram Side

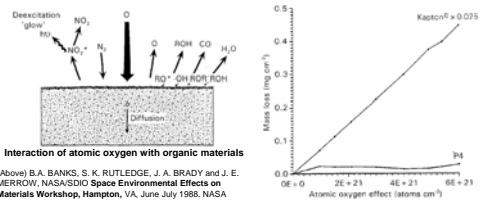


On the ram side of MISSE 6 Utah State has the Double Stack, a two tiered experiment with 75 samples being exposed to space atmosphere and 50 concealed samples experiencing the temperature cycles and pressures of space. The two tiered design allows for varying atomic oxygen (AO) and ultra violet radiation (UV) exposure.

Ram Sample Holder SUSpECS Double Stack



The Double Stack will also investigate oxidation by atomic oxygen and the effects that shadowing have on atomic oxygen exposure. (Below) Measuring the mass erosion rate of Kapton due to atomic oxygen radiation degradation has long been the standard in determining how much atomic oxygen a surface has been exposed to. (Above and Right) Double Stack Ag foils will be evaluated as an accurate AO fluence monitor sensor and calibrated against kapton sensors. This study will use high purity silver and measure the penetration depth of the oxide layers to determine the atomic oxygen exposure. This test will also study the effects caused by shadowing and the possibilities of ballistic scattering of atomic oxygen.



Rocky I

Launch and Deployment State of Utah Space



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Orbitium

Misse-6 Payload: Contamination Study



Launch and Deployment Activities



(Left) Shuttle Endeavour (STS-123) launched at 2:14 am on March 11th 2008. Aboard were two passive experiment containers (PEC) containing three experiments from students at Utah State University. (Right) Shuttle Endeavour on a pass by of the International Space Station (ISS) to check for damage to the shuttle that may have occurred during launch. With the shuttle bay open the PEC's can be seen in the top left corner. Each PEC weighs ~78 lbs and is the size of a large suitcase. The PEC's contain numerous experiments from a wide variety of contributors.

Integration of SUSpECS in to MISSE-6



SUSpECS I, II & III: Individual investigators prepared separate sample holders. Holders were integrated into Passive Experiment Containers (PECs). The PEC's were mounted on ISS for 6-12 months stay by astronauts Bob Behnken on EVA 5 March 22nd 2008 with the help of a hammer.



Approximately 125 samples are mounted on three 5 cm by 15 cm panels on both the ram (75) and wake (50) sides of the ISS. They have been carefully chosen to provide needed information for a broad cross section of prototypical materials used on the exteriors of spacecrafts. (See Below) The materials will be tested for electron-, ion-, and photon-induced electron emission yield curves and emission spectra. Characterization measurements include electron microscopy, reflection spectroscopy, resistivity and Auger electron spectroscopy.

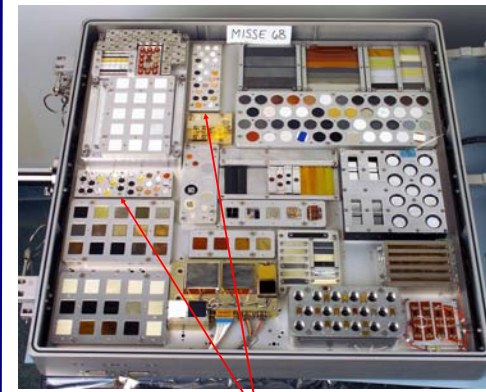
- This large communication satellite interface materials which are contained in SUSpECS.
- Graphite Composite
 - Au/Mylar
 - Kapton
 - Black Kapton
 - Aquadag
 - Al
 - White Paint
 - ITO
 - RTV
 - FR4
 - Coverglass



SUSpECS Objectives

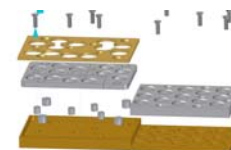
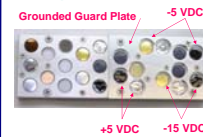
- Basic research extends our understanding of the materials/space environment interactions.
- Specific knowledge is gain for critical materials in several on-going projects of the team members.
- Valuable collaborations between team members is fostered.
- Analysis capabilities and flight experience are developed that will prove useful not only for follow-up funding for post-flight analysis of the SUSpECS sample set, but for other joint ventures involving reliability and aging of materials in the space environment.

Wake Side

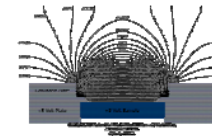


The SUSpECS sample holder on the wake side of the International Space Station will investigate the effects that spacecraft charging has on contamination of samples. Four sets of 4 samples (Ag, Al, graphitic carbon, and Kapton GC) are biased at +5 V, -5 V, and -18 V, in addition to the control set grounded to ISS. These samples will be examined to determine the changes in contamination from the space environment that results from the sample charging.

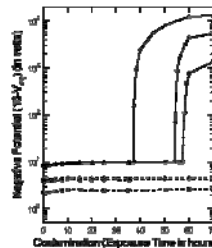
Wake Sample Holder SUSpECS Electrical



(Right) Modeling electronic fields and particle trajectories of the biased wake-side samples. A side view shows the equipotential lines on a single sample charged to +5 volts. This charging attracts ions that can damage materials, and enhance contamination.



(Right) Studies at USU have shown that very thin layers of contamination—even a few monolayers—can potentially cause significant changes in electron emission properties that can dramatically affect the charging of satellites. The graph shows the differential charging of clean Au and 2-3 monolayers carbon-contaminated Au surfaces on a hypothetical satellite in GEO orbit.



SUSpECS Material Samples List

Material	Source	
001	200C ASAN725 Oxide (CMC)	ATK
002	200C S200 Nonwoven CMC	ATK
003	200C S200 Nonwoven Carbon Composite #1	ATK
004	200C S200 Nonwoven Carbon Composite #2	ATK
005	200C S200 Nonwoven Carbon Composite #3	ATK
006	200C S200 Nonwoven Carbon Composite #4	ATK
007	200C S200 Nonwoven Carbon Composite #5	ATK
008	200C S200 Nonwoven Carbon Composite #6	ATK
009	200C S200 Nonwoven Carbon Composite #7	ATK
010	200C S200 Nonwoven Carbon Composite #8	ATK
011	200C S200 Nonwoven Carbon Composite #9	ATK
012	200C S200 Nonwoven Carbon Composite #10	ATK
013	200C S200 Nonwoven Carbon Composite #11	ATK
014	200C S200 Nonwoven Carbon Composite #12	ATK
015	200C S200 Nonwoven Carbon Composite #13	ATK
016	200C S200 Nonwoven Carbon Composite #14	ATK
017	200C S200 Nonwoven Carbon Composite #15	ATK
018	200C S200 Nonwoven Carbon Composite #16	ATK
019	200C S200 Nonwoven Carbon Composite #17	ATK
020	200C S200 Nonwoven Carbon Composite #18	ATK
021	200C S200 Nonwoven Carbon Composite #19	ATK
022	200C S200 Nonwoven Carbon Composite #20	ATK
023	200C S200 Nonwoven Carbon Composite #21	ATK
024	200C S200 Nonwoven Carbon Composite #22	ATK
025	200C S200 Nonwoven Carbon Composite #23	ATK
026	200C S200 Nonwoven Carbon Composite #24	ATK
027	200C S200 Nonwoven Carbon Composite #25	ATK
028	200C S200 Nonwoven Carbon Composite #26	ATK
029	200C S200 Nonwoven Carbon Composite #27	ATK
030	200C S200 Nonwoven Carbon Composite #28	ATK
031	200C S200 Nonwoven Carbon Composite #29	ATK
032	200C S200 Nonwoven Carbon Composite #30	ATK
033	200C S200 Nonwoven Carbon Composite #31	ATK
034	200C S200 Nonwoven Carbon Composite #32	ATK
035	200C S200 Nonwoven Carbon Composite #33	ATK
036	200C S200 Nonwoven Carbon Composite #34	ATK
037	200C S200 Nonwoven Carbon Composite #35	ATK
038	200C S200 Nonwoven Carbon Composite #36	ATK
039	200C S200 Nonwoven Carbon Composite #37	ATK
040	200C S200 Nonwoven Carbon Composite #38	ATK
041	200C S200 Nonwoven Carbon Composite #39	ATK
042	200C S200 Nonwoven Carbon Composite #40	ATK
043	200C S200 Nonwoven Carbon Composite #41	ATK
044	200C S200 Nonwoven Carbon Composite #42	ATK
045	200C S200 Nonwoven Carbon Composite #43	ATK
046	200C S200 Nonwoven Carbon Composite #44	ATK
047	200C S200 Nonwoven Carbon Composite #45	ATK
048	200C S200 Nonwoven Carbon Composite #46	ATK
049	200C S200 Nonwoven Carbon Composite #47	ATK
050	200C S200 Nonwoven Carbon Composite #48	ATK
051	200C S200 Nonwoven Carbon Composite #49	ATK
052	200C S200 Nonwoven Carbon Composite #50	ATK
053	200C S200 Nonwoven Carbon Composite #51	ATK
054	200C S200 Nonwoven Carbon Composite #52	ATK
055	200C S200 Nonwoven Carbon Composite #53	ATK
056	200C S200 Nonwoven Carbon Composite #54	ATK
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058	200C S200 Nonwoven Carbon Composite #56	ATK
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060	200C S200 Nonwoven Carbon Composite #58	ATK
061	200C S200 Nonwoven Carbon Composite #59	ATK
062	200C S200 Nonwoven Carbon Composite #60	ATK
063	200C S200 Nonwoven Carbon Composite #61	ATK
064	200C S200 Nonwoven Carbon Composite #62	ATK
065	200C S200 Nonwoven Carbon Composite #63	ATK
066	200C S200 Nonwoven Carbon Composite #64	ATK
067	200C S200 Nonwoven Carbon Composite #65	ATK
068	200C S200 Nonwoven Carbon Composite #66	ATK
069	200C S200 Nonwoven Carbon Composite #67	ATK
070	200C S200 Nonwoven Carbon Composite #68	ATK
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073	200C S200 Nonwoven Carbon Composite #71	ATK
074	200C S200 Nonwoven Carbon Composite #72	ATK
075	200C S200 Nonwoven Carbon Composite #73	ATK
076	200C S200 Nonwoven Carbon Composite #74	ATK
077	200C S200 Nonwoven Carbon Composite #75	ATK
078	200C S200 Nonwoven Carbon Composite #76	ATK
079	200C S200 Nonwoven Carbon Composite #77	ATK
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083	200C S200 Nonwoven Carbon Composite #81	ATK
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085	200C S200 Nonwoven Carbon Composite #83	ATK
086	200C S200 Nonwoven Carbon Composite #84	ATK
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088	200C S200 Nonwoven Carbon Composite #86	ATK
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095	200C S200 Nonwoven Carbon Composite #93	ATK
096	200C S200 Nonwoven Carbon Composite #94	ATK
097	200C S200 Nonwoven Carbon Composite #95	ATK
098	200C S200 Nonwoven Carbon Composite #96	ATK
099	200C S200 Nonwoven Carbon Composite #97	ATK
100	200C S200 Nonwoven Carbon Composite #98	ATK
101	200C S200 Nonwoven Carbon Composite #99	ATK
102	200C S200 Nonwoven Carbon Composite #100	ATK



Wake Side SUSpECS 3

Passive UV Exposure
 25 Grounded Samples
 10 Concealed Samples

Scientific Solutions Inc has technology that uses nematic liquid crystal as the tuning medium in Fabry-Perot interferometers. The Liquid Crystal Fabry-Perot (LCFP) has passed temperature and vibration testing but the final test will be to see if it can withstand the atmosphere of lower earth orbit (LEO).