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#### Silicones, Silicones, Silicones Nusil Controlled Volatility (CV) 2946: Silicone Bonding Agent Contact Transfer was the main issue. NVR foils in curing tests showed no silicones Application Mitigation Techniques on Flight H/W: Disposable Garments Glove Change-out Restricted Activity · Separate trash cans used/bags removed from cleanroom CC person present Testing post cure showed no contact transfer Tayco Heaters: Acrylic adhesive but Pressure Sensitive Adhesive (PSA) slip agents contained silicones Cleaning would not remove silicones. Too late to change heaters Application Mitigation Techniques: · Clean front side with Hexane Use tweezers Change-out gloves Kapton Tape: Analex screens tape for silicones Check labels for Analex testing Green Flashbreaker Tape: Acrylic Adhesive TML 1.02 CVCM 0.25 Tayco produced Kapton Heaters Difficult to remove and not flight approved



# LOLA Radiator NS43C





• The touch-up job performed at ASO on the Orbiter caused continuous flaking noted on the surrounding MLI.

• Initial cleaning of the coating did not eliminate the flaking. Continued cleaning kept pulling coating. Cleaned to original coating levels.

• LL: No last minute aesthetic touch ups; Potential contamination risk from particle generation/flaking.



LOLA's NS43C coated Radiator had damaged coating on outer edges Thermal ascertained a touch-up was aesthetically needed and not

performance driven.







•Bag removal prior to encapsulation was performed in the middle of the night to limit the exposure of the observatory to contaminants

•Removal of the bag was again challenging due to the stack of two payloads

•Access was very limited due to risk of contact with either payload or the stand on which the faining would be placed

Scheme was designed again using parachute cord to lift the bag vertically off the spacecraft
There were many meetings to address concerns about removing the bag with the limitations
Bag removal occurred with minimal difficulties in less than 1 hour









particles.) (Used from Joe Hammerbacher - SGT)







## Fairing Clean Tents



•The LRO observatory was transported to the launch pad already encapsulated per normal Atlas procedures

•At the launch complex, the payload area of the Vertical Integration Facility (VIF) is not a cleanroom

•Access into the fairing was required by ULA and the LCROSS project from both the mission unique doors as well as the boatail doors.

•Full garmenting was required for this access

•Exposure of cleanroom garments to the "unclean" area was not acceptable •Two mission unique door tents and four boatail door tents were designed and fabricated

•The mission unique tents included a separate garmenting area, the bowtail tents did not

•The requirements for all tents was class 100K, however the goal for the mission unique tents was a 10K environment

•All tents were operated well below the class 10K goal as measured by particle counter data monitored during activity within the tents









### Other Lessons



•ULA reluctant to accept IEST particle counting for Level 450 Cleanliness Requirements

•Cleanliness in the fairing verified by 450 PAC equivalent •Cleanliness easily met LRO requirements

 Instrument teams familiarity with cleanliness requirements and procedures was sometimes more limited than indicated

·More assistance was required than originally anticipated

•Creation of a Purge Engineer position within the contamination group for this project was a dramatic benefit

•Timely access to someone familiar with, and able to make changes to the LRO purge system

•Greater understanding of the needs both of the purge system and the spacecraft

•Greater flexibility in purge system tweaking and alteration to meet changing needs, particularly at the launch site









