



# CxP EVA System/ETDP

Lunar Regolith Simulant TIM



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# Agenda



- Current ETDP Testing Summaries: (*Regolith & Simulant Applications, Quantities, Schedule*)
  - Pressure Garment System: Materials
  - Vehicle Interface Element: Umbilical Connectors
  - Portable Life Support System: QDs and Valves
  - Power, Comm., Avionics & Informatics: Dust Tolerant Connectors
- Prioritized Future Needs
- Questions



# PGS and VIE



- Pressure Garment System – Issues: Abrasion Resistant Outer-layer Fabrics
  - Quantities of Simulant: PGS team experimenting in Advanced Suit Lab with the fabrication of various EVA type regolith to use in the tumble test
    - 10 oz of JSC-1 Lunar simulant
      - Past tumble tests: mixture of volcanic rock and lunar simulant (JSC-1) have been used (Volcanic rock became smooth after a few hours of tumbling)
    - 3 lbs Lunar rock simulant, fabricated in B34 Advanced Suit Lab
      - After some initial testing of this regolith, it has shown to hold up fairly well over several hours of tumbling
  - Applications Overview – 4 different fabrics
    - Fabrication and tumble testing of fabric test cylinders to induce abrasion (1<sup>st</sup> week of March)
    - Taber Abrasion wheel and Lunar simulant testing - based off abrasion protocol developed at GRC (mid-March)
- Vehicle Interface Element: Umbilical Connector 1 cycle testing occurred on 8/13/2008 and 8/14/2008; Umbilical Connector 2 cycle testing occurred on 8/28/2008 and 8/29/2008:
  - Simulant Used: JSC-1AF
    - Comments:
      - sticks to things very easily due to its size; becomes airborne with the slightest breeze; acts like a layer of sand paper when scraped against anything
  - Quantities Used: ~1 or 2 oz
  - 1500 total mate/demate cycles (1000 mate/demate cycles without lunar stimulant)
    - 500 mate/demate cycles in the presence of lunar simulant



# PLSS and PCAI



- Portable Life Support System - Issues: regolith contamination in fluid loops, clogging valves, Quick Disconnects
  - Simulant Used:
    - Simulants range from standard sand-blast media to JSC-1
    - Needs to have right mechanical properties – right size/sharpness, shapes
      - Secondary need would be to have right sticking properties to metals, polymer seals, membranes, etc.
  - Potential applications:
    - Suit Water Membrane Evaporator tests; Water pump tests
    - O2 component tests (QDs, purge vlv, relief vlv)
      - Direct sand blasting
      - Deflected sand blasting
      - Powder coating
- Power Comm. Avionics & Informatics: Electrical Connectors, Controls, Switches
  - Simulant Needs:
    - Need mechanical prop – abrasive/jammed into parts of connectors
      - Secondary - electrostatic
  - Potential Applications
    - Currently prototyping switch concept mockups
    - Currently prototyping electrical connectors that use a piercable membrane cover to keep dust out of pins and connector bodies
  - Schedule:
    - Begin evaluating connectors and switches beginning of FY10





# Prioritized Future Needs



- Textiles: Proving out existing materials/lasting 100 EVAs
- Visor Materials: Dust repellent/abrasion resistant coatings
- Connectors: Primary need abrasion, secondary electrostatic
- Pressure Integrity: Protection from dust collection/abrasion in more delicate pressure seals/bearings
- Sealing Interface for Suit Port: The interface is the only seal between the EVA crewmember and the pressurized environment of the LER; TMG
  - Both physical and chemical properties needed in simulant
- Dust Gate: Bristles inside the habitat hatch of the suitlock
  - Needs a feasibility study
- Cleaning Techniques: Electromagnetic/static brush/wand
- Dust Resistant EVA Tools: Moving parts getting clogged, etc.



# Questions



- Need guidance on what level/extent of testing is needed
  - Components, EVA System, EVA System w/other elements
  - Number of cycles, Duration
- How does JSC 1 and 1A compare to the Apollo 15 soil samples?
- Need recommendations on what simulant to use for each purpose
  - Current simulant was made for chemical properties only?
  - Need a simulant that can be used for abrasion that has the right physical properties (the right sharpness, etc)
  - Need a simulant that can be used for attractiveness (the right chemical properties, physical sticking properties, etc) for coatings/cleaning
  - Need a simulant that provides both?