GENESIS SPACECRAFT SCIENCE CANISTER PRELIMINARY INSPECTION AND CLEANING. J. D. Hittle[1], M. J. Calaway[1], J. H. Allton[2], J. L. Warren[1], C. M. Schwarz[3] and E. K. Stansbery[2], [1]Jacobs Sverdrup/ESC, Houston, TX, [2]NASA/Johnson Space Center, Houston, TX, [3]MEI Techologies/ESC, Houston, TX. judith.h.allton@nasa.gov

Introduction: The Genesis science canister is an aluminum cylinder (75 cm diameter and 35 cm tall) hinged at the mid-line for opening (fig. 1). This canister was cleaned and assembled in an ISO level 4 (Class 10) cleanroom at Johnson Space Center (JSC) prior to launch. The clean solar collectors were installed and the canister closed in the cleanroom to preserve collector cleanliness. The canister remained closed until opened on station at Earth-Sun L1 for solar wind collection. At the conclusion of collection, the canister was again closed to preserve collector cleanliness during Earth return and re-entry. Upon impacting the dry Utah lakebed at 300 kph the science canister integrity was breached [1]. The canister was returned to JSC. The canister shell was briefly examined, imaged, gently cleaned of dust and packaged for storage in anticipation of future detailed examination. The condition of the science canister shell noted during this brief examination is presented here. The canister interior components were packaged and stored without imaging due to time constraints.

Fig. 1. Pre-flight configuration of the science canister.

Pre-flight configuration: The light-weight canister was not designed to withstand a large pressure differential upon re-entry, but to re-pressurize through a molecular sieve/particulate filter to remove ablation gases and particles. This filter was located on the bottom exterior of the canister (fig. 2). The cover exterior was painted white for thermal control. External ribs supported the cover and attachment points for an array inside.

Post-recovery observations: Four significant observations were made: a) one 400-μm micrometeorite impact crater, b) visible areas of brown discoloration on white paint, c) printed circuit board components exhibiting plastic deformation, and d) fine black dust and coarse granulated black residue found on the base of the canister.

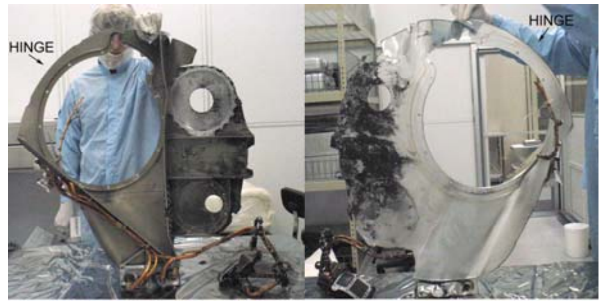

Fig. 2. Exterior (left) and interior (right) views of the science canister base, as received at JSC. Circular openings in base, beginning with largest, were sites for mounting the concentrator, filter and array deployment mechanism.

Fig. 3. Interior (upper) and exterior (lower) views of the science canister cover, as received at JSC. Arrows point to the location of the micrometeorite crater (fig. 4) and brown discoloration (fig. 5).

Micrometeorite impact: One crater, with morphology of typical micrometeorite impact craters, was observed. The crater, approximately 400 μm in diameter, is surrounded by a dark halo (fig. 4). The apparent impact may have resulted in removal of white paint surrounding the impact site.

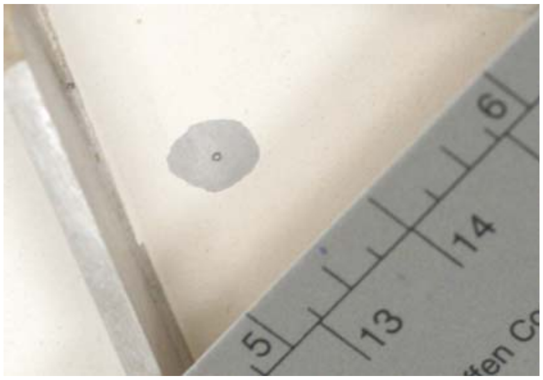

Fig. 4. Micrometeorite impact on the painted surface of the canister cover (scale in inches) next to a rib. Bright crater is surrounded by a dark halo. Diameter of bare aluminum surrounding crater is 6-8 mm.

Brown discoloration: Fig. 5 shows a gradient of discoloration on the canister's white painted surface. Discoloration appears around rib "shadows". Accurately mapping and analyzing the distribution of discoloration may be useful. Interior parts of the canister, which are unpainted and unanodized aluminum, also have discoloration referred to as "brown stain" which is thought to be due to UV polymerization of a hydrocarbon or siloxane contaminant [2]. However, it is unclear whether the two types of discolorations are due to related mechanisms.

Fig. 5. Gradient of discoloration on the canister cover. The white square, sitting in a 4-inch dish, is pre-flight reference material.

Circuit components: In addition to mechanical damage from the hard landing, a few printed circuit board components exhibit plastic deformation, perhaps due to thermal damage.

Dark residue: Dark, dusty residue can be seen on both sides of the canister base. Located near the filter site, larger white spherical particles are admixed with the dark residue. These white spheres are thought to be filter media debris. Potential sources of the dark dust are filter debris, heat shield debris, or ablation products. Tape pull samples of the dark material were obtained from these areas for analysis.

Cleaning and storage. The canister was cleaned for storage so that loose dust would not further react with the hardware surfaces and to prevent cross-contamination during storage. Gentle cleaning of the surface was done by using a fine-haired brush to sweep loose particles into a filtered vacuum cleaner, as shown in fig. 6. The vacuumed debris was collected on a filter and saved for analysis. However, the white painted surface was not cleaned. Finally, both items were enclosed in a black bag to inhibit UV degradation and placed in permanent storage.

Fig. 6. Cleaning of the canister cover by gentle brushing into vacuum filter.

Significance of proper curation. The canister is retained by the Science Team for use in characterizing contamination on the collector surfaces. Much of the characterization of the brown stain and cleaning method development to date has been performed on an aluminum thermal shield. Reference materials for the canister components and the cleaning processes were archived prior to launch; thus, changes due to space exposure, hard landing and other handling can be compared. Detailed mapping of the brown stain distribution on interior components is likely to help determine the source of the brown stain. Questions should be addressed to the Genesis Curator, Judy Allton, KT, Johnson Space Center, Houston, TX.

References: [1] McNamara K. M., (2005) LPSCXXXVI, Abst. #2403, [2] Burnett D.S. et al (2005) LPSCXXXVI, Abst. #2405.

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