SIZE DISTRIBUTION OF GENESIS SOLAR WIND ARRAY COLLECTOR FRAGMENTS RECOVERED.

J. H. Allton[1], E. K. Stansbery[2], K. M. McNamara[2] ; [1]Lockheed Martin c/o NASA/Johnson Space Center, Mail Code KT, Houston, TX 77058; judith.h.allton@jsc.nasa.gov, [2] NASA/JSC, Houston, TX 77058.

Introduction: Genesis launched in 2001 with 271 whole and 30 half hexagonally-shaped collectors mounted on 5 arrays, comprised of 9 materials described in [1]. The array collectors were damaged during re-entry impact in Utah in 2004 [2], breaking into many smaller pieces and dust. A compilation of the number and approximate size of the fragments recovered was compiled from notes made during the field packaging performed in the Class 10,000 cleanroom at Utah Test and Training Range [3].

Array Collectors as Launched:. Specific arrays, with collectors of a thickness unique to that array, were exposed to capture separate samples of the bulk solar wind (700 µm thick collectors), the transient wind associated with coronal mass ejections (650 µm thick collectors), the high speed solar wind from coronal holes (600 µm thick collectors), and the low-speed interstream solar wind (550 µm thick collectors). Each array carried hexagons mounted typically as shown in Fig. 1, although material layout and amount varied in each array.

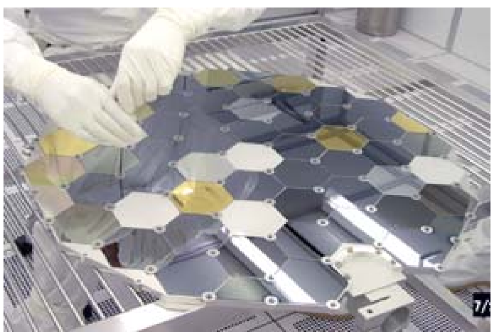

Fig. 1. B array collector arrangement for bulk solar wind, as it was prepared for flight. Note small circular fasteners attaching hexagons and compare to Fig. 5.

Table 1. Number of equivalent whole hexagons (2 half hex = 1 whole hex) launched.

MATERIAL	NUMBER OFHEXAGONS
CZ silicon	52
FZ silicon	93
diamond on silicon, DOS	18
sapphire	21
silicon on sapphire, SOS	21
aluminum on sapphire, AlOS	26.5
gold on sapphire, AuOS	34.5
Ge	19
CCoAuOS	1

Each of the 4 deployable arrays carried 54 whole hexagons and 6 half-hexagons. Each hexagon measured 10.2 cm maximum dimension, an area of 65 cm^2. The non-deployable array carried 55 whole and 6 halves.

Utah Recovery Fragment Handling: A very great portion of the fragments packaged in Utah were retrieved from the interior of the canister, and thus were dry and had little exposure to lakebed mud (Fig. 2). Most fragments are visibly dusty, and much of this dust appears to be powdered silicon and germanium. The packaging process in Utah had the primary goal of stabilizing the fragments so that further surface scratching was prevented. This stabilization was accomplished by placing individual fragments inside polystyrene vials, the diameter of which prevented the solar-winded surface from touching the vial walls. A knit polyester dunnage was used to immobilize the fragments. Another method used the light tack of "cleanroom post-it notes" to immobilize fragments from the back side.

Fig. 2. Collector fragments trapped in array frame. Field of view is 15 cm.

Fig. 3. Sorting shards by material type.

Array Collectors Fragments Recovered: Nearly 10,000 fragments were individually stabilized. Fragments > 1cm were imaged and described (Fig. 3). A substantial portion of fragments > 5mm was also imaged and decribed. Eleven different processors, working from from Septemebr 8 to Oct 4, 2004, produced the data compiled in Table 2. Sizing was done by the longest dimension of the fragment. Because it was difficult to visually distinguish among FZ silicon, CZ silicon and diamond on silicon, these three categories are grouped together. Nevertheless this information is useful for developing a strategy for preliminary assessment, sample storage and allocation. It became apparent early in the processing that silicon and germanium were preferentially broken into smaller pieces during impact. One whole hexagon and 3 half hexagons survived intact – all are sapphire-based collectors. All of the silicon and germanium collectors were oriented in the (100) direction, whereas the sapphire-based collectors have no continuous cleavage plane. Figure 2 shows this difference in size distribution clearly.

Table 2. Number of fragments individually documented in Utah.

	> 25 mm	> 10 mm	<10 mm
Si+DOS	11	310	4772
AuOS	130	465	974
AlOS	110	427	504
SOS	89	311	298
SAP	50	173	310
Ge	0	0	367
CCoAuOS	3	16	18
Size total	393	1702	7243
Sum all fragments: 9338			

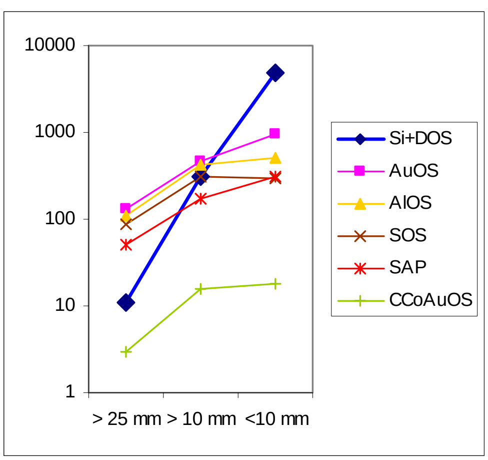

Fig. 4. Size distribution of silicon fragments and sapphire-based fragments.

A comparison of 10 to 25 mm fragment composition to pre-flight source material for the fragments supports depletion of cm-sized non-sapphire-based collectors in the recovered fragments (Table3).

Table 3. Proportions of pre vs post flight composition of collectors and 10-25 mm fragments.

Material	Pre-flight %, whole collectors	Recovered %, 10-25 mm fragments
Si+DOS	57	18
AuOS	12	27
AlOS	09	25
SOS	7	18
SAP	7	10
Ge	7	0
CCoAuOS	<0	1

Uniquely identified fragments. Included in the Table 2 data are 200 fragments which can be uniquely identified because they were still attached to their arrays (Fig. 5).

Fig. 5. Collector fragments still attached to array frame. Compare fasteners to Fig. 1 pre-flight.

Acknowegements: The following people worked 12-hour, physically-demanding days to characterize and package the 10,000 fragments summarized in this paper: Judy Allton, Ron Bastien, Don Burnett, Claire Dardano, Amy Jurewicz, Karen McNamara, Carol Schwarz, Eileen Stansbery, Lisa Vidonic, Jack Warren, and Dottie Woolum. The Genesis team also received outstanding response from JSC and JPL/Caltech support personnel who quickly sent supplies and containers.

References: [1] Jurewicz A. J. G. *et al*. (2002) *Spa. Sci. Rev.*, **105**, 535-560 (2002). [2] McNamara K. M. (2005) LPS XXXVI, this volume. [3] Stansbery E. K. *et al*. (2005) LPSC XXXVI, this volume.