

STS-104 ORBITER POST LANDING INSPECTION
Debris Assessment
26 July 2001

After the 11:39 p.m. local/eastern time landing on 24 July 2001, a post landing inspection of OV-104 Atlantis was conducted at the Kennedy Space Center on SLF runway 15 and in Orbiter Processing Facility bay 2. This inspection was performed to identify debris impact damage and, if possible, debris sources.

The Orbiter TPS sustained a total of 126 hits of which 26 had a major dimension of 1-inch or larger. This total does not include the numerous hits on the base heat shields attributed to SSME vibration/acoustics and exhaust plume recirculation.

The following table lists the STS-104 Orbiter damage hits by area:

	<u>HITS > 1-inch</u>	<u>TOTAL HITS</u>
Lower Surface	24	108
Upper Surface	0	0
Window Area	0	14
Right Side	0	0
Left Side	0	0
Right OMS Pod	0	0
Left OMS Pod	2	4
TOTALS	26	126

The orbiter lower surface sustained 108 total hits, of which 24 had a major dimension of 1-inch or larger. Approximately 39 damage sites (with eight larger than 1-inch in length) were located in the area from the nose gear to the main landing gear wheel wells. More damage occurred on the right-hand side of the vehicle than on the left-hand, with a typical pattern, some of these hits may be attributed to impacts from ice in the LO2 feedline bellows. ET TPS venting modifications continue to have a reducing effect on the quantity and size of the damage sites. Analysis of ET separation film may help determine the cause of these hits.

The majority of the lower surface hits were around the LH2 umbilical area (42 hits). Most of these damage sites around the ET/ORB umbilical were most likely caused by pieces of the umbilical purge barrier flailing in the airstream and contacting tiles before pulling loose and falling aft. The ET TPS venting modifications continue to have a reducing effect on the quantity and size of the damage sites.

The largest lower surface tile damage site, located inboard of the LH2 umbilical, measured 4-1/2-inches long by 3/4-inches wide by 0.250-inches deep. A combination of umbilical ice and/or umbilical purge barrier material could have been the cause of this damage site.

The landing gear tires were reported to be in good condition. There was no ply under cutting on the main landing gear tires.

ET/Orbiter separation devices EO-1, EO-2, and EO-3 functioned normally. No ordnance fragments were found on the runway beneath the umbilicals. The EO-2 and EO-3 fitting retainer springs appeared to be in nominal configuration, though five of the "salad bowl" clips were missing from EO-3. The EO-2/3 pyro debris shutters were fully closed. A small piece of umbilical closeout foam (pyro can closeout) was adhered to the umbilical plate near the LO2 disconnect. No debris was found beneath the umbilicals.

Typical amount of tile damage occurred on the base heat shield. All SSME Dome Heat Shield closeout blankets were in good condition though some small material was torn/frayed. Engines 1 and 2 had blanket damage at the 6 and 9 o'clock positions respectively.

No unusual tile damage occurred on the leading edges of the OMS pods and vertical stabilizer. There were four tile damage sites on the leading edge of the LH OMS Pod, with two having a major dimension greater than one inch.

Damage sites on the window perimeter tiles appeared to be less than usual in quantity and size. Hazing and streaking of forward-facing Orbiter windows appears to be normal.

The post-landing walkdown of Runway 15 was performed immediately after landing. All components, except the mortar cover, of the drag chute were recovered and appeared to have functioned normally.

Two pieces of AMES gap filler, 5" long by 1" wide, were found on the runway under the nose landing gear doors. Tile gap fillers have been found on previous missions and are not considered an anomaly.

In summary, both the total number of Orbiter TPS debris hits and the number of hits 1-inch or larger were within established family. The potential identification of debris damage sources for mission STS-104 will be based on the laboratory analysis of Orbiter post landing microchemical samples, inspection of the recovered SRB components, film analysis, and aerodynamic debris particle trajectory analysis. The results of these analyses will be documented in the STS-104 Debris/Ice/TPS Assessment and Integrated Photographic Analysis report.

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