Debris Transport Assessment of Debris Impacting Orbiter Lower Surface in STS-107 Mission

STS-107 MMT

January 24, 2003

Subcontract 1970483303
W|B.S. 1.2.2.1 / 20037
PDRD SC004

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STS-107 Debris Impacting Orbiter Wing
Debris Impact Conditions to Be Evaluated for Area on Orbiter Lower Surface

Issue – At about 82 seconds into the flight, multiple pieces of debris were seen emanating from the ET bipod area and later seen impacting the Orbiter lower surface.

Film Analysis Results indicate impact at about 1/3 of the wing from vehicle centerline

3 pieces of debris were observed

Debris can be 20” long

Debris appeared to break-up upon Orbiter impact

- A shower of debris is seen soon after impact

Debris Trajectory Analysis estimated the impact conditions for what was observed

- Assumed debris particle emanates from bipod ramp area (XO 389, YO 50)

Three debris sizes analyzed:

- 20” x 16” x 6” (representing bipod ramp)
- 20” x 10” x 6” (representing bipod ramp)
- 20” x 10” x 2” (representing flange foam)

- Debris material considered to be foam (density = 2.4 lb/ft3)
- Trajectories based on ballistic coefficient for Mach = 2.5 alpha 3.0
- The distribution of impact conditions on predicted impact area estimated from combination of trajectory results and existing debris database

Film review continuing to better define impact area
Predicted Impact Area Derived from Film Observations and Trajectory Analysis
Velocity and Impact Angle Distribution Inside Impact Area

(Debris Size = 20" x 10" x 6", Density = 2.4 lb/ft³)

Impact Velocity

(f/s/sec.)

Impact Angle

(degrees)

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Impact Velocity
(ft/sec.)

Impact Angle
(degrees)

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Back Up