

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

STS-107 MMT

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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

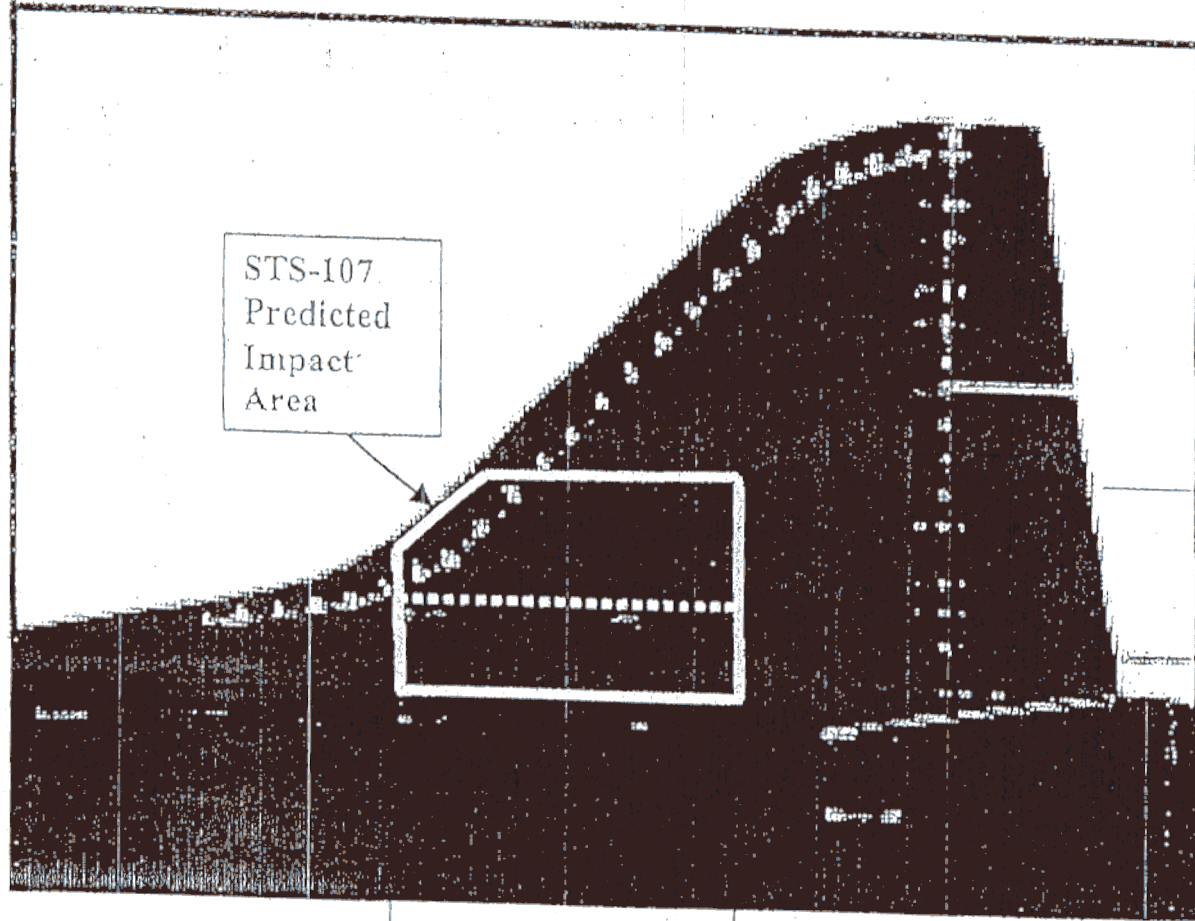
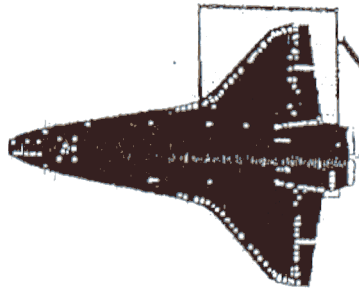
- Assumed debris particle emanates from bipod ramp area (XO 389, YO 50)

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



STS-107
Predicted
Impact
Area

O 1020

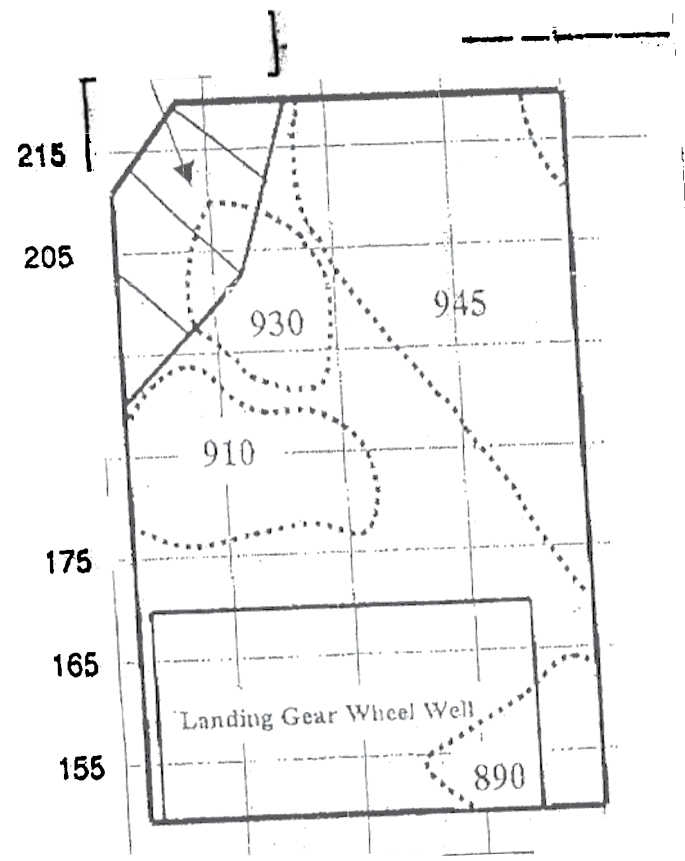
XO 1200

YO

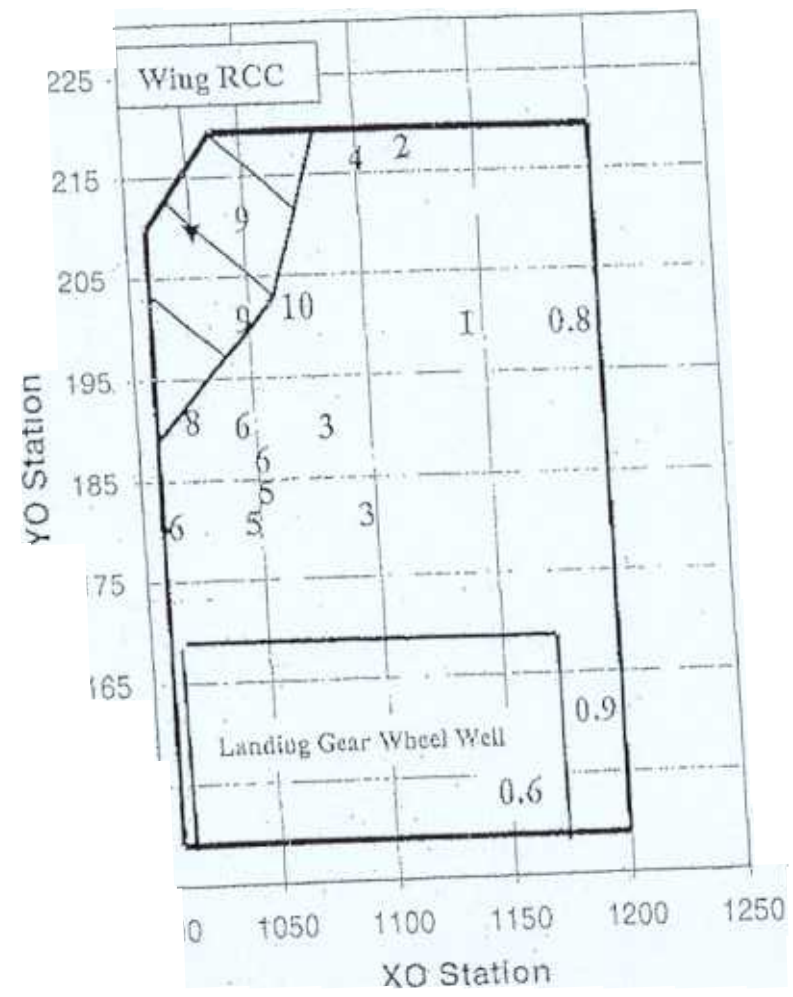
YO

 **BOEING**

Impact Velocity



XO Station



STS-107 Debris Impacting Orbiter Wing

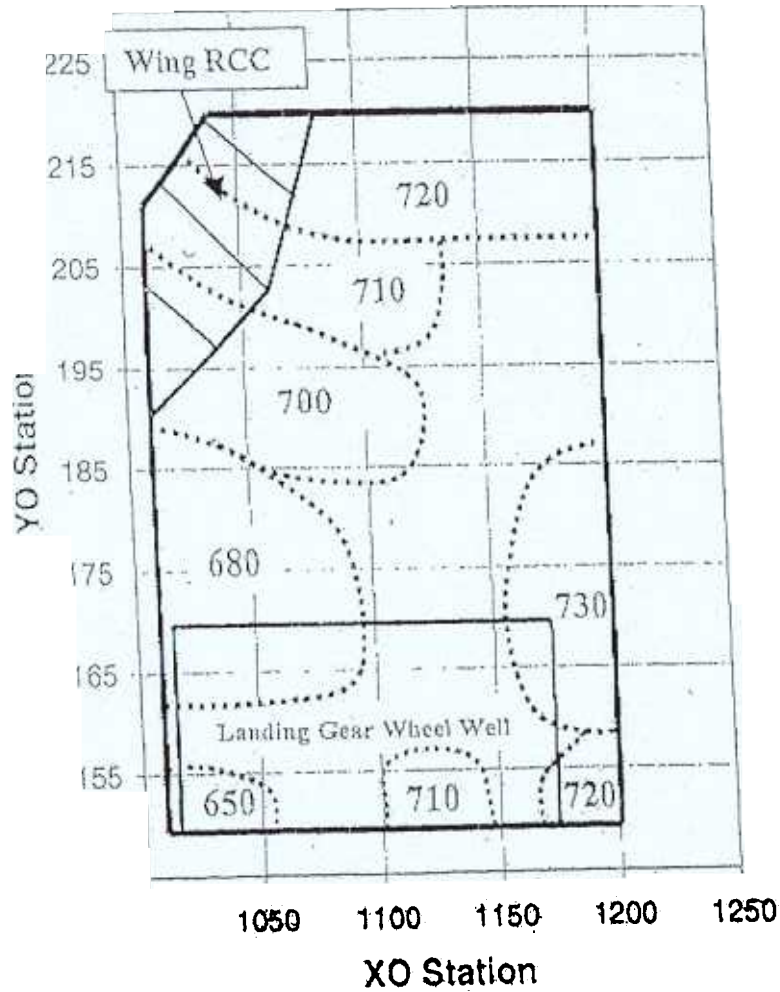


Velocity and Impact Angle Distribution Inside Impact Area

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

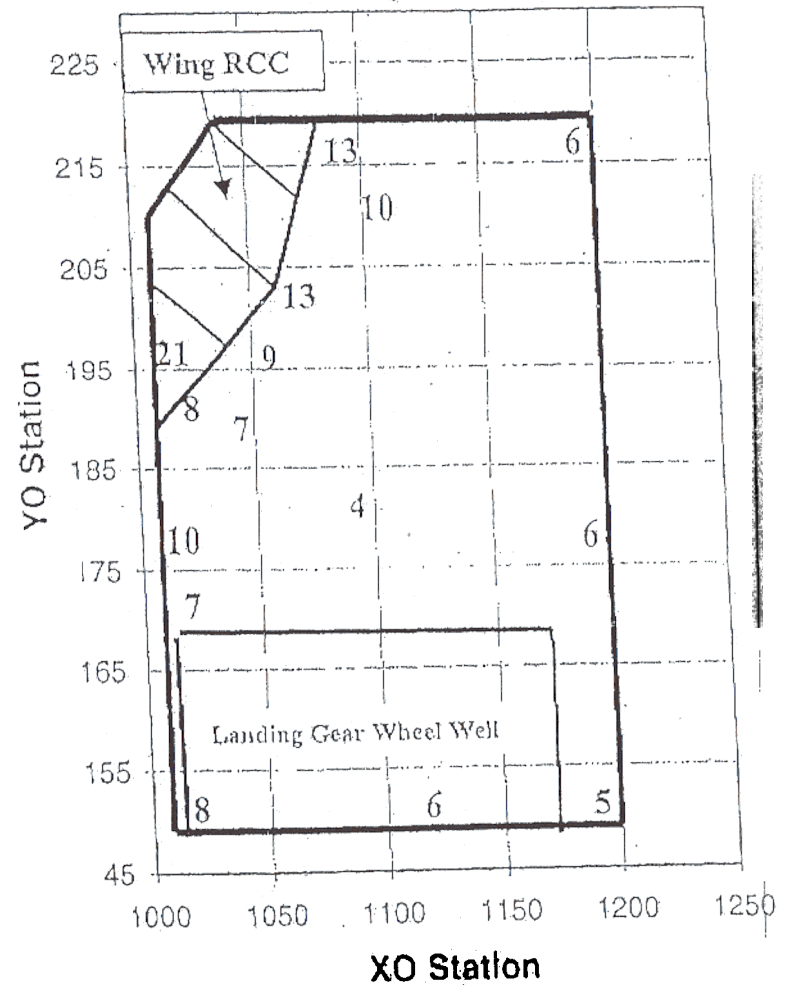
Impact Velocity

(ft/sec.)



Impact Angle

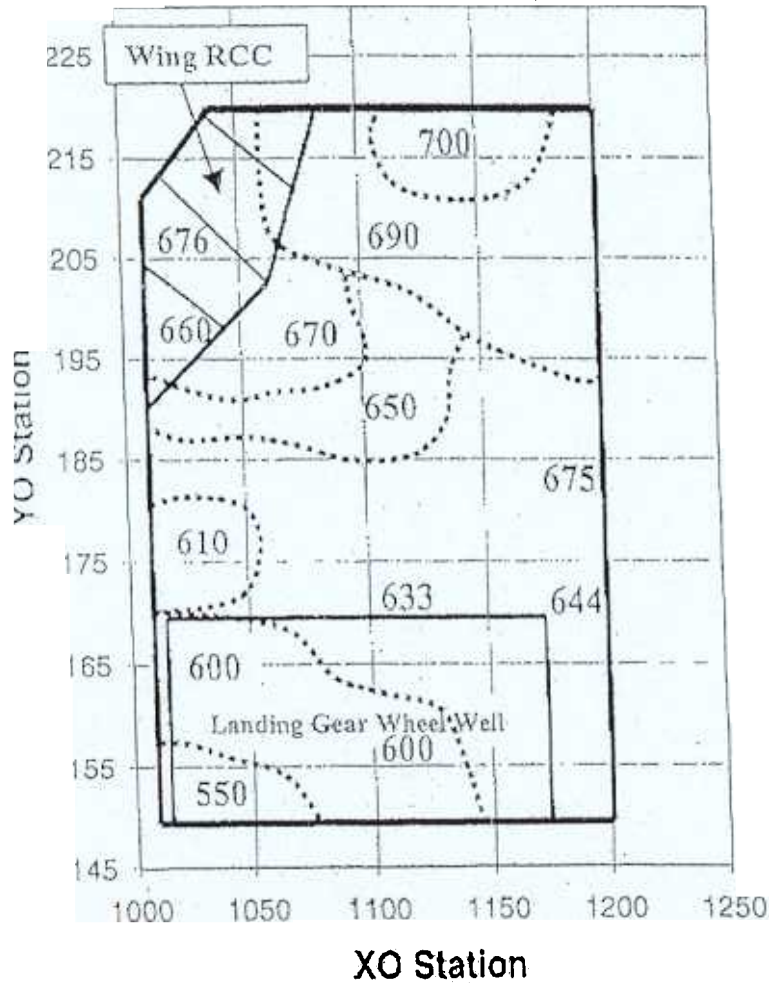
(degrees)



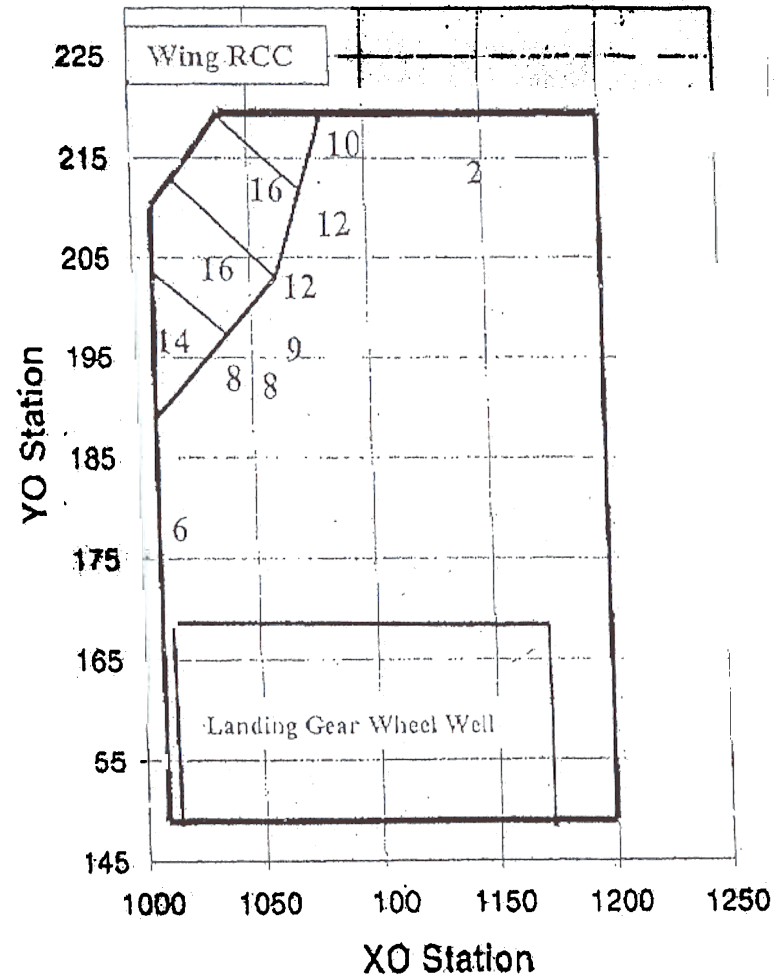
Velocity and Impact Angle Distribution Inside Impact Area

(Debris Size = 20" x 16" x 6", Density = 2.4 lb/ft³)

Impact Velocity (ft/sec.)




Impact Angle (degrees)



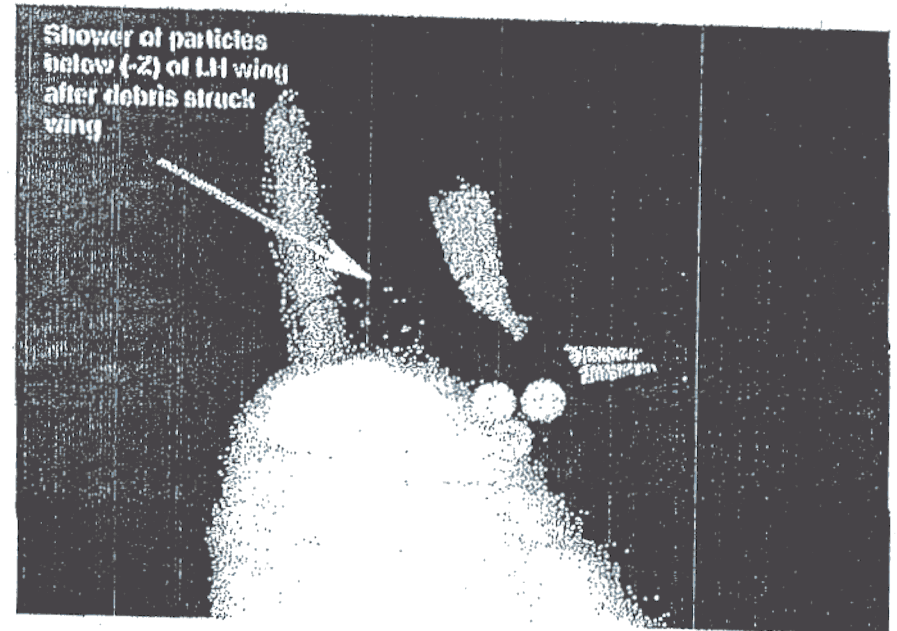
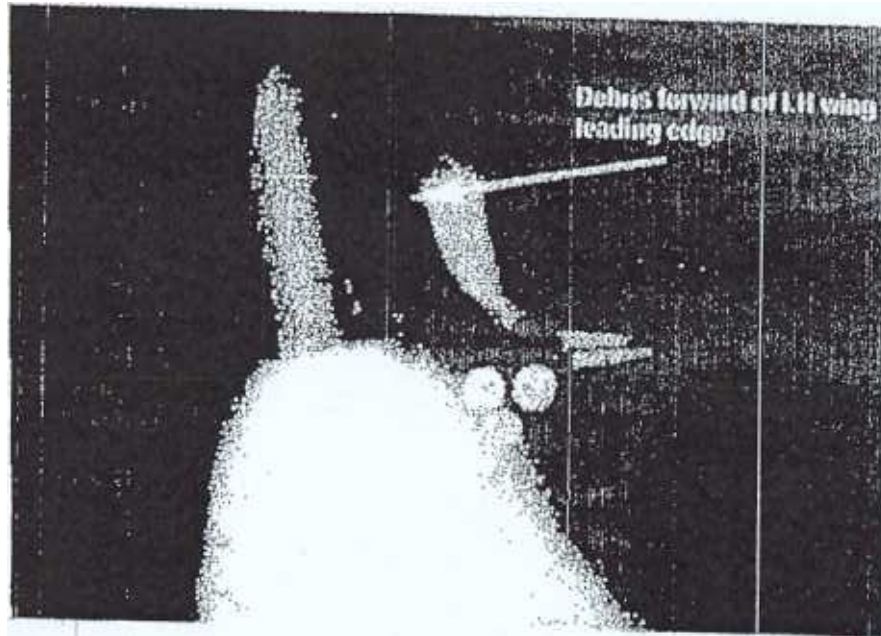
Back Up

sg Orb W

 **BOEING**

Debris Emanating From Bipod Area Impacts Orbiter Lower Wing

As depicted between the ET



BOEING