

Thermal Protection System (TPS) Enhancement Goals

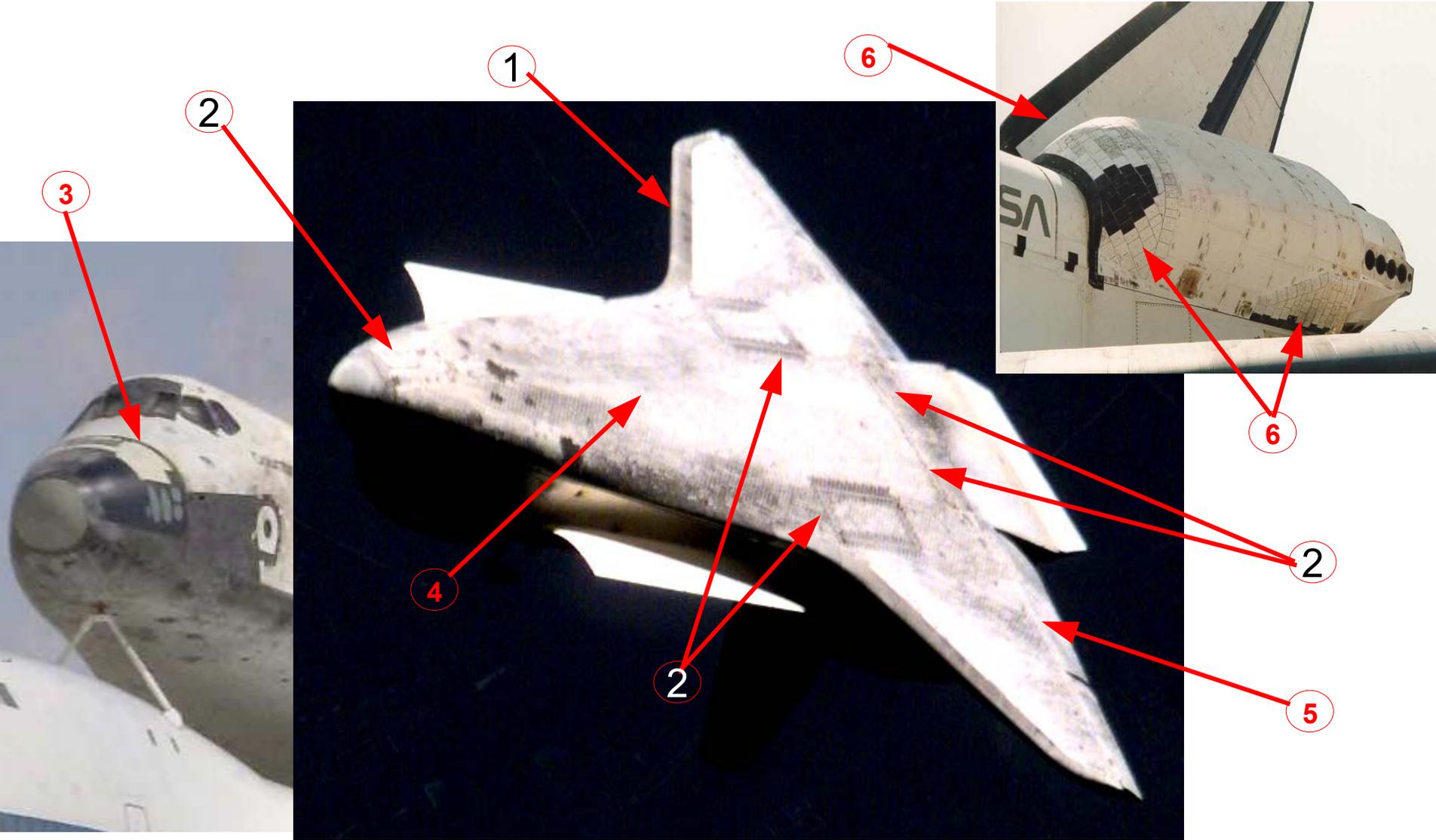
TPS Enhancements

Space Shuttle Program initiatives are in development to increase thermal protection system impact durability through the following design improvements:

- **Improved impact durability**
- **Increase Thermal Capability**
- **Reduce Leak Paths**
- **Add Redundancy**

Six Critical TPS Areas Targeted For TPS Enhancements

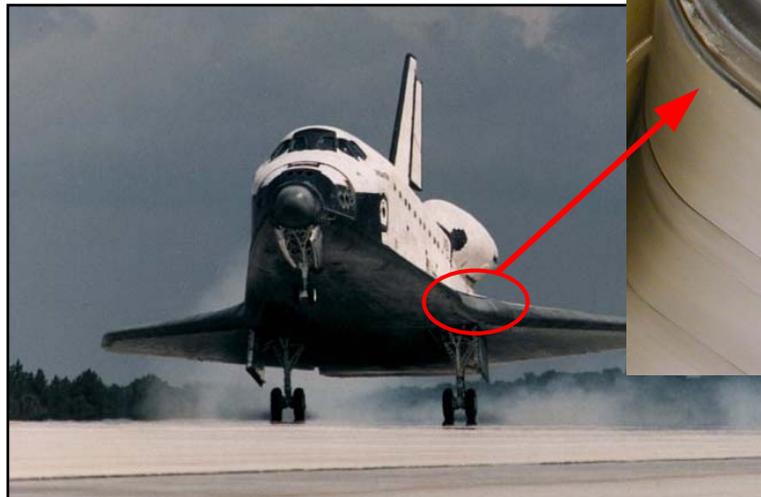
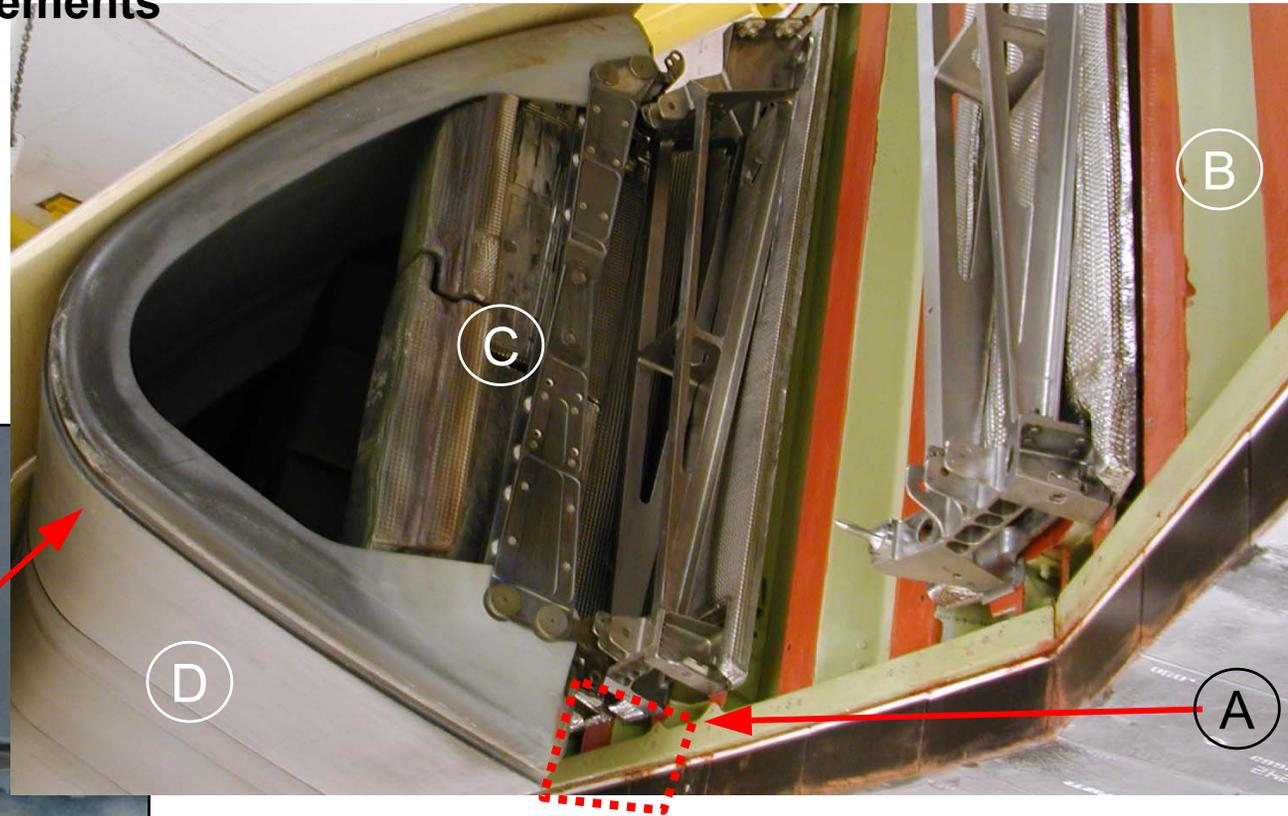
TPS Enhancements



1. Wing Leading Edge Subsystem (WLESS)

TPS Enhancements

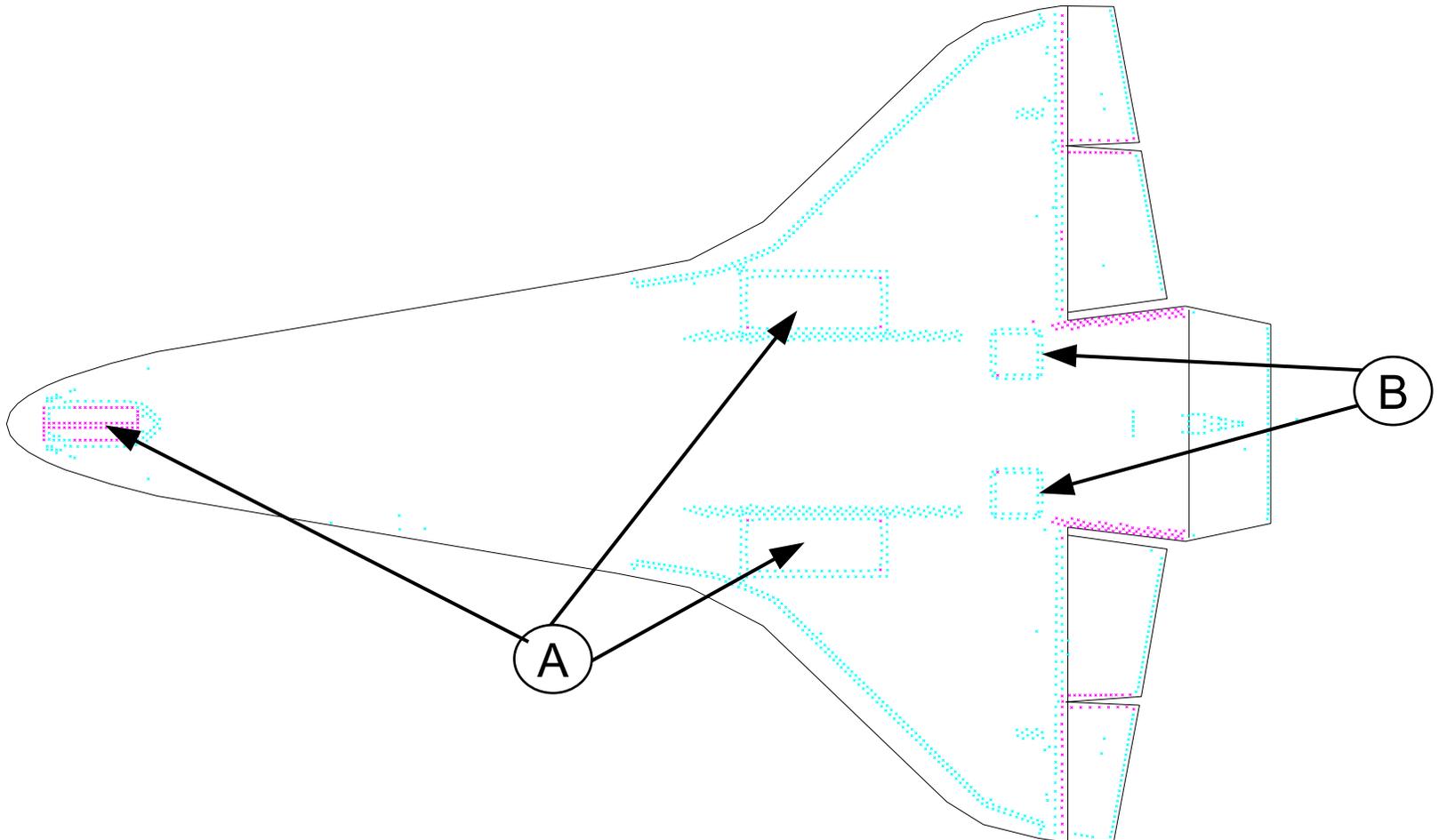
- A. Access Panels Redesign**
- B. Wing Spar Insulators**
- C. Additional Fitting Insulators**
- D. RCC Panel Enhancements**



2. Main Landing Gear & External Tank Door TPS

TPS Enhancements

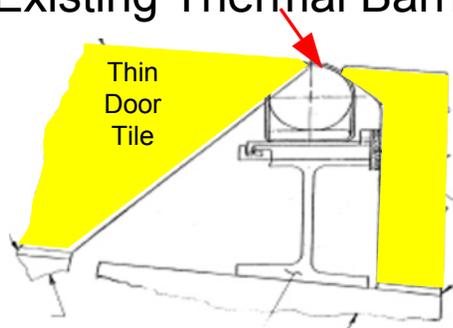
- A. Nose and Main Landing Gear Door (MLGD)
- B. External Tank Door



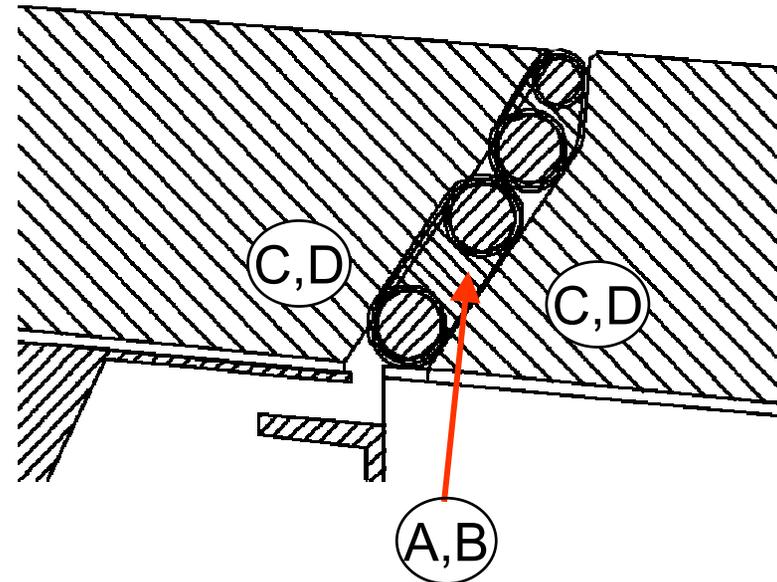
2. Main Landing Gear & External Tank Door TPS

TPS Enhancements

Existing Thermal Barrier



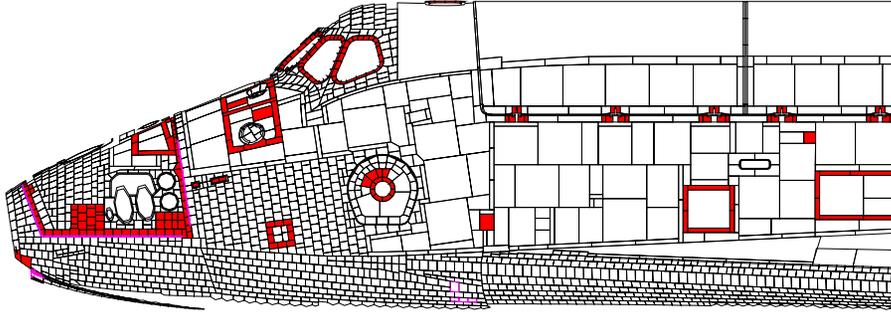
Design Enhancement



- A. Redundant Thermal Barriers
- B. Higher temperature thermal barrier fabric
- C. Filled gaps, improved tiles sizes & shapes
- D. Next generation hardened tile

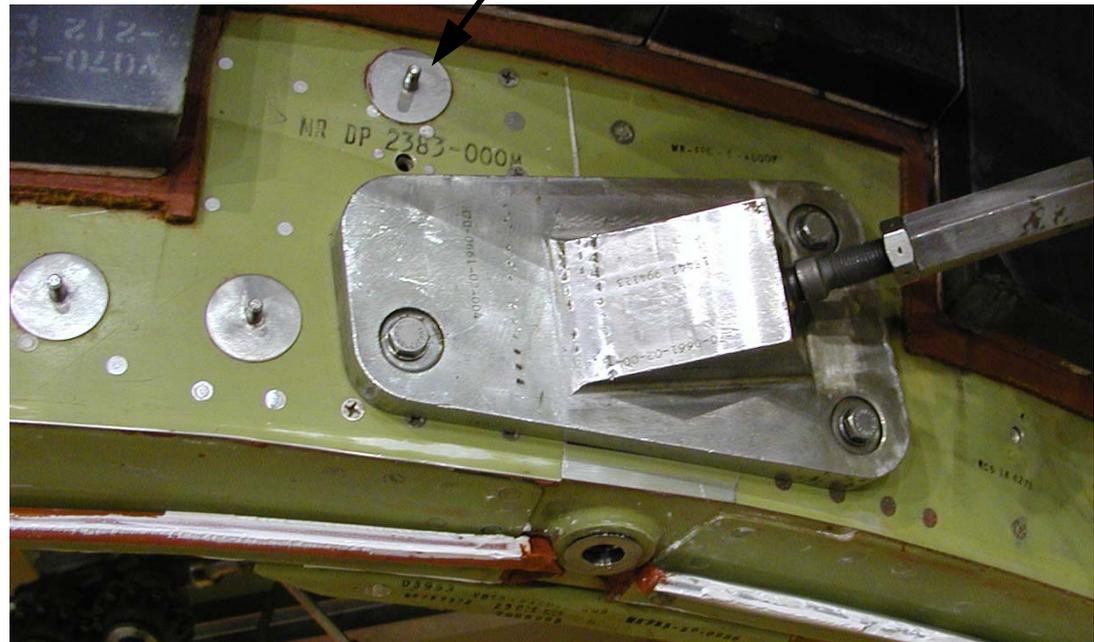
3. Bonded Studs on Carrier Panels

TPS Enhancements



 **Carrier Panel Locations**

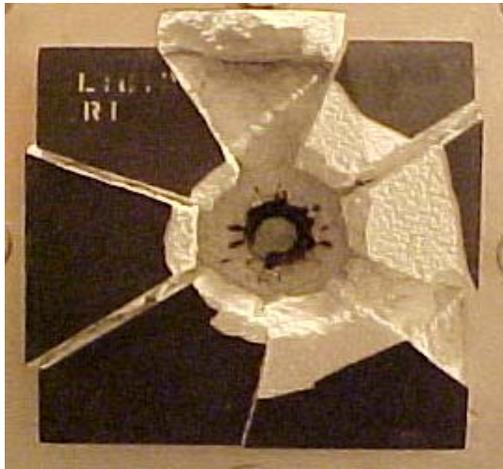
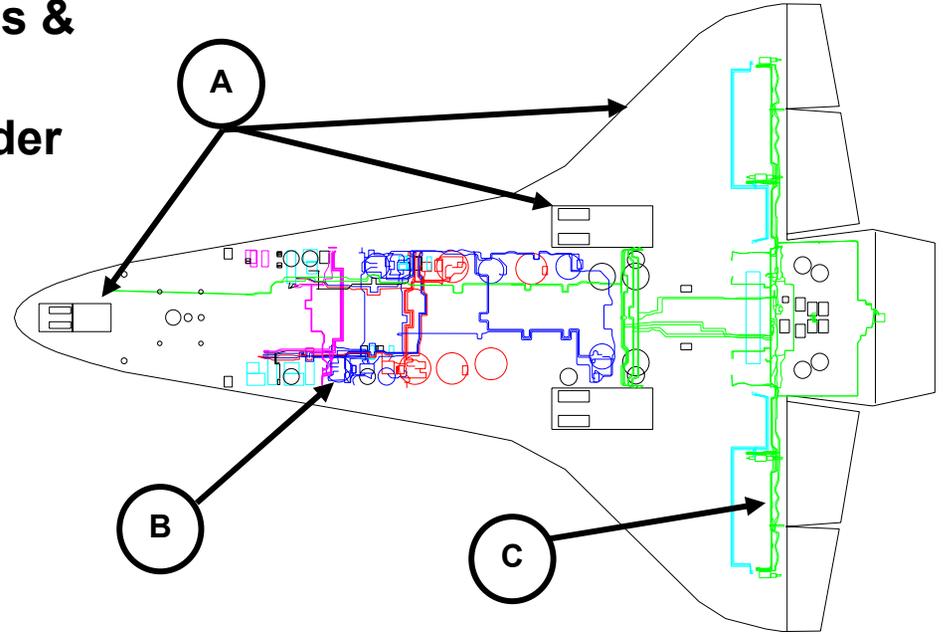
Stud Bonded to FRCS Skin, replace with mechanical fastener



4. Advanced Lower Surface Acreage Tile

TPS Enhancements

- A. Lower surface door penetrations & LESS close-outs
- B. Lower surface mid-fuselage under critical subsystems
- C. Lower surface control surface hinge areas



Current Tile

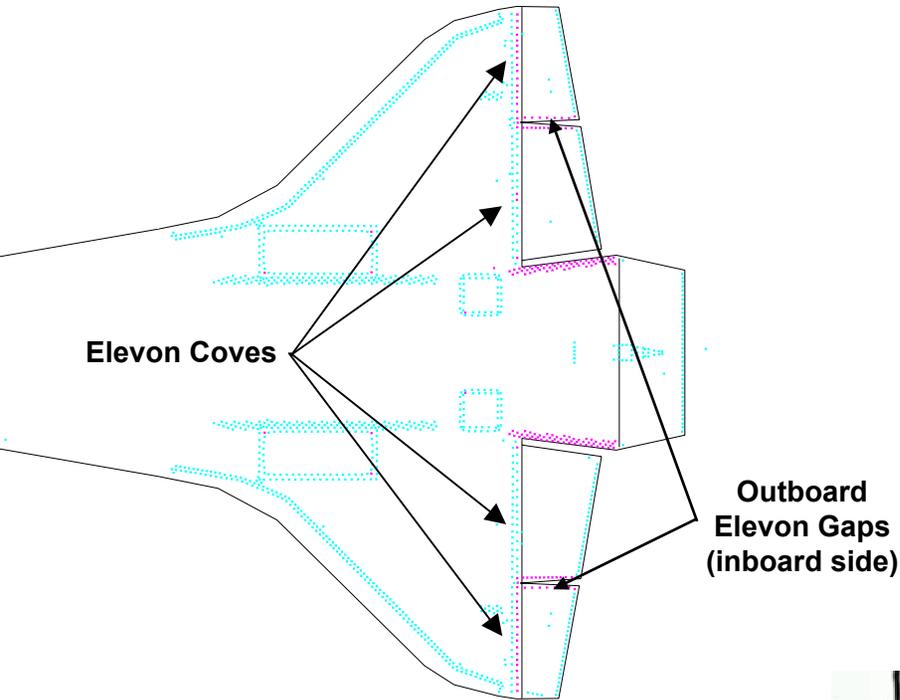
Impacted with 5.56 mm
aluminum pellet at 6.8
km/sec



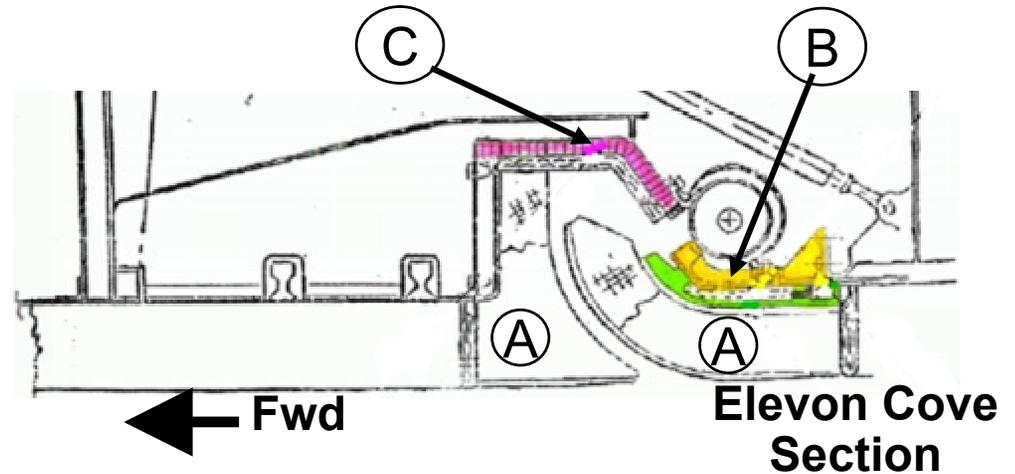
BRI Tile

5. Outboard Elevon Cove TPS & Seals Redesign

TPS Enhancements



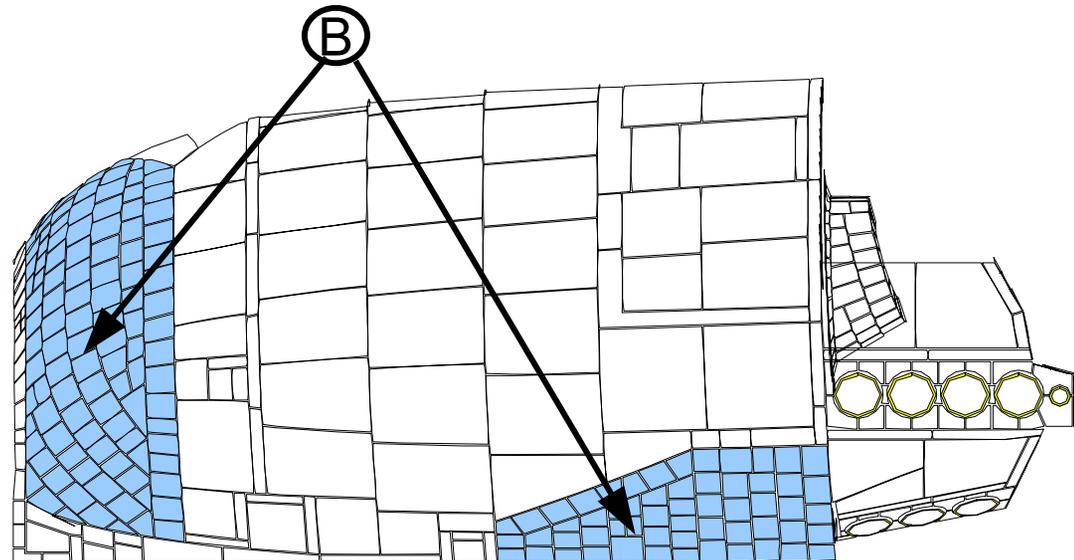
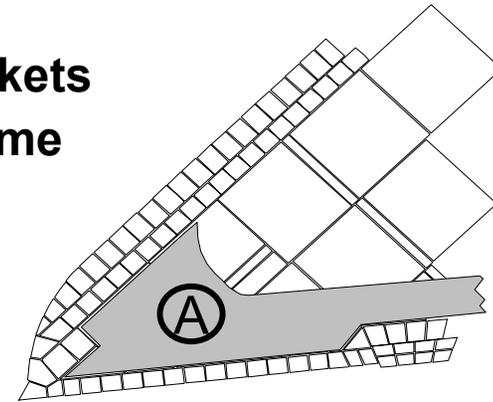
- A. Next generation hardened tile**
- B. Improved & redundant attachments**
- C. Back-up ablator**



6. Orbiter Maneuvering System (OMS) Dome

TPS Enhancements

- A. Add gray high emittance coating to side blankets
- B. Replace upper surface OMS Pod Forward Dome tiles with new generation tougher tiles



Thermal Protection System Enhancement Summary

TPS Enhancements

Six Orbiter areas have been initially identified for design improvements to:

- **Improved impact durability**
- **Increase Thermal Capability**
- **Reduce Leak Paths**
- **Add Redundancy**

Identified areas are in concept development and feasibility assessment

Additional improvements are also being evaluated

Implementation durations for proposed concepts will vary from near term (<1 year) to far term (2 – 5 years)