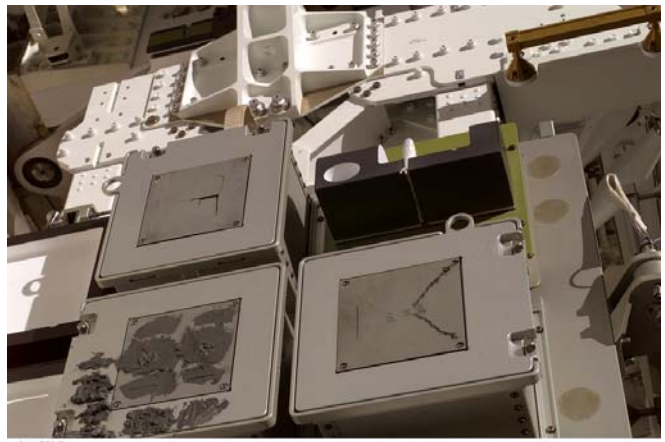
STS-121 Detailed Test Objective (DTO)
RCC Crack Repair

Background

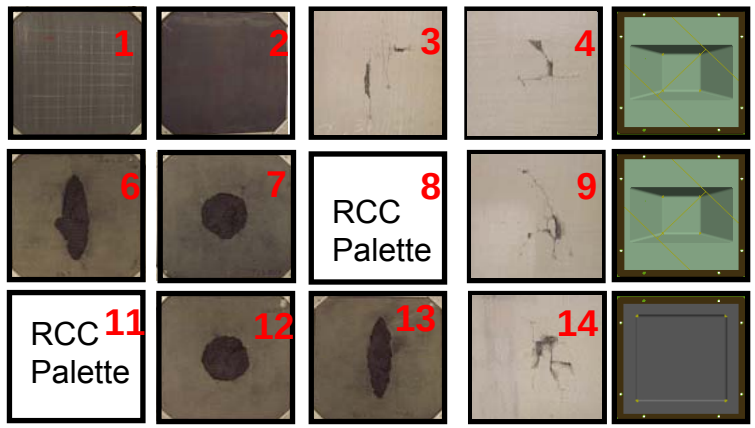
- NOAX (Non-Oxide Adhesive Experimental) Crack Repair one of four TPS Repair techniques baselined by Shuttle Program January 2006
- NOAX successfully flown and demonstrated on STS-114
  - Evaluated tools and techniques to apply NOAX material
  - Compared on-orbit state/porosity distribution of repaired materials with that of ground-based samples



STS-114 DTO Porosity Sample

DTO Objectives

- Validate revised material application procedures and techniques
- Asses EVA tool functionality and ability to repair WLE damage within RCC transient temperature profiles
- Evaluate use of photogrammetry as a post-repair verification tool
- Assess influence of external environments on NOAX application (outgassing, temperature, UV)



STS-121 DTO Sample Layout

STS-121 Crack Repair DTO Summary

- **RCC Crack Repair DTO was successfully completed during EVA#3 on STS-121 in 7 hrs 11 minutes**
  - 5 of 8 Crack Repair arc jet samples completed
  - Samples repaired at colder temperatures than intended in EVA Timeline*
    - NOAX material responded as expected from 1-G thermal vac testing

•Repaired Samples:

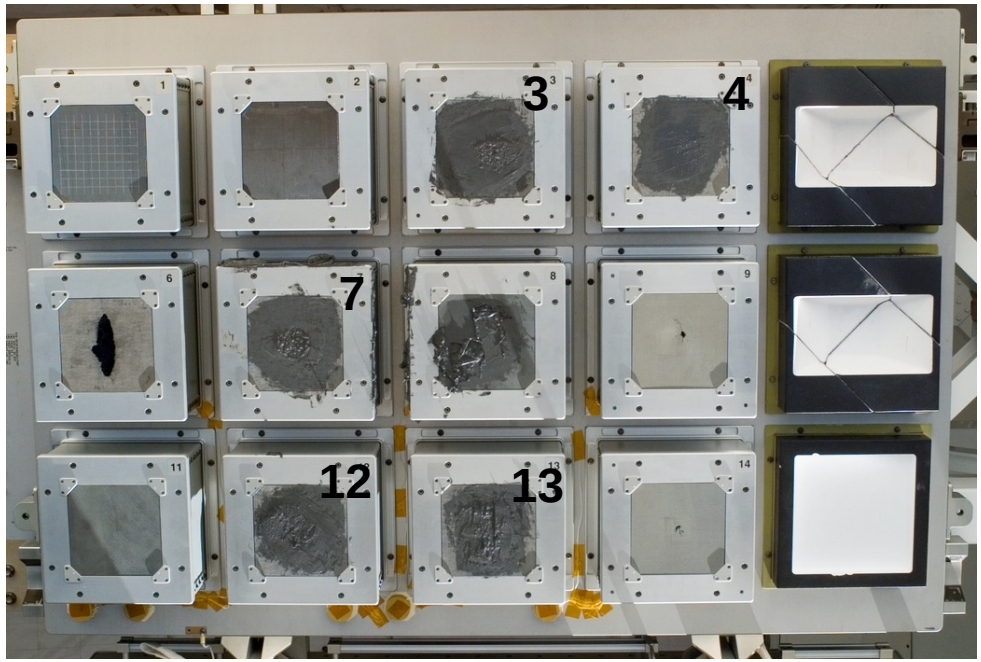
•Sample 3 – Impact Crack
- •nominal temps: 93F down to ~45F

•Sample 4 – Impact Crack
- •off-nominal temps: 44F down to 35F

•Sample 7 – 2in dia spall
- •below spec temps: ~36F and below

•Sample 12 – 2in dia spall
- •below spec temps: ~29F and below

•Sample 13 – 4in x 1.2in gouge
- •below spec temps: ~26F and below



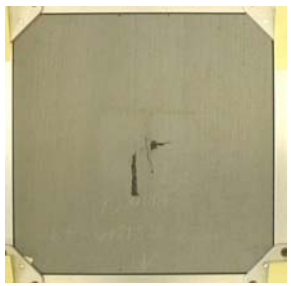
STS-121 DTO Samples – Post Repair

*NOAX Application Temp. Range: 40 – 140 F ; Optimal Temp. Range: 70 – 110 F

STS-121 Crack Repair DTO Test Results

- **Post-processing completed on 2 of 5 DTO Samples**
  - Samples scanned and thermally cycled to simulated on-orbit passive curing profile (48 hours: 40 F - 200 F)

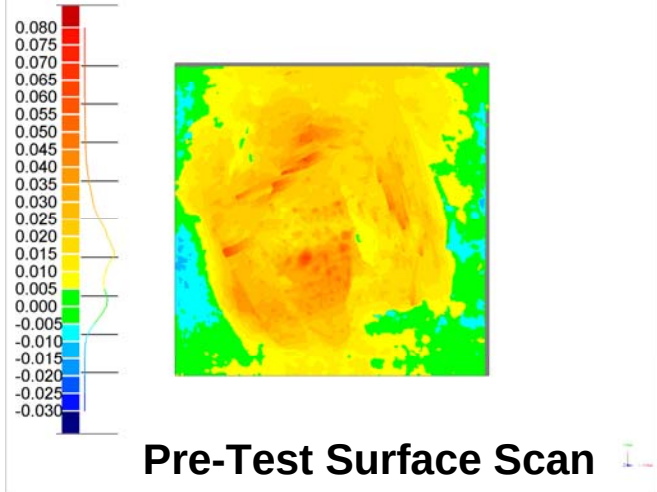
DTO Sample #3



Pre-Repair

- Impact Crack
- Nominal temps: 93F down to 45F

Pre-Test



Pre-Test Surface Scan

Post-Test

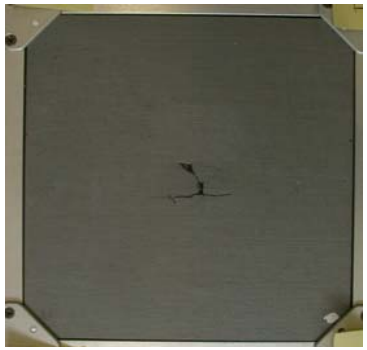
Arc Jet Test Conditions

-2960 F Condition

- ~ 120 psf Surface Pressure
- 1200 Second Duration
  - Repaired area of C-C substrate not exposed
  - -Sample survived entry heating profile

STS-121 Crack Repair DTO Test Results

DTO Sample #4

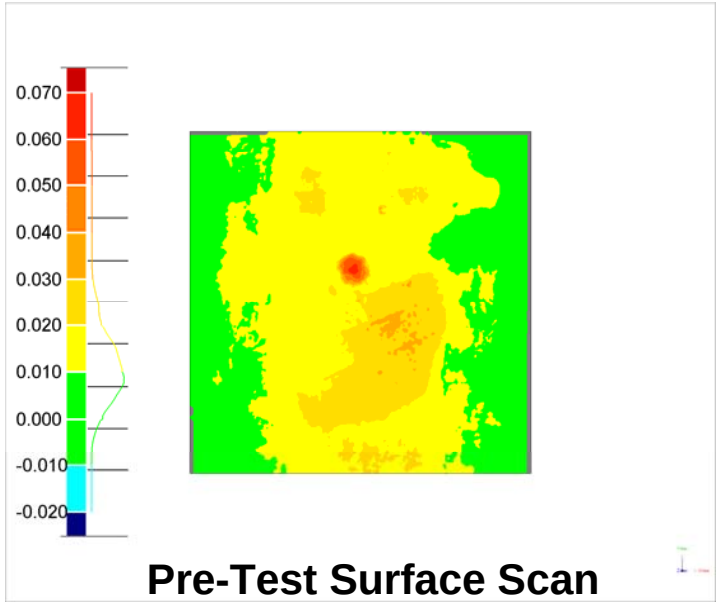


Pre-Repair

- Impact Crack
- Off-nominal temps: 44F down to 35F

Pre-Test

Post-Test



Pre-Test Surface Scan

Arc Jet Test Conditions

-2700 F Condition

- ~ 120 psf Surface Pressure

-1200 Second Duration

- Repaired area of C-C substrate not exposed

-Sample survived entry heating profile