

TWR-75731  
ECS SS10968



**SPACE SHUTTLE PROGRAM**  
Space Shuttle Projects Office (MSFC)  
NASA Marshall Space Flight Center, Huntsville, Alabama



# *Reusable Solid Rocket Motor* **STS-100 Flight Readiness Review/CoFR**

*Motor Set RSRM-79*

**5 April 2001**

*Presented by Stan Graves*



## **Thiokol Propulsion**

an Alcoa business

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STS-100 (RSRM-79)

# Agenda

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## Flight Readiness Review/CoFR

- 1.0 Previous Flight Assessment—STS-102
- 2.0 Certification Status—**No Constraints**
- 3.0 Changes Since Previous Flight—**None**
- 4.0 Configuration Inspection
  - 4.1 As-Built Versus As-Designed, Hardware, and Closeout Photo Review Status—**No Issues**
  - 4.2 Hardware Changeouts Since ET/SRB Mate Review—**None**
- 5.0 SMRB Nonconformances
- 6.0 Technical Issues/Special Topics—**None**
- 7.0 Major Issues for STS-104 and STS-105—**No Issues**
- 8.0 Readiness Assessment

Backup      LCC and Contingency Temperatures for STS-100



# Previous Flight Assessment—STS-102

## Disassembly Evaluation Summary—Status of Disassembly Activity

KSC Operations		LH RSRM	RH RSRM	Remarks
Initial LH/RH SRB viewing	*	Complete	Complete	
SRB/RSRM walkaround assessment	*	Complete	Complete	
Demate/evaluate aft exit cone (AEC)	*	Complete	Complete	
Remove/evaluate S&A and OPTs	*	Complete	Complete	
Remove/evaluate nozzle	*	Complete	Complete	
Remove/evaluate stiffener rings/stubs		Complete	Complete	
Remove/evaluate igniter	*	Complete	Complete	
Demate/evaluate field joints/evaluate insulation	*	Complete	Complete	
<b>Utah Operations</b>				
Disassemble/evaluate nozzle (joint No. 4 and 5)	*	Complete	Complete	
Disassemble/evaluate nozzle (joint No. 2 and 3)	*	Complete	Complete	
Disassemble/evaluate S&A	*	Complete	Complete	
Washout nozzle phenolics		20 Apr 2001	20 Apr 2001	
Washout nozzle AEC phenolics		25 May 2001	25 May 2001	
Measure/evaluate aft dome and RH segment insulation		21 Sep 2001	21 Sep 2001	
Measure/evaluate igniter insulation		21 Sep 2001	21 Sep 2001	

\* RSRM Project committed to complete prior to next launch

- No constraints to STS-100 flight



# SMRB Nonconformances

**DRs 437975, 437976, 437978, 436990, Case Hardware**

**Multiple Motors**

P/N multiple, S/N multiple  
SMRB Criteria: 1 Hardware Criticality: 1

Grit blast hose contamination

## Discrepancy

**Suspect Condition: Selected case hardware may have localized silicone/paraffin contamination from first few seconds of grit blasting after hose changeout**

## Issue

**Effect of localized contamination transfer on bond system integrity (case insulation, weatherseal, and paint)**

## Disposition

**Use as is**

## Background

**Grit blast hose changeout during case cylinder blast resulted in a small area (3 in. by 2 in.) of paraffin deposition at startup—part rejected and returned to refurbishment**

**Discussions with all hose vendors indicate the use of silicone as a release agent in hose manufacture. One hose vendor, indicates the use of paraffin in the rubber formulation**

**All case hardware processed with new hoses identified for suspect condition and assessed**

**Contamination is purged from hoses during the first 15 seconds of blast—potential affected area bounded for the assessment**

**Baseline inspections show no evidence of contamination concerns for potentially affected hardware**

# SMRB Nonconformances

## DRs 437975, 437976, 437978, 436990, Case Hardware (Cont)

### Multiple Motors

P/N multiple, S/N multiple  
SMRB Criteria: 1 Hardware Criticality: 1

Grit blast hose contamination

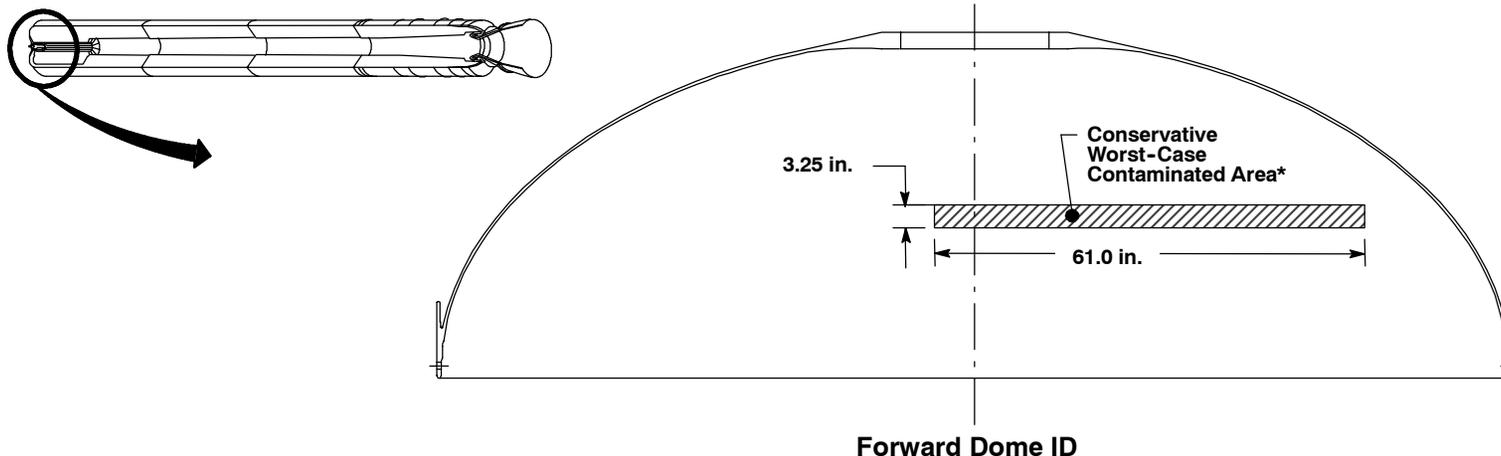
#### Justification—Forward Dome ID

Internal insulation bond surface sample inspection capable of detecting contamination at levels well below bondline failure levels—no contamination detected

Loaded level ultrasonic inspection identified no unbonds

Insulation edges probed full circumference—no edge separations detected

Structural analysis of conservative worst-case unbond\* (storage loading) shows a margin of safety of 1.8 (SF = 2.0) against unbond propagation





# SMRB Nonconformances

## DRs 437975, 437976, 437978, 436990, Case Hardware (Cont)

### Multiple Motors

P/N multiple, S/N multiple  
SMRB Criteria: 1 Hardware Criticality: 1

Grit blast hose contamination

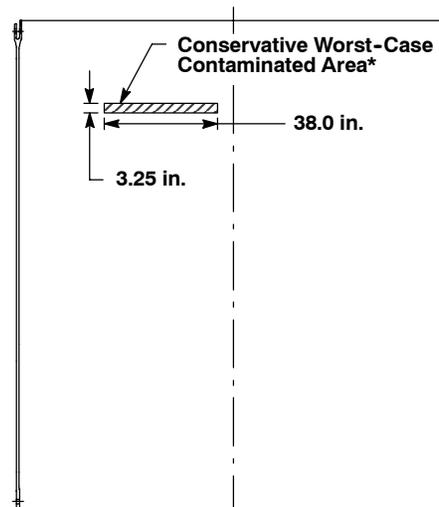
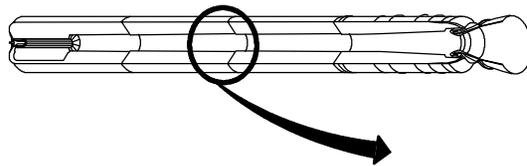
#### Justification—Case ID

Internal insulation bond surface inspection of entire ID capable of detecting contamination at levels well below bondline failure levels—no contamination detected

Loaded level ultrasonic inspection identified no unbonds

Insulation edges probed full circumference—no edge separations detected

Structural analysis of conservative worst-case unbond\* (storage loading) shows a margin of safety of 2.5 (SF = 2.0) against unbond propagation



Case Cylinder ID

# SMRB Nonconformances

## DRs 437975, 437976, 437978, 436990, Case Hardware (Cont)

### Multiple Motors

P/N multiple, S/N multiple  
SMRB Criteria: 1 Hardware Criticality: 1

Grit blast hose contamination

### Justification—Case OD

Weatherseal insulation bond surface sample inspection capable of detecting contamination at levels well below bondline failure levels—no contamination detected

Weatherseal edges probed full circumference—no edge separations detected

Structural analysis of conservative worst-case weatherseal unbond\* (with no edge separations) shows a margin of safety greater than 1.1 (SF = 2.0) against unbond propagation

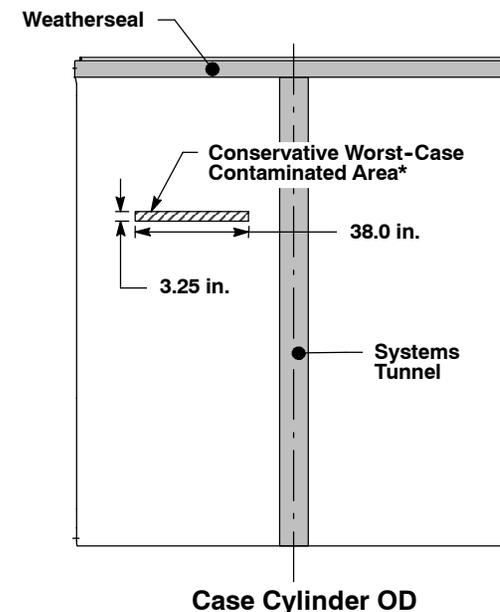
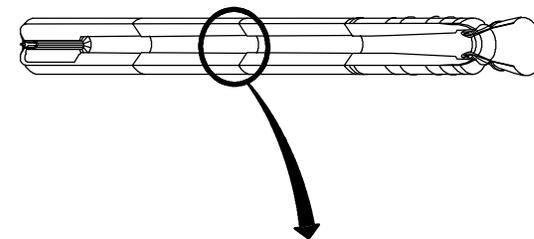
Systems tunnel subsequently grit blasted prior to bonding and pull tested to 1.4 times maximum load

Structural analysis of conservative worst-case systems tunnel unbond\* (full width) shows a margin of safety of 5.0 (SF = 2.0)

Painted surfaces verified by visual inspection before painting and throughout process including at KSC

On-hardware pull tests of paint adjacent to cork runs shows paint well bonded

Structural analysis of cork runs of conservative worst-case unbond\* (full width) shows a margin of safety of 0.05 (SF = 2.0) against unbond propagation





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STS-100 (RSRM-79)

5.0-5

# SMRB Nonconformances

DRs 437975, 437976, 437978, 436990, Case Hardware (Cont)

Multiple Motors

P/N multiple, S/N multiple  
SMRB Criteria: 1 Hardware Criticality: 1

Grit blast hose  
contamination

## Summary

Silicone and paraffin contamination at levels affecting insulation and weatherseal bonds would be detected through baseline inspections

Analyses show large margins of safety for worst-case unbond conditions

Painted surfaces verified by visual inspection before painting and throughout process including at KSC

On-hardware pull tests of paint adjacent to cork runs show no contamination issue

STS-100 and subsequent are safe to fly



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*STS – 100 Readiness Assessment*

*Pending satisfactory completion of normal operations flow (per OMRSD), the RSRM hardware is ready to support flight for mission*

*STS – 100*

*5 April 2001*

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# Current Flight Predictions

## LCC and Contingency Temperatures for STS-100

	<u>Heater Location</u>	<u>LCC</u>	<u>Minimum Allowable Sensor Temperature*</u>	
			<u>LH</u>	<u>RH</u>
	Igniter	74°F	72°F	72°F
	Forward Field Joint	80°F	71°F	66°F
	Center Field Joint	80°F	71°F	67°F
	Aft Field Joint	80°F	69°F	70°F
	Nozzle-to-Case Joint	75°F	68°F	67°F

\*Launch commit criteria (LCC) contingency temperature in the event of heater failure

Note: Calculation includes all standard repair conditions