CR-184050

TWR-17545
Vol IV

SPACE SHUTTLE
Solid Rocket Motors
Thiokol Corporation

Flight Set 360L006 STS-34 Field Joint Protection System, Thermal Protection System, and Systems Tunnel Components Volume IV–Final Report

August 1990

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Thiokol CORPORATION

SPACE OPERATIONS

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TWR-17545
Vol IV

Flight Set 360L006 STS-34 Field Joint Protection System, Thermal Protection System, and Systems Tunnel Components Final Report Volume IV

August 1990

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CONTENTS

FIGURES

ACRONYMS

DWV	dielectric withstanding voltage
FJPS	field joint protection system
GEI	ground environment instrumentation
IFA	in-flight anomaly
IPR	interim problem report
JPS	joint protection system
KSC	Kennedy Space Center
LCC	launch commit criteria
LH	left hand
mA	milliampere
NSTS	National Space Transportation System
OMI	Operations Maintenance Instructions
OMRSD	Operations and Maintenance Requirements and Specification Document
PEEL	postflight engineering evaluation limits
PEEP	Postflight Engineering Evaluation Plan
PR	problem report
RH	right hand
RSRM	redesigned solid rocket motor
SIT	systems integration test
SRB	solid rocket booster
SSME	space shuttle main engine
STS	space transportation system
TPS	thermal protection system
V	volt

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INTRODUCTION

Two redesigned solid rocket motors (RSRM), designated 360L006A and 360L006B, as part of NASA Space Shuttle Mission STS-34, were launched from Kennedy Space Center (KSC) on 18 October 1989. The three field joints on each motor, a total of six field joints, were protected by the field joint protection system (FJPS) shown in Figure 1. The FJPS is used to keep the field joint O-rings above the minimum launch commit criteria (LCC) temperature during the launch countdown, to keep rainwater from entering the field joint, and to protect the joint components from aerodynamic heating during flight. The igniter-to-case joint on each RSRM was fitted with an igniter heater to keep the igniter seals above minimum LCC temperature requirements during launch countdown (Figure 2).

The ground environment instrumentation (GEI) and heater power cables are protected by the thermal protection system (TPS). The purpose of the TPS is to protect the GEI and heater systems from aeroheating during flight.

After booster separation and splash down, the boosters were recovered and towed to KSC Hangar AF for postflight inspection and disassembly. The FJPS, TPS, systems tunnel, and igniter heater installation inspections were performed per Postflight Engineering and Evaluation Plan (PEEP) TWR-50050, Vol I (Reference 1).

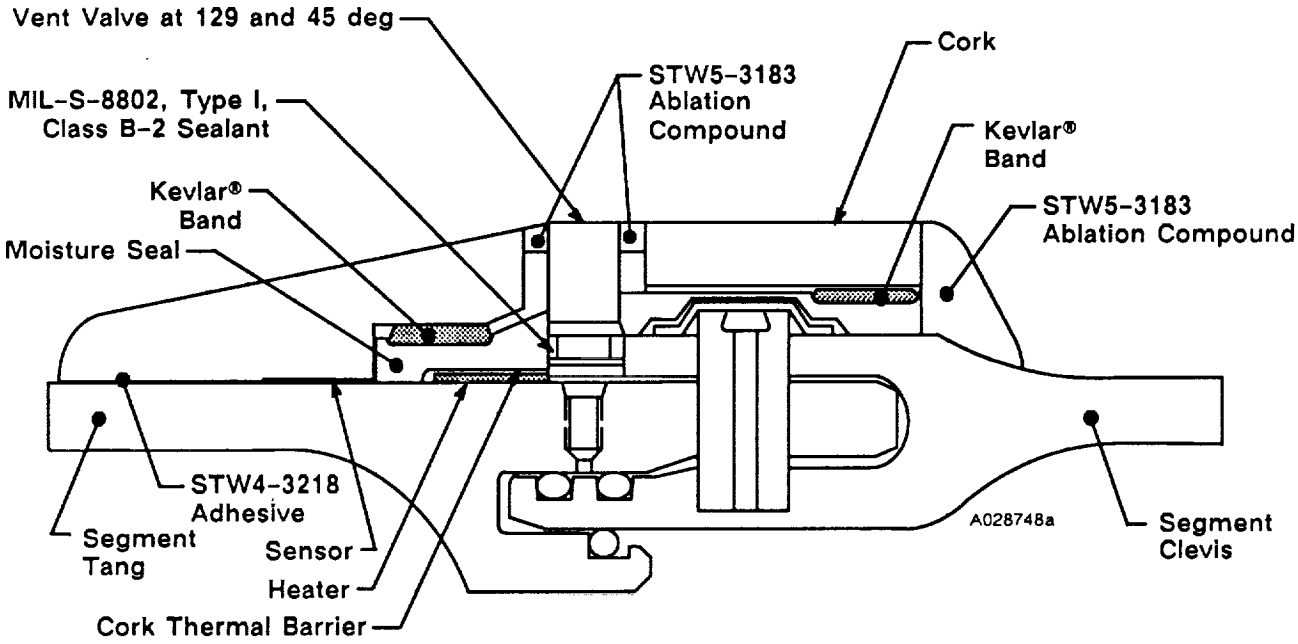
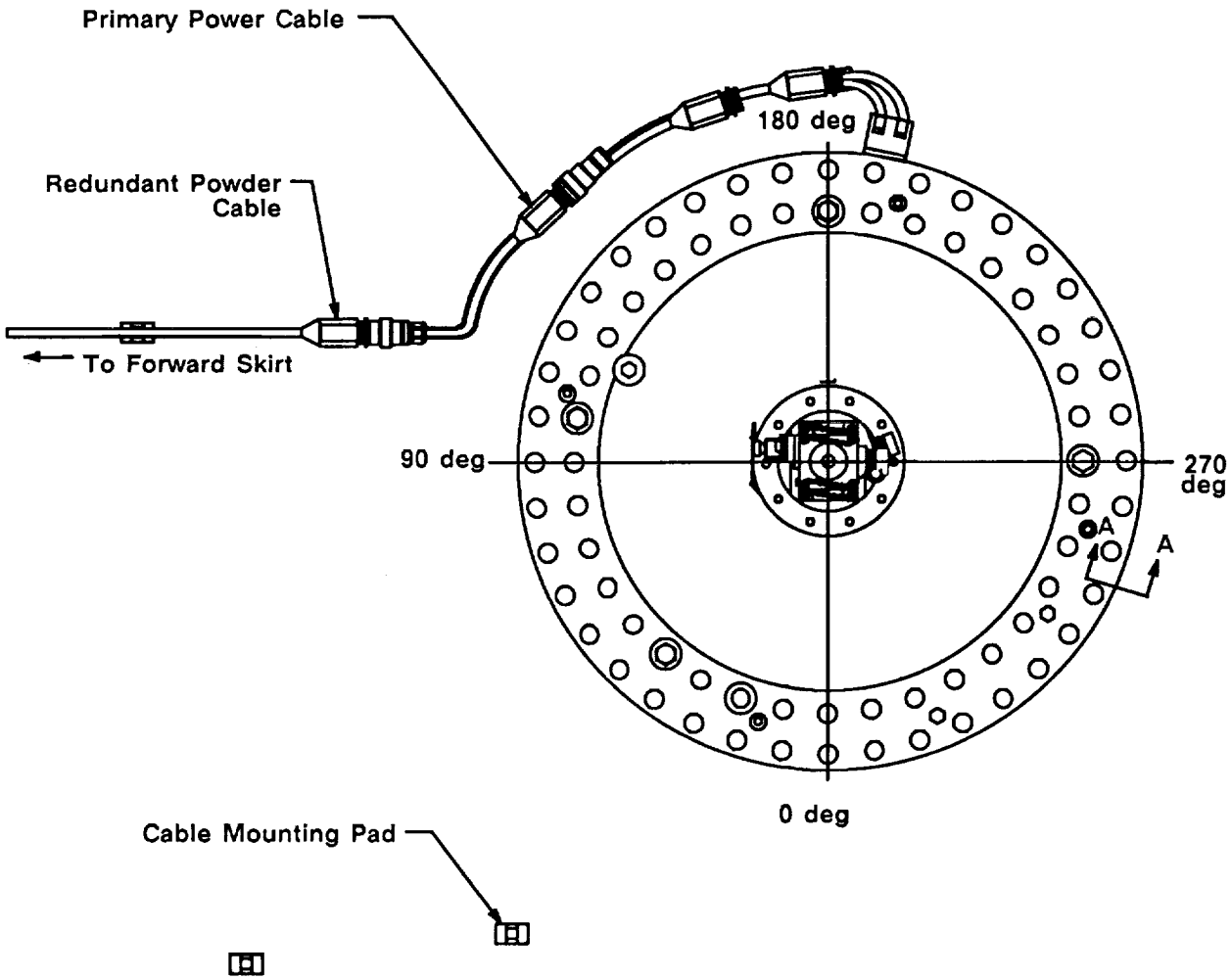


Figure 1. Field Joint Protection System



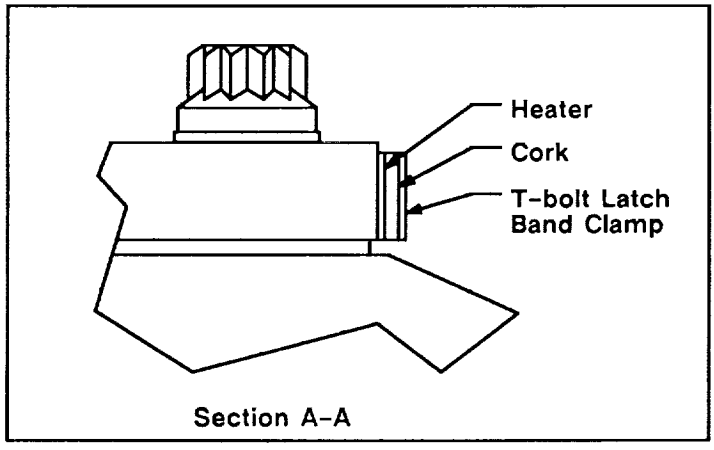


Figure 2. Igniter-to-Case Joint Heater Configuration

A024403a

2

OBJECTIVE

The objective of this report is to document any heater anomalies during the launch countdown and any anomalies to the FJPS, TPS, or systems tunnel components during flight and recovery operations. This report will also address all "squawks" or problem reports (PR) initiated during postflight evaluation.

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SUMMARY

Postflight assessment results indicate that all TPS and systems tunnel components were in excellent condition, as compared to previous flights, with typical flight heat effects and erosion. No squawks or PRs were written against the TPS or systems tunnel. There were a total of sixteen aft edge hits, eight on each motor; the largest missing piece of TPS cork measured 4 by 1.5 by 0.25 inch. Each hit left a clean substrate, indicating that the damage was caused by nozzle severance debris/ water impact. No postflight engineering evaluation limits (PEEL) requirements or NSTS debris criteria for missing TPS were violated.

One unbond measuring 5.0 in. circumferentially by 1.0 in. axially was found on the left hand (LH) center field joint K5NA closeout. The observation was elevated to an in-flight anomaly (IFA), STS-34-M-4, by the NASA Ice/Debris team. This condition was caused by impact damage to the case, as evidenced by a black streak the same width as the unbound and deformation of the K5NA aft edge. It was determined that the unbond occurred after booster separation and no corrective action was taken.

The RH center field joint heater failed the dielectric withstanding voltage (DWV) test after joint closeout. The heater was then disabled by opening the circuit breaker, and the redundant heater was used. Postflight evaluation of the primary heater discovered a 2,900-ohm short between the primary heater and the heater shield. The redundant heater performed nominally during the launch countdown.

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CONCLUSIONS/RECOMMENDATIONS

The JPS heaters performed as expected and maintained the field joint temperatures within the LCC required range during launch countdown. Postflight inspection verified that the TPS, FJPS, and systems tunnel all performed as designed with typical flight heat effects and erosion. The anomaly observed on the FJPS occurred after booster separation and had no impact on flight safety or schedule

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DISCUSSION

5.1 PREFLIGHT HEATER CONTROL SYSTEM AND PERFORMANCE

The field joint heaters and igniter-to-case joint heaters performed nominally during the launch countdown. No LCC thermal violations occurred during the LCC timeframe.

The igniter heaters were activated between L-24 hours and L-4 hours and 50 minutes and maintained the joints within the LCC temperature limits of 66° to 123°F. The heaters were deactivated approximately 50 minutes earlier than specified in the Operations and Maintenance Requirements and Specification Document (OMRSD). The early deactivation resulted in an interim problem report (IPR), which was dispositioned by a waiver of the OMRSD. Because of the short launch window, an effort was made to perform launch sequence steps at the earliest time allowed by the Operations Maintenance Instructions (OMI). Although the appropriate OMRSD requirements are referenced in the OMI steps, no actual mention is made of the requirement that igniter heater deactivation is not to be performed prior to L-4 hours. Therefore, igniter heater power removal was performed at the earliest possible moment: L-4 hours and 50 minutes. The result of the early deactivation was negligible due to the warm ambient temperatures prior to launch.

The field joint heaters were activated between L-11 hours, 11 minutes and L-1 minute and maintained the joints within the LCC temperature limits of 85° to 122°F. Of the 24 sensors, 23 recorded temperatures in the expected range. The LH center field joint temperature sensor located at 195 deg showed an inaccurate reading. The sensor was severed prior to the systems integration test (SIT), and was deleted from the control logic of the field joint heater. The loss of the single sensor did not violate the LCC requirement that two of the four sensors per heater be operational, and heater control was not affected.

The RH center field joint heater failed the DWV test after installation and joint closeout. The test requires that the heater and cabling exhibit no more than 1 mA current leakage when a 1,500 V electrical potential is applied element-to-element and element-to-shield. The RH center field joint primary heater failed the 1 mA requirement when only 100 V was applied. Due to the severity of the failure, the heater was disabled by opening the circuit breaker and the redundant heater was activated. The redundant heater passed the DWV test and performed nominally during the launch countdown. Postflight evaluation of the primary heater revealed a 2,900-ohm short between the primary heater and the heater shield. The exact cause of failure was not positively identified; however, microscopic examination of the heater revealed a metallic sliver in the heater shield which could have contributed to the failure. A similar failure of a secondary field joint heater on Flight 4 was attributed to a short between the heater power cable and the connector shell.

5.2 POSTFLIGHT INSPECTION OF FJPS, TPS, SYSTEMS TUNNEL, AND IGNITER HEATER INSTALLATION

The condition of both motors was similar to previous flight motors; most of the heat effects occurred on the inboard side of the aft segments. These areas experience high aerodynamic heating normal to protuberance components. They also receive the high plume radiation and base recirculation heating induced by the adjacent solid rocket boosters (SRB) and space shuttle main engine (SSME) on the aft-facing surfaces. There was slight charring of the TPS over the GEI cabling runs in this area, typical of previous flights.

5.2.1 Field Joint Protection System

The FJPS was in good condition overall. There were no signs of ablation on any of the joint protection systems (JPS), and only slight paint blistering on the cork cover. The paint on the K5NA closeout aft of the cork was also slightly darkened and blistered, with occasional pitting. This condition was typical of previous flights and was probably due to aerodynamic heating and the result of nozzle severance debris and water impact.

One unbond, measuring 5.0 in. circumferentially by 1.0 in. axially, was noted at the 0-deg location on the LH center field joint K5NA closeout. The observation was

elevated to an IFA (STS-34-M-4) by the NASA Ice/Debris team (Appendix A). The K5NA was unbonded from both the motor case wall and the JPS cork but remained in place. Impact damage to the case was evidenced by a black streak the same width as the unbound. The aft edge of the K5NA closeout was deformed at the unbond location, but there was no soot underneath. Both the unbond and the streak were attributed to either burning debris from the nozzle severance system or water impact. Minor divots caused by debris have been seen on previous flights, but this is the first occurrence of a K5NA unbond. Since the unbond occurred after booster separation, there is no impact relative to flight safety for future missions.

5.2.2 Thermal Protection System

TPS performance was excellent during flight operation, with typical heat effects and no ablation. There were no IFAs, squawks, or PRs written against the TPS.

There were a total of sixteen aft edge hits, eight on each motor. Of the TPS cork pieces that were missing, each left a clean substrate, which indicates that the hits were caused by nozzle severance debris/water impact. Six of these cork pieces exceeded 0.07 $in.^3$, but none violated NSTS debris criteria for missing TPS since they were not lost during ascent. The largest GEI cork piece missing was approximately 4.0 by 1.5 by 0.25 inch, or 1.5 $in.^3$. This piece was located at Station 1410 on the LH aft center segment at approximately 270 deg. It was either a handling or a splashdown scrape and left a clean substrate.

5.2.3 Systems Tunnel

The cork TPS adjacent to the systems tunnel floor plate was in excellent condition. There was very little paint blistering, and all K5NA closeouts over cables and tunnel seams were in excellent condition. No IFAs, squawks, or PRs were written against the systems tunnel.

5.2.4 Igniter Heater and Forward Dome Power Cable Installation

Postflight inspection of the igniter heater installation and power cables revealed no anomalies. The igniter heater, cork, and band clamp were removed and inspected at Hangar AF with no anomalies noted.

APPENDIX A

LH Center Field Joint Anomaly Documentation

Postfire Observation Report No. 360L006A-13
In-Flight Anomaly Report No. STS-34-M-4
Postfire Anomaly Report No. 360L006A-13
Program Requirements Control Board Directive No. S44804J
24-Hour Report DR 4-5/179
Memo: Closure of Significant Problem Report DR 4-5/179

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POSTFIRE OBSERVATION RECORD (PFOR) A-4
Field Joint External Insulation Condition

Motor No.: [illegible] Side: ☑ Left (A) ☐ Right (B) Date: 10-21-[illegible]

Inspector(s): [illegible]

Joint: ☐ Forward Skirt (FSK) ☐ Forward (FWD) ☑ Center (CTR) ☐ Aft (AFT) ☐ Aft Skirt (ASK)

Field Joint External Insulation Observations:

	Yes	No	Comment #
A. Charred/Heat Affected Material (HTAFF)?	✓		2
B. Missing TPS Material > 0.7 cu. in. Due To Ascent/Motor Operation (TPSVD)?		✓	
C. Missing TPS Material > 0.7 cu. in. Due To Reentry/Debris/Water Impact (TPSDM)?		✓	
D. Unbonds/Cracks (DEBND)?	✓		1
E. Evidence of Water Leakage From Field Joint (WATER)?		✓	
F. Missing/Unbonded Vent Valves (MISSG)? (FWD, CTR, and AFT joints only.)		✓	

Record the following if any of the above conditions exist:

Condition (Observation Code)	Starting Station Location (in.)	Ending Station Location (in.)	Starting Degree Location (deg.)	Ending Degree Location (deg.)	Circum-ferential Width (in.)	Axial Length (in.)	Radial Depth (in.)	Volume (in.^{3})

Notes / Comments

1. KSNA on aft edge of cork is unbonded but still in place at 0°. It is due to impact damage because there is a streak on the case. The unbond measures 5 in. circ. by 1.0 in axially. The evidence of debris impact is obvious because the black streak on the case is as wide as the unbond (5 in circ) and the aft edge of the KSNA at the unbond is deformed. There is no soot in the unbond.
2. Normal heat effects and minor impact damage on KSNA on aft edge of cork due to debris from motor chugging.

Clarification sheet(s) attached? ✓ no ______ yes (Provide clarification number(s).)

REV. ___

ORIGINAL PAGE IS OF POOR QUALITY

DOC NO. | VOL
SEC | PAGE

NOV 21 '89 12:26 FROM SRM PROJECT OFFICE

FLIGHT PROBLEM REPORT

No. STS-34-M-4

Statement of Problem:

A K5NA unbond was noted on the aft edge of the 360L006A.

Discussion:

The unbond was located at the 0 degree location and measured 8 inches circumferentially. The K5NA was unbonded from both the motor case wall and JPS cork but remained in place. The aft edge of the K5NA was deformed, indicating contact with some object(s).

Conclusions:

A scrape was found just aft of the K5NA and in line with the 0 degree location, indicating contact was made with some object(s). The scrape was approximately the same width as the unbond. Due to the geometry involved, it is unlikely that potential debris from the ET or orbiter could have caused the noted condition. As a result, both the scrape and the unbond are attributed to debris from the nozzle jettison or possibly water impact.

Corrective Action:

Minor divots to the JPS/K5NA have been observed on previous flights with water impact or nozzle jettison debris being noted as the cause of failure in the closure rationale. (Reference TWR 50080 "Postfire Engineering Evaluation Plan"). Inspections of JPS and K5NA closeout are performed as part of the regular pre-flight assembly activities.

Effects on Subsequent Missions:

Since the unbond occurred after booster separation, there is no debris hazard to the orbiter and no impact relative to flight safety for future missions.

Approved: Royce E. Mitchell 11/21/89
SRB Project Manager / Date

Personnel Assigned:

MTI: Gary Stephens/James Seiler MSFC: L. Kenks 11/21/89

Resolution: The SRM Project recommends Lower Level closure of this item. The problem (tracked via Significant Problem Report (SPR)# DR4-S/179) has been CLOSED in the MSFC PRACA system for STS-33R and subs on 11/15/89.

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OF POOR QUALITY

POSTFIRE ANOMALY RECORD (PFAR)

1. PFAR NUMBER	3. INSPECTION LOCATION	4. REFERENCE SQUAWK NUMBER	5. REFERENCE PR NUMBER
360L006A-13	KSC X T-24/T-97	N/A	N/A
2. SRM MOTOR NUMBER	H-7 A-2	6. REFERENCE IFA NUMBER	7. REFERENCE SPR NUMBER
360L006A		STS-34-M-4	DR4-5/179

8. TITLE
UNBONDED K5NA IN LH CENTER FIELD JOINT JPS

9. CLASSIFICATION
OBSERVATION X MINOR ANOMALY --- MAJOR ANOMALY --- CRITICAL ANOMALY ---

10. PART NUMBER	11. SERIAL NUMBER	12. PART DESCRIPTION
N/A	N/A	K5NA ABLATION COMPOUND STW5-3183

13. REPORTED BY (NAME / ORGANIZATION / OBSERVATION DATE)
S. E. MANZ / THERMAL INSULATION DESIGN ENGINEERING / 10/21/89

14. RESPONSIBLE COMPONENT TEAM / PROGRAM MANAGER
JPS / G. L. STEPHENS

15. RESPONSIBLE PROJECT ENGINEER (NAME / ORGANIZATION)
J. M. SEILER / SYSTEMS INTEGRATION AND ENGINEERING

16. RESPONSIBLE DESIGN ENGINEER (NAME / ORGANIZATION)
C. L. PROKOP / STAGE HARDWARE DESIGN

17. DESCRIPTION (ATTACH PFOR, FIGURES, PHOTOGRAPHS, ETC.)
K5NA on the aft edge of the center field joint JPS was unbonded but still in place at 0 degrees. The unbond measured 5.0 inches circumferentially by 1.0 inches axially. Debris impact was evidenced by a black streak on the case at the unbond location having the same width as the unbond. The unbonded K5NA was deformed but there was no soot found underneath.

18. JUSTIFICATION OF CLASSIFICATION (POSTFIRE ENGINEERING EVALUATION LIMITS)
Not a design issue, condition caused by debris impact during reentry.

19. CAUSE
Obvious debris impact. Debris source could have been created at nozzle severance or water impact.

20. RECOMMENDED CORRECTIVE ACTION
None.

21. ANOMALY APPROVAL SIGNATURE
RPRB SECRETARY: /S/S. T. MUNSON DATE: 11/16/89

22. OBSERVATION/ANOMALY APPROVAL SIGNATURES
PE: /S/J. M. SEILER DATE: 11/16/89
PM: /S/G. L. STEPHENS DATE: 11/21/89

23. RESULTS OF RECOMMENDED CORRECTIVE ACTION
N/A

24. REPORT RESULTS TO RPRB? YES --- NO X ---

25. RPRB CLOSURE SIGNATURE
(REQUIRED ONLY IF BLOCK 24 CHECKED "YES")
RPRB SECRETARY: N/A DATE: N/A

26. OBSERVATION/ANOMALY CLOSURE SIGNATURE
PM: /S/G. L. STEPHENS DATE: 11/21/89

27. ORIGINATION DATE	28. REQUIRED STATUS DATE	29. PR CLOSURE DATE	30. PFAR CLOSURE DATE
11/08/89	11/02/89		11/21/89

REV. 3/28/89

PCIN 44804	NSTS PROGRAM REQUIREMENTS CONTROL BOARD DIRECTIVE - LEVEL II	PAGE 01 OF 01
PRCBD S44804J		PRCB DATE #

CHANGE TITLE
A K5NA UNBOND WAS NOTED ON THE AFT EDGE OF THE 360L006 (IFA STS-34-M-4)

CHANGE PROPOSAL(S) NO. AND SOURCE	DOCUMENTS AFFECTED (NO.,TITLE,PARA)
STS-34 ANOMALY TRACKING LIST FLIGHT PR. NO. STS-34-M-4	
INITIATED BY: MSFC-EH44/L. HANKS	SUBMITTED BY: MSFC-SA51/R. MITCHELL

LEVEL II BASELINE CHANGE DIRECTION: OPR: WA MBE/AR
BOARD:OSB

PRCBD S44804J IS ISSUED TO AUTHORIZE THE CLOSEOUT OF STS-34 ANOMALY NUMBER STS-34-M-4 PER THE ATTACHED PAGE(S). IFA STS-34-M-4 IS BEING DISPOSITIONED OUTSIDE THE REGULAR PRCB BASED ON ADEQUATE DISCUSSION AT THE STS-33 FRR ON NOVEMBER 6-7, 1989. THIS DIRECTIVE LEVIES NO FORMAL PROGRAM ACTION.

EFFECTIVITY: STS-34

LEVEL II IMPACTS AUTHORIZED BY THIS DIRECTION: --WEIGHT: NONE, --SCHEDULE: NONE, --COST: NONE.

ACTIONS:
NO FORMAL PROGRAM ACTION REQUIRED.

THIS PRCBD WAS PROCESSED OUTSIDE THE FORMAL LEVEL II PRCB.

AUTHORIZATION:

Kay A. Greene — 12-8-89

CHAIRMAN, LEVEL II PRCB — DATE

BARS RPT 8020 BARS NSTS FORM 4003

Thiokol CORPORATION

SPACE OPERATIONS

3 November 1989
8502:FY90:M191/DJB

TO: G. B. Thompson, Manager
RSRM System Safety

CC: See distribution

FROM: D. J. Braithwaite - Ext. 6904
RSRM Liaison/Problem Reporting

SUBJECT: 24-Hour Report DR4-5/179, "Center Field Joint Aft Edge K5NA Unbond, 360L006 (STS-34A), LH (A)"

REFERENCE: IFA: STS-34-M-4

A K5NA unbond was found on the aft edge of the center field joint of 360L006A.

This problem has been classified as an In-Flight Anomaly, and is therefore reportable to NASA per DPD 400, Rev. C, DR4-5.

The subject 24-Hour report has been coordinated with the cognizant Project Engineer and Program Manager, and will be followed by 5-Day and 21-Day written reports and/or a closure recommendation memo.

Dave Braithwaite
D. J. Braithwaite

Concurrence:

K. A. Dixon
K. A. Dixon, Supervisor
RSRM Liaison/Problem Reporting

J. M. Seiler
J. M. Seiler, Systems Integration Project Engineer

G. L. Stephens 11-3-89
G. L. Stephens, Program Manager

SIGNIFICANT PROBLEM REPORT DR4-5/179

24-HOUR REPORT

PROBLEM TITLE: Center Field Joint Aft Edge K5NA Unbond, 360L006 (STS-34A), LH (A)

Reference: In-Flight Anomaly STS-34-M-4

A. NATURE OF THE PROBLEM:

A K5NA unbond was noted on the aft edge of the 360L006A center field joint. The unbond was located at the 0 degree location and measured 5 inches circumferentially. The K5NA was unbonded from both the case wall and JPS cork. The aft edge of the K5NA was deformed, indicating some type of impact.

B. IMPACT OR POTENTIAL IMPACT OF THE PROBLEM:

None. Minor impact damage to the K5NA caused by water or debris impact is not uncommon. This condition has no effect on flight safety or segment reusability.

C. DATE OF OCCURRENCE:

18 October 1989
(Identified as a PAS report 3 November 1989)

D. LOCATION OF ARTICLE AT TIME OF OCCURRENCE:

Detected during postflight assessment, Hanger AF, Kennedy Space Center.

E. TEST OR OPERATION BEING PERFORMED AT TIME OF OCCURRENCE:

Detected during postflight assessment at KSC.

F. CONDITIONS AT TIME OF OCCURRENCE:

Unknown.

G. ARTICLE:

Stock Number: 5752
Part Name: Ablation compound, cork-filled (K5NA)

H. CONTRACTOR DELIVERABLE ITEM DESCRIPTION:

RSRM Case, 360L006A

I. DESCRIPTION OF FAILURE INCLUDING COMPARISON OF EXPECTED EVENTS WITH ACTUAL EVENTS:

A K5NA unbond was found on the aft edge of the center field joint on 360L006A. The K5NA was unbonded from both the case wall and cork. Minor divots caused by debris have been seen on previous flights, but this is the first occurrence of a K5NA unbond.

J. CRITICALITY WITH RELATIONSHIP TO MISSION EFFECTS:

Criticality 3.

K. CAUSE OF FAILURE:

A scrape was found just aft of the unbond area and in line with the 0 degree location, indicating contact with some object(s). The scrape was approximately the same width as the unbond. Debris from the nozzle jettison or water impact are considered to be the cause for both the scrape and unbond. Due to the geometry involved it is unlikely that debris from the orbiter or external tank could have caused the noted condition.

Thiokol CORPORATION
SPACE OPERATIONS

Charles A. Speak
Vice President, RSRM Program Management

06 November 1989
E600-FY90-362

George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Attention Mr. R. E. Mitchell, SA42

Gentlemen:

Subject: Closure of Significant Problem Report, DR 4-5/179

Reference: Memo 8502:FY90:M192/DJB, B. Thompson from D. Braithwaite, DR 4-5/179, "Center Field Joint Aft Edge K5NA Unbond, 360L006 (STS-34A), LH (A)", dated 03 November 1989

The information and rationale presented in the referenced memo are provided to support closure of the subject problem.

If you have any questions regarding this matter, please contact Brent Thompson at Thiokol on extension 3356.

Very truly yours,

C. A. Speak

CAS:RMP/lh

Encl: a/s
cc: F. Brasfield TC/MSFC
B. Loden, CALSPAN
K. Henson, SA51
S. Coleman, SA52
F. Bingham, 851
T. Johnson, E62C
B. Papasian
K. Dixon, 851
E. Skrobiszewski, K68
R. Hurst, 851
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B. Thompson

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Thiokol CORPORATION

SPACE OPERATIONS

3 November 1989
8502:FY90:M192/DJB

TO: G. B. Thompson, Manager
Systems Safety

CC: R. R. Bowman, C. A. Speak, S. B. Kulkarni
D. E. Thompson, R. M. Rasmussen,
M. T. Allison, T. L. Johnson, J. H. Keller

FROM: D. J. Braithwaite, Ext. 6904
RSRM Liaison/Problem Reporting

SUBJECT: Closure Recommendation for Significant Problem Report DR4-5/179 **"Center Field Joint Aft Edge K5NA Unbond, 360L006 (STS-34A), LH (A)"**

REFERENCE: In-Flight Anomaly No. STS-34-M-4

BACKGROUND

A K5NA unbond was noted on the aft edge of the 360L006A center field joint. The unbond was located at the 0 degree location and measured 5 inches circumferentially. The K5NA was unbonded from both the case wall and JPS cork.

CAUSE OF PROBLEM

The aft edge of the K5NA was deformed indicating some type of debris impact. A scrape was found just aft of the unbond area and in line with the 0 degree location, indicating contact with some object(s). The scrape was approximately the same width as the unbond. Both the scrape and the K5NA unbond are attributed to debris from the nozzle jettison or water entry. Minor divots caused by debris have been seen on previous flights. Due to the geometry involved it is unlikely that debris from the external tank or orbiter could have caused the noted condition.

P.O. Box 707, Brigham City, UT 84302-0707 (801) 863-3511

CLOSURE RATIONAL

It is requested that the subject SPR be closed based on the following:

- Deformation of the K5NA and the scrape on the case wall indicate that the unbonds were caused by impact.
- Minor damage to the K5NA caused by debris or water impact is not uncommon (reference - TWR 50050 "Postfire Engineering Evaluation Plan").
- Unbonds such as this (occurring during reentry) have no affect on flight safety or segment reusability.

If you have any questions about this issue please contact Dave Braithwaite at the extension listed above.

D. J. Braithwaite

K. A. Dixon, Supervisor
RSRM Liaison/Problem Reporting

J. M. Seiler
Systems Integration Project Engineer

11-3-89
G. L. Stephens
Program Manager

for
M. A. Kahn, Director
Safety, Reliability & Quality Assurance

REFERENCES

1. TWR-50050 VOL. I, Book 1, Revision A, 'KSC Postflight Engineering Evaluation Plan (Internal and External Insulation)', L.E. MacCauley and T. Morgan, 21 November 1989.

2. TWR-17430, 'KSC Ten-Day Postflight Hardware Evaluation Report For 360L006 (RSRM-6, STS-34)', L.E. MacCauley, 10 November 1989.

3. TWR-17545 VOL. I, 'Flight Motor Set 360L006 (STS-34) Final Report', D.M. Garecht, 27 april 1990.

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