Countdown Data Book

Thiokol CORPORATION

SPACE OPERATIONS

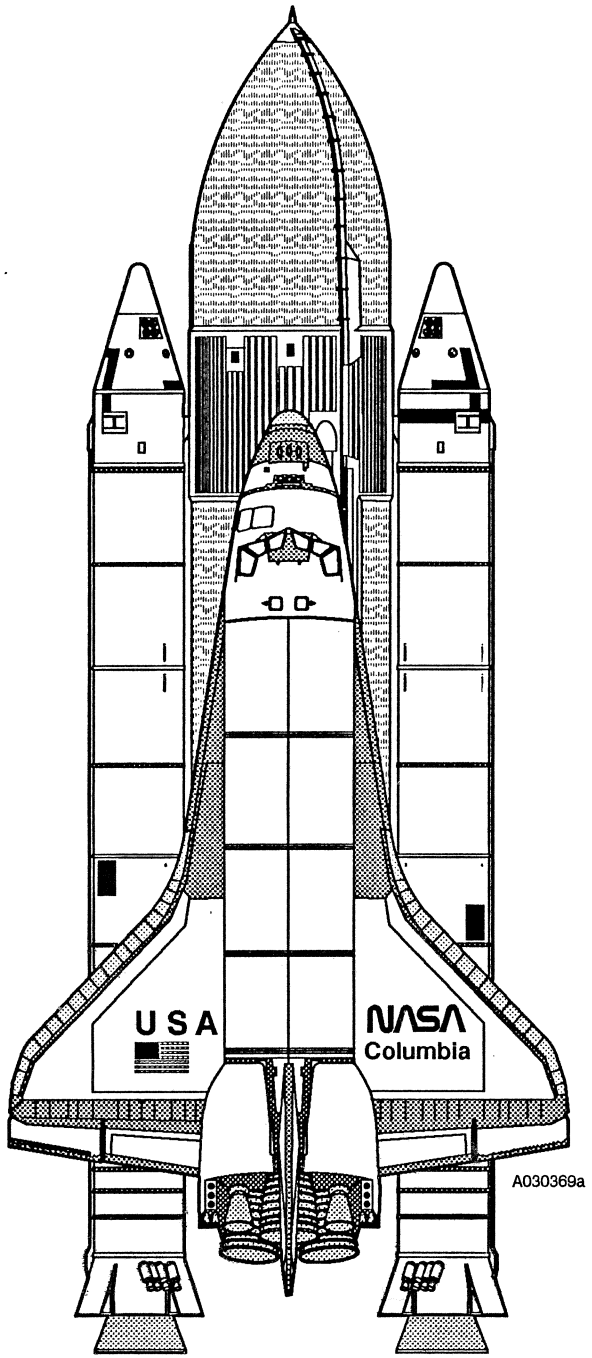
P. O. Box 707, Brigham City, UT 84302-0707 (801) 863-3511

Attention

The Countdown Data Book has been reformatted into two separate sections. The first section contains flight–specific information and will be provided separately prior to each launch. The second section contains launch countdown requirements and general RSRM information. It is divided into components to facilitate real–time problem solving. The second section is expected to change infrequently, and change pages will be provided when necessary. This revised format offers significant cost savings.

Please save this revised Countdown Data Book in a safe place. You will only receive revisions to the flight–specific section prior to each flight.

TWR-64849
ECS SS6036



360T034 (STS-58) Data Book

October 1993

Thiokol CORPORATION

SPACE OPERATIONS

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

Introduction

Mission Summary

Launch Date:	14 October 1993		Orbiter:	Columbia (OV-102)
			MLP:	1
Lift Off Time:	10:53 EDT		Launch Pad:	39B, KSC
Launch Window:	10:53 - 13:00 EDT		Landing Sites:	
			NOM EOM	Edwards AFB, Ca
Crew:	Commander:	John Blaha	TAL	Ben Guerir, Morroco
	Pilot:	Rick Searfoss		Moron, Spain
	MS1:	Rhea Seddon		Zaragoza, Spain
	MS2:	Bill MacArthur	AOA	Edwards, AFB
	MS3:	David Wolf		
	MS4:	Shannon Lucid	Landing Date:	28 October 1993
	PS1:	Martin Fettman		

Orbit/Inclination: 153 nm / 39 degrees

Cargo Bay Payloads: SLS-2 (Spacelab Life Sciences-2)
SAREX-II (Shuttle Amateur Radio Experiment-II)

Next Mission

Designation:	360L023 (STS-61)
Current Launch Date:	30 November 1993 (U/R)
Launch Time:	04:30 EDT (U/R)
Orbiter:	Endeavour (OV-105)
Payload:	HST

Introduction

Key RSRM Countdown Events

EDT	Actual Time Remaining	Countdown Clock Time	Event
2330	L–83 hr 23 min	T–43 hr	S0007 call to station (CTS) 23:30 on 10 Oct 1993
0000	L–82 hr 53 min	T–43 hr	Start of Countdown
1600	L–66 hr 53 min	T–27 hr	Start 8 hr hold
0000	L–58 hr 53 min	T–27 hr	End 8 hr hold
0800	L–50 hr 53 min	T–19 hr	Start 8 hr hold
1600	L–42 hr 53 min	T–19 hr	End 8 hr hold
2400	L–34 hr 53 min	T–11 hr	Start 20 hr 33 min hold
0753	L–27 hr	T–11 hr	*SRB aft skirt purge activated (if required)**
1053	L–24 hr	T–11 hr	*Verify RSRM PMBT is acceptable**
1653	L–18 hr	T–11 hr	*Igniter joint heater activated* *(through T–9 min)*
2033	L–14 hr 20 min	T–11 hr	End 20 hr 33 min hold
2203	L–12 hr 50 min	T–9 hr 30 min	*SRB call to stations (CTS)*
2223	L–12 hr 30 min	T–9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
2253	L–12 hr 00 min	T–8 hr 40 min	SRB TVC power up
2333	L–11 hr 20 min	T–8 hr	*Joint heater system activated (through T–1 min)**
0133	L–9 hr 20 min	T–6 hr	Start 1–hr hold
0133	L–9 hr 20 min	T–6 hr	*Begin Level A support*
0133	L–9 hr 20 min	T–6 hr	LCC verification
0233	L–8 hr 20 min	T–6 hr	End 1–hr hold
0318	L–7 hr 35 min	T–5 hr 15 min	Start LH_2, fast fill (continue for 1 hr 30 min)
0323	L–7 hr 30 min	T–5 hr 10 min	Start LO_2, fast fill (continue for 2 hr 5 min)
0433	L–6 hr 20 min	T–4 hr	Verify SIIs (PIC resistant test)
0533	L–5 hr 20 min	T–3 hr	Stable LO_2/LH_2 replenish
0533	L–5 hr 20 min	T–3 hr	Start 2–hr hold
0633	L–4 hr 20 min	T–3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T–3 hr	Perform ice/debris inspection (Ice Team to pad)
0733	L–3 hr 20 min	T–3 hr	End 2–hr hold
0748	L–3 hr 5 min	T–2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
0748	L–3 hr 5 min	T–2 hr 45 min	Verify no LCC violations
0903	L–1 hr 50 min	T–1 hr 30 min	*OPT 75 percent reading calibration check**
0913	L–1 hr 40 min	T–1 hr 20 min	Contingency hold point (GMT delta adjust)
0948	L–1 hr 5 min	T–45 min	SRB and ET range safety system closed loop test

Introduction

Key RSRM Countdown Events (Cont)

EDT	Actual Time Remaining	Countdown Clock Time	Event
1013	L–40 min	T–20 min	Start 10–min hold
		T–20 min	HSC launch readiness check (on OIS 263)
1023	L–30 min	T–20 min	End 10–min hold
1028	L–25 min	T–15 min	*Aft skirt GN_2 high flow rate cleansing purge*
1034	L–19 min	T–9 min	Start 10–min hold
		T–9 min	NSTS operations manager launch readiness status check (on SSPO)
		T–9 min	*Case acreage LCC expire (after status check)*
1043	L–10 min	T–9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T–5)*
1044	L–9 min	T–9 min	End 10–min hold
		T–9 min	Initiate GLS auto sequence
		T–7 min 30 sec	Contingency hold point (prior to OAA retract)
		T–5 min	Contingency hold point (prior to S&A arm and APU start)
1048	L–5 min	T–5 min	Nozzle–to–case and field joint LCC expires (prior to S&A arm)
		T–5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T–5 min	APU power up (orbiter)
		T–5 min	Radio Net silence
		T–4 min	Contingency hold point (prior to SSME purge)
		T–2 min 55 sec	Contingency hold point (prior to LO_2 prepressurization)
		T–1 min 57 sec	Contingency hold point (prior to LH_2 prepressurization)
1052	L–1 min	T–1 min	*Field joint heater power off*
		T–31 sec	Contingency hold point (prior to auto sequence start)
	L–31 sec	T–31 sec	Go for auto sequence start
	L–28 sec	T–28 sec	SRB APU power up
	L–21 sec	T–21 sec	SRB gimbal profile check
	L–17.5 sec	T–17.5 sec	SRM igniter PIC arm command
	L–16 sec	T–16 sec	Gimbal test complete, nozzle–to–launch configuration
		T–16 sec	H_2O sound suppression system start
	L–11 sec	T–11 sec	S&A device armed verification, system inhibits off
	L–10 sec	T–10 sec	Free H_2 burnoff system ignition
	L–6.6 sec	T–6.6 sec	SSME 3 start
	L–6.5 sec	T–6.5 sec	SSME 2 start
	L–6.4 sec	T–6.4 sec	SSME 1 start
1053	L–0	T–0	*SRB Ignition*
			Launch period begins 10:53 EDT (based on 14 Oct 1993 Launch)**

* OMRSD event—specifics in Component Section of Countdown Data Book
** Contingency Launch Schedule on following page

Introduction
Launch Window

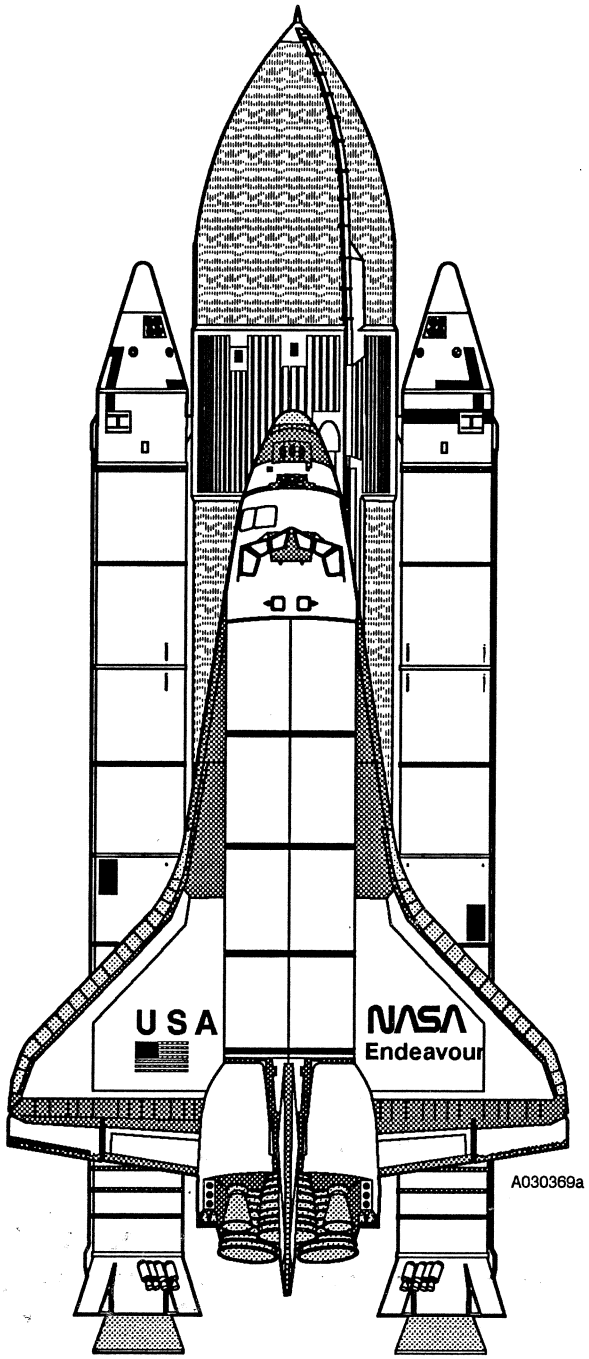
Launch Date	Launch Window Open (GMT)*	Launch Window Close (GMT)*
10/13/93	14:53	17:02
10/14/93	14:53	17:00
10/15/93	14:53	16:59
10/16/93	14:53	16:57
10/17/93	14:53	16:56
10/18/93	14:53	16:54
10/19/93	14:53	16:53
10/20/93	14:53	16:51

* Note: All times are in GMT unless otherwise specified.

EDT = GMT - 4 hours	EST = GMT - 5 hours
CDT = GMT - 5 hours	CST = GMT - 6 hours
MDT = GMT - 6 hours	MST = GMT - 7 hours
PDT = GMT - 7 hours	PST = GMT - 8 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)

TWR-60613
ECS SS4730



360L023 (STS-61) Data Book

December 1993

Thiokol CORPORATION

SPACE OPERATIONS

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

Introduction

Mission Summary

Launch Date:		01 December 1993	**Orbiter:**	Endeavour (OV-105)
			MLP:	1
Lift Off Time:		04:57 EST	**Launch Pad:**	39B, KSC
Launch Window:		04:57 - 06:04 EST	**Landing Sites:**	
			NOM EOM	KSC, Fla.
Crew:	Commander:	Dick Covey	TAL	Banjul, The Gambia
	Pilot:	Ken Bowersox		Moron, Spain
	MS1:	Kathy Thornton		Ben Guerir, Morroco
	MS2:	Claude Nicollier	AOA	Edwards, AFB
	MS3:	Jeff Hoffman		
	MS4:	Story Musgrave	**Landing Date:**	12 December 1993
	MS1:	Tom Akers	**Landing Time**	3:33 am EST

Orbit/Inclination: 320 nm / 28.45 degrees

Cargo Bay Payload: HST SM-01 (Hubble first servicing mission)

Next Mission

Designation:	360T035 (STS-60)
Current Launch Date:	20 January 1994
Launch Time:	07:16 EST
Orbiter:	Discovery (OV-103)
Payload:	WSF-1
	SPACEHAB-2

Introduction

Key RSRM Countdown Events

EST	Actual Time Remaining	Countdown Clock Time	Event
0830	L–68 hr 27 min	T–43 hr	**S0007 call to station (CTS) 08:30 on 28 Nov 1993**
0900	L–67 hr 57 min	T–43 hr	**Start of Countdown**
0100	L–51 hr 57 min	T–27 hr	**Start 4 hr hold**
0500	L–47 hr 57 min	T–27 hr	**End 4 hr hold**
1300	L–39 hr 57 min	T–19 hr	**Start 4 hr hold**
1700	L–35 hr 57 min	T–19 hr	**End 4 hr hold**
0100	L–27 hr 57 min	T–11 hr	**Start 13 hr 37 min hold**
0157	L–27 hr	T–11 hr	*SRB aft skirt purge activated (if required)**
0457	L–24 hr	T–11 hr	*Verify RSRM PMBT is acceptable**
1057	L–18 hr	T–11 hr	*Igniter joint heater activated* *(through T–9 min)*
1437	L–14 hr 20 min	T–11 hr	**End 13 hr 37 min hold**
1607	L–12 hr 50 min	T–9 hr 30 min	*SRB call to stations (CTS)*
1627	L–12 hr 30 min	T–9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
1657	L–12 hr 00 min	T–8 hr 40 min	**SRB TVC power up**
1737	L–11 hr 20 min	T–8 hr	*Joint heater system activated (through T–1 min)**
1937	L–9 hr 20 min	T–6 hr	**Start 1–hr hold**
1937	L–9 hr 20 min	T–6 hr	*Begin Level A support*
1937	L–9 hr 20 min	T–6 hr	**LCC verification**
2037	L–8 hr 20 min	T–6 hr	**End 1–hr hold**
2122	L–7 hr 35 min	T–5 hr 15 min	**Start LH_2, fast fill (continue for 1 hr 30 min)**
2127	L–7 hr 30 min	T–5 hr 10 min	**Start LO_2, fast fill (continue for 2 hr 5 min)**
2237	L–6 hr 20 min	T–4 hr	**Verify SIIs (PIC resistant test)**
2337	L–5 hr 20 min	T–3 hr	**Stable LO_2/LH_2 replenish**
2337	L–5 hr 20 min	T–3 hr	**Start 2–hr hold**
0037	L–4 hr 20 min	T–3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T–3 hr	**Perform ice/debris inspection (Ice Team to pad)**
0137	L–3 hr 20 min	T–3 hr	**End 2–hr hold**
0152	L–3 hr 5 min	T–2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
0152	L–3 hr 5 min	T–2 hr 45 min	**Verify no LCC violations**
0307	L–1 hr 50 min	T–1 hr 30 min	*OPT 75 percent reading calibration check**
0317	L–1 hr 40 min	T–1 hr 20 min	**Contingency hold point (GMT delta adjust)**
0352	L–1 hr 5 min	T–45 min	**SRB and ET range safety system closed loop test**

Key RSRM Countdown Events (Cont)

EST	Actual Time Remaining	Countdown Clock Time	Event
0417	L-40 min	T-20 min	Start 10-min hold
		T-20 min	HSC launch readiness check (on OIS 263)
0427	L-30 min	T-20 min	End 10-min hold
0432	L-25 min	T-15 min	*Aft skirt GN_2 high flow rate cleansing purge*
0438	L-19 min	T-9 min	Start 10-min hold
		T-9 min	NSTS operations manager launch readiness status check (on SSPO)
		T-9 min	*Case acreage LCC expire (after status check)*
0447	L-10 min	T-9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T-5)*
0448	L-9 min	T-9 min	End 10-min hold
		T-9 min	Initiate GLS auto sequence
		T-7 min 30 sec	Contingency hold point (prior to OAA retract)
		T-5 min	Contingency hold point (prior to S&A arm and APU start)
0452	L-5 min	T-5 min	Nozzle-to-case and field joint LCC expires (prior to S&A arm)
		T-5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T-5 min	APU power up (orbiter)
		T-5 min	Radio Net silence
		T-4 min	Contingency hold point (prior to SSME purge)
		T-2 min 55 sec	Contingency hold point (prior to LO_2 prepressurization)
		T-1 min 57 sec	Contingency hold point (prior to LH_2 prepressurization)
0456	L-1 min	T-1 min	*Field joint heater power off*
		T-31 sec	Contingency hold point (prior to auto sequence start)
	L-31 sec	T-31 sec	Go for auto sequence start
	L-28 sec	T-28 sec	SRB APU power up
	L-21 sec	T-21 sec	SRB gimbal profile check
	L-17.5 sec	T-17.5 sec	SRM igniter PIC arm command
	L-16 sec	T-16 sec	Gimbal test complete, nozzle-to-launch configuration
		T-16 sec	H_2O sound suppression system start
	L-11 sec	T-11 sec	S&A device armed verification, system inhibits off
	L-10 sec	T-10 sec	Free H_2 burnoff system ignition
	L-6.6 sec	T-6.6 sec	SSME 3 start
	L-6.5 sec	T-6.5 sec	SSME 2 start
	L-6.4 sec	T-6.4 sec	SSME 1 start
0457	L-0	T-0	*SRB Ignition*
			Launch period begins 04:57 EST (based on 01 Dec 1993 Launch)**

SAREX-II (Shuttle Amateur Radio Experiment-II)

* OMRSD event—specifics in Component Section of Countdown Data Book
** Contingency Launch Schedule on following page

Introduction

Launch Window

Launch Date	Launch Window Open (EST)*	Launch Window Close (EST)*
11/30/93	05:28	06:35
12/01/93	04:57	06:04
12/02/93	04:26	05:38
12/03/93	04:00	05:07
12/04/93	03:29	04:37
12/05/93	02:59	04:11
12/06/93	02:33	03:40
12/07/93	02:02	03:09

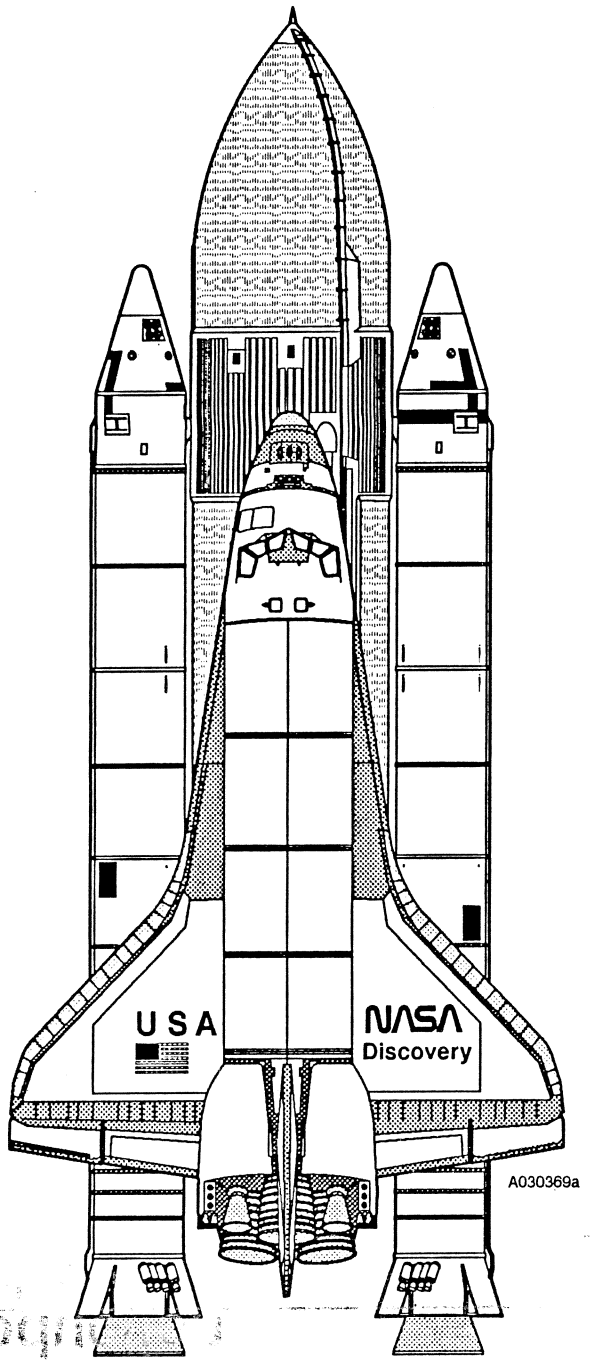
* Note: All times are in EST unless otherwise specified.

EDT = GMT - 4 hours	EST = GMT - 5 hours
CDT = GMT - 5 hours	CST = GMT - 6 hours
MDT = GMT - 6 hours	MST = GMT - 7 hours
PDT = GMT - 7 hours	PST = GMT - 8 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)

TWR-64848 Rev. C
ECS SS6036

W. HOLLIS LSO-420



360T033 (STS-51) Data Book

August 1993

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

Introduction

Mission Summary

Launch Date: 12 August 1993

Lift Off Time: 09:10 EDT

Launch Window: 09:10 - 10:07 EDT

Crew:
- Commander: Frank Culbertson
- Pilot: William Readdy
- MS1: Jim Newman
- MS2: Dan Bursch
- MS3: Carl Walz

Orbiter: Discovery (OV-103)
MLP: 3
Launch Pad: 39B, KSC

Landing Sites:
- NOM EOM: KSC, Fla
- TAL: Banjul, The Gambia; Ben Guerir, Morroco; Moron, Spain
- AOA: Edwards, AFB

Landing Date: 22 August 1993

Orbit/Inclination: 160 nm / 28.45 degrees

Cargo Bay Payloads:
- ACTS/TOS
- ORFEUS-SPAS
- LDCE

Next Mission

Designation: 360T034 (STS-58)
Current Launch Date: 10 Sept 1993
Launch Time: 11:29 EDT
Orbiter: Columbia (OV-102)
Payload: SLS-02/LM

Introduction

Key RSRM Countdown Events

EDT	Actual Time Remaining	Countdown Clock Time	Event
0900	L-72 hr 10 min	T-43 hr	**S0007 call to station (CTS) 09:00 on 12-Aug**
0930	L-71 hr 40 min	T-43 hr	**Start of Countdown**
0130	L-55 hr 40 min	T-27 hr	**Start 8 hr hold**
0930	L-47 hr 40 min	T-27 hr	**End 8 hr hold**
1730	L-39 hr 40 min	T-19 hr	**Start 4 hr hold**
2130	L-35 hr 40 min	T-19 hr	**End 4 hr hold**
0530	L-27 hr 40 min	T-11 hr	**Start 13 hr 16 min hold**
0610	L-27 hr	T-11 hr	*SRB aft skirt purge activated (if required)**
0910	L-24 hr	T-11 hr	*Verify RSRM PMBT is acceptable**
1506	L-18 hr	T-11 hr	*Igniter joint heater activated** *(through T-9 min)*
1850	L-14 hr 20 min	T-11 hr	**End 13 hr 16 min hold**
2020	L-12 hr 50 min	T-9 hr 30 min	*SRB call to stations (CTS)*
2040	L-12 hr 30 min	T-9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
2110	L-12 hr 00 min	T-8 hr 40 min	**SRB TVC power up**
2150	L-11 hr 20 min	T-8 hr	*Joint heater system activated (through T-1 min)**
2350	L-9 hr 20 min	T-6 hr	**Start 1-hr hold**
2350	L-9 hr 20 min	T-6 hr	*Begin Level A support*
2350	L-9 hr 20 min	T-6 hr	**LCC verification**
0050	L-8 hr 20 min	T-6 hr	**End 1-hr hold**
0135	L-7 hr 35 min	T-5 hr 15 min	**Start LH_2, fast fill (continue for 1 hr 30 min)**
0140	L-7 hr 30 min	T-5 hr 10 min	**Start LO_2, fast fill (continue for 2 hr 5 min)**
0250	L-6 hr 20 min	T-4 hr	**Verify SIIs (PIC resistant test)**
0350	L-5 hr 20 min	T-3 hr	**Stable LO_2/LH_2 replenish**
0350	L-5 hr 20 min	T-3 hr	**Start 2-hr hold**
0450	L-4 hr 20 min	T-3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T-3 hr	**Perform ice/debris inspection (Ice Team to pad)**
0550	L-3 hr 20 min	T-3 hr	**End 2-hr hold**
0605	L-3 hr 5 min	T-2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
0605	L-3 hr 5 min	T-2 hr 45 min	**Verify no LCC violations**
0720	L-1 hr 50 min	T-1 hr 30 min	*OPT 75 percent reading calibration check**
0730	L-1 hr 40 min	T-1 hr 20 min	**Contingency hold point (GMT delta adjust)**
0805	L-1 hr 5 min	T-45 min	**SRB and ET range safety system closed loop test**

Introduction

Key RSRM Countdown Events (Cont)

EDT	Actual Time Remaining	Countdown Clock Time	Event
0830	L-40 min	T-20 min	Start 10-min hold
		T-20 min	HSC launch readiness check (on OIS 263)
0840	L-30 min	T-20 min	End 10-min hold
0845	L-25 min	T-15 min	*Aft skirt GN_2 high flow rate cleansing purge*
0853	L-19 min	T-9 min	Start 10-min hold
		T-9 min	NSTS operations manager launch readiness status check (on SSPO)
		T-9 min	*Case acreage LCC expire (after status check)*
0900	L-10 min	T-9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T-5)*
0901	L-9 min	T-9 min	End 10-min hold
		T-9 min	Initiate GLS auto sequence
		T-7 min 30 sec	Contingency hold point (prior to OAA retract)
		T-5 min	Contingency hold point (prior to S&A arm and APU start)
0905	L-5 min	T-5 min	Nozzle-to-case and field joint LCC expires (prior to S&A arm)
		T-5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T-5 min	APU power up (orbiter)
		T-5 min	Radio Net silence
		T-4 min	Contingency hold point (prior to SSME purge)
		T-2 min 55 sec	Contingency hold point (prior to LO_2 prepressurization)
		T-1 min 57 sec	Contingency hold point (prior to LH_2 prepressurization)
0909	L-1 min	T-1 min	*Field joint heater power off*
		T-31 sec	Contingency hold point (prior to auto sequence start)
	L-31 sec	T-31 sec	Go for auto sequence start
	L-28 sec	T-28 sec	SRB APU power up
	L-21 sec	T-21 sec	SRB gimbal profile check
	L-17.5 sec	T-17.5 sec	SRM igniter PIC arm command
	L-16 sec	T-16 sec	Gimbal test complete, nozzle-to-launch configuration
		T-16 sec	H_2O sound suppression system start
	L-11 sec	T-11 sec	S&A device armed verification, system inhibits off
	L-10 sec	T-10 sec	Free H_2 burnoff system ignition
	L-6.6 sec	T-6.6 sec	SSME 3 start
	L-6.5 sec	T-6.5 sec	SSME 2 start
	L-6.4 sec	T-6.4 sec	SSME 1 start
0910	L-0	T-0	*SRB Ignition*
			Launch period begins 0910 EDT (based on 12 August 1993 Launch)**

* OMRSD event—specifics in Component Section of Countdown Data Book
** Contingency Launch Schedule on following page

Introduction

Launch Window

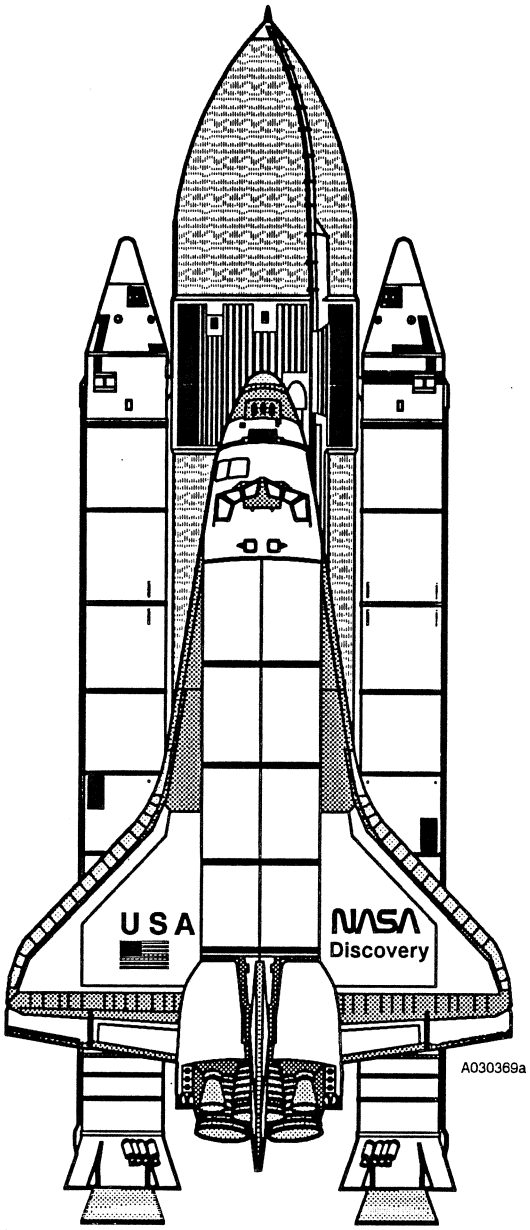
Launch Date	Launch Window Open (GMT)*	Launch Window Close (GMT)*
08/12/93	13:10	14:07

* Note: All times are in GMT unless otherwise specified.

EDT = GMT - 4 hours	EST = GMT - 5 hours
CDT = GMT - 5 hours	CST = GMT - 6 hours
MDT = GMT - 6 hours	MST = GMT - 7 hours
PDT = GMT - 7 hours	PST = GMT - 8 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)

TWR-64848
ECS SS6036



360T033 (STS-51) Data Book

July 1993

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

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Introduction

Mission Summary

Launch Date: 17 July 1993

Lift Off Time: 09:22 EDT

Launch Window: 09:22 - 10:45 EDT

Crew:		
	Commander:	Frank Culbertson
	Pilot:	William Readdy
	MS1:	Jim Newman
	MS2:	Dan Bursch
	MS3:	Carl Walz

Orbiter: Discovery (OV-103)
MLP: 3
Launch Pad: 39B, KSC

Landing Sites:
NOM EOM: KSC, Fla
TAL: Banjul, The Gambia
Ben Guerir, Morroco
Moron, Spain
AOA: Edwards, AFB

Landing Date: 27 July 1993

Orbit/Inclination: 160 nm / 28.45 degrees

Cargo Bay Payloads:
ACTS/TOS
ORFEUS-SPAS
LDCE

Next Mission

Designation: 360T034 (STS-58)
Current Launch Date: 10 Sept 1993
Launch Time: 11:29 EDT
Orbiter: Columbia (OV-102)
Payload: SLS-02/LM

Introduction

Key RSRM Countdown Events

EDT	Actual Time Remaining	Countdown Clock Time	Event
0900	L–72 hr 22 min		S0007 call to station (CTS) 09:00 on 14–July
0930	L–71 hr 52 min	T–43 hr	Start of Countdown
0130	L–55 hr 52 min	T–27 hr	Start 8 hr hold
0930	L–47 hr 52 min	T–27 hr	End 8 hr hold
1730	L–39 hr 52 min	T–19 hr	Start 4 hr hold
2130	L–35 hr 52 min	T–19 hr	End 4 hr hold
0530	L–27 hr 52 min	T–11 hr	Start 13 hr 32 min hold
0622	L–27 hr	T–11 hr	*SRB aft skirt purge activated (if required)**
0922	L–24 hr	T–11 hr	*Verify RSRM PMBT is acceptable**
1522	L–18 hr	T–11 hr	*Igniter joint heater activated**(through T–9 min)*
1902	L–14 hr 20 min	T–11 hr	End 13 hr 32 min hold
2032	L–12 hr 50 min	T–9 hr 30 min	*SRB call to stations (CTS)*
2052	L–12 hr 30 min	T–9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
2122	L–12 hr 00 min	T–8 hr 40 min	SRB TVC power up
2202	L–11 hr 20 min	T–8 hr	*Joint heater system activated (through T–1 min)**
0002	L–9 hr 20 min	T–6 hr	Start 1–hr hold
0002	L–9 hr 20 min	T–6 hr	*Begin Level A support*
0002	L–9 hr 20 min	T–6 hr	LCC verification
0102	L–8 hr 20 min	T–6 hr	End 1–hr hold
0147	L–7 hr 35 min	T–5 hr 15 min	Start LH_2, fast fill (continue for 1 hr 30 min)
0152	L–7 hr 30 min	T–5 hr 10 min	Start LO_2, fast fill (continue for 2 hr 5 min)
0302	L–6 hr 20 min	T–4 hr	Verify SIIs (PIC resistant test)
0402	L–5 hr 20 min	T–3 hr	Stable LO_2/LH_2 replenish
0402	L–5 hr 20 min	T–3 hr	Start 2–hr hold
0502	L–4 hr 20 min	T–3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T–3 hr	Perform ice/debris inspection (Ice Team to pad)
0602	L–3 hr 20 min	T–3 hr	End 2–hr hold
0617	L–3 hr 5 min	T–2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
0617	L–3 hr 5 min	T–2 hr 45 min	Verify no LCC violations
0732	L–1 hr 50 min	T–1 hr 30 min	*OPT 75 percent reading calibration check**
0742	L–1 hr 40 min	T–1 hr 20 min	Contingency hold point (GMT delta adjust)
0817	L–1 hr 5 min	T–45 min	SRB and ET range safety system closed loop test

Introduction

Key RSRM Countdown Events (Cont)

EDT	Actual Time Remaining	Countdown Clock Time	Event
0842	L–40 min	T–20 min	Start 10–min hold
		T–20 min	HSC launch readiness check (on OIS 263)
0852	L–30 min	T–20 min	End 10–min hold
0857	L–25 min	T–15 min	*Aft skirt GN_2 high flow rate cleansing purge*
0903	L–19 min	T–9 min	Start 10–min hold
		T–9 min	NSTS operations manager launch readiness status check (on SSPO)
		T–9 min	*Case acreage LCC expire (after status check)*
0912	L–10 min	T–9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T–5)*
0913	L–9 min	T–9 min	End 10–min hold
		T–9 min	Initiate GLS auto sequence
		T–7 min 30 sec	Contingency hold point (prior to OAA retract)
		T–5 min	Contingency hold point (prior to S&A arm and APU start)
0917	L–5 min	T–5 min	Nozzle–to–case and field joint LCC expires (prior to S&A arm)
		T–5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T–5 min	APU power up (orbiter)
		T–5 min	Radio Net silence
		T–4 min	Contingency hold point (prior to SSME purge)
		T–2 min 55 sec	Contingency hold point (prior to LO_2 prepressurization)
		T–1 min 57 sec	Contingency hold point (prior to LH_2 prepressurization)
0921	L–1 min	T–1 min	*Field joint heater power off*
		T–31 sec	Contingency hold point (prior to auto sequence start)
	L–31 sec	T–31 sec	Go for auto sequence start
	L–28 sec	T–28 sec	SRB APU power up
	L–21 sec	T–21 sec	SRB gimbal profile check
	L–17.5 sec	T–17.5 sec	SRM igniter PIC arm command
	L–16 sec	T–16 sec	Gimbal test complete, nozzle–to–launch configuration
		T–16 sec	H_2O sound suppression system start
	L–11 sec	T–11 sec	S&A device armed verification, system inhibits off
	L–10 sec	T–10 sec	Free H_2 burnoff system ignition
	L–6.6 sec	T–6.6 sec	SSME 3 start
	L–6.5 sec	T–6.5 sec	SSME 2 start
	L–6.4 sec	T–6.4 sec	SSME 1 start
0922	L–0	T–0	*SRB Ignition*
			Launch period begins 0922 EDT (based on 17 July 1993 Launch)**

* OMRSD event—specifics in Component Section of Countdown Data Book
** Contingency Launch Schedule on following page

Introduction

Launch Window

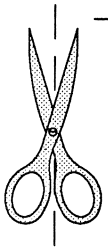
Launch Date	Launch Window Open (GMT)*	Launch Window Close (GMT)*
07/17/93	13:22	14:25
07/18/93	13:22	14:25
07/19/93	12:57	14:24
07/20/93	12:57	14:23
07/21/93	12:58	14:22
07/22/93	12:59	14:22
07/23/93	12:59	14:22
07/24/93	13:00	14:21
07/25/93	13:00	14:21
07/26/93	13:01	14:20
07/27/93	13:01	14:19
07/28/93	13:02	14:19

* Note: All times are in GMT unless otherwise specified.

EDT = GMT - 4 hours	EST = GMT - 5 hours
CDT = GMT - 5 hours	CST = GMT - 6 hours
MDT = GMT - 6 hours	MST = GMT - 7 hours
PDT = GMT - 7 hours	PST = GMT - 8 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)

COMMENTS / REQUESTS ARE APPRECIATED



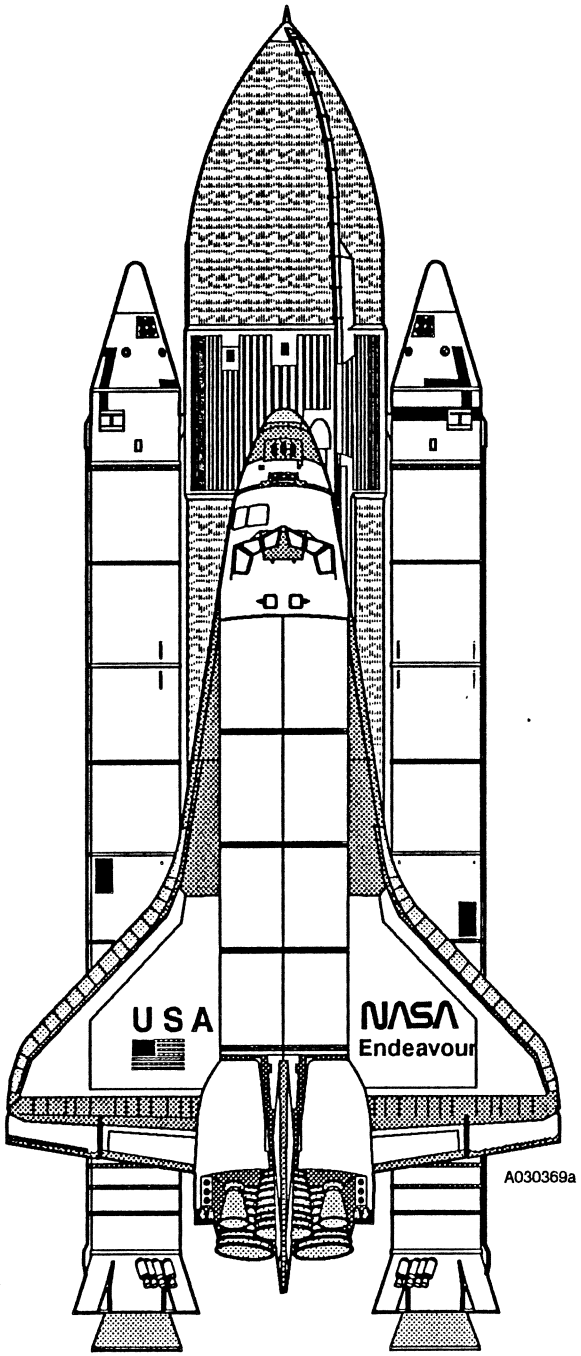
Name: _____ **Phone No.:** ( ) _____

Company: _____ **Mail Stop:** _____

Thiokol Corporation
P.O. Box 707
Brigham City, Utah 84302-0707

Attn: Flight Readiness
M/S L87A

TWR-64847
ECS SS6036



360T032 (STS-57) Data Book

June 1993

Thiokol CORPORATION

SPACE OPERATIONS

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

Introduction

Mission Summary

Launch Date: 20 June 1993

Lift Off Time: 09:37 EDT

Launch Window: 09:37–10:48 EDT

Crew:
- Commander: Ronald Grabe
- Pilot: Brian Duffy
- MS1: David Low
- MS2: Nancy Sherlock
- MS3: Jeff Wisoff

Orbiter: Endeavour (OV–105)
MLP: 2
Launch Pad: 39B, KSC

Landing Sites:
- NOM EOM: KSC, Fla
- TAL: Banjul, The Gambia; Ben Guerir, Morroco; Moron, Spain
- AOA: Edwards, AFB

Landing Date: 27 June 1993

Orbit/Inclination: 250 nm / 28.45 degrees

Cargo Bay Payloads:
- EURECA–1R (Retrieval)
- SPACEHAB – 1
- SHOOT
- CONCAP–IV
- GAS BRIDGE

Next Mission

Designation: 360T033 (STS–51)
Current Launch Date: July 17, 1993
Launch Time: 08:20 EDT
Orbiter: Discovery (OV–103)
Payload:
- ACTS
- ORFEUS
- SPAS

Introduction

Key RSRM Countdown Events

EDT	Actual Time Remaining	Countdown Clock Time	Event
0200	L–79 hr 33 min		S0007 call to station (CTS) 02:00 on 17–JUNE
0230	L–79 hr 03 min	T–43 hr	Start of Countdown
1830	L–63 hr 03 min	T–27 hr	Start 8 hr hold
0230	L–55 hr 03 min	T–27 hr	End 8 hr hold
1030	L–47 hr 03 min	T–19 hr	Start 4 hr hold
1430	L–43 hr 03 min	T–19 hr	End 4 hr hold
2330	L–35 hr 03 min	T–11 hr	Start 20 hr 43 min hold
0633	L–27 hr	T–11 hr	*SRB aft skirt purge activated (if required)**
0933	L–24 hr	T–11 hr	*Verify RSRM PMBT is acceptable**
1533	L–18 hr	T–11 hr	*Igniter joint heater activated***(through T–9 min)*
1913	L–14 hr 20 min	T–11 hr	*SRB aft skirt purge activated (if not required earlier)**
1913	L–14 hr 20 min	T–11 hr	End 20 hr 43 min hold
2043	L–12 hr 50 min	T–9 hr 30 min	*SRB call to stations (CTS)*
2103	L–12 hr 30 min	T–9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
2133	L–12 hr 00 min	T–8 hr 40 min	SRB TVC power up
2213	L–11 hr 20 min	T–8 hr	*Joint heater system activated (through T–1 min)**
0013	L–9 hr 20 min	T–6 hr	Start 1–hr hold
0013	L–9 hr 20 min	T–6 hr	*Begin Level A support*
0013	L–9 hr 20 min	T–6 hr	LCC verification
0113	L–8 hr 20 min	T–6 hr	End 1–hr hold
0158	L–7 hr 35 min	T–5 hr 15 min	Start LH_2, fast fill (continue for 1 hr 30 min)
0203	L–7 hr 30 min	T–5 hr 10 min	Start LO_2, fast fill (continue for 2 hr 5 min)
0313	L–6 hr 20 min	T–4 hr	Verify SIIs (PIC resistant test)
0413	L–5 hr 20 min	T–3 hr	Stable LO_2/LH_2 replenish
0413	L–5 hr 20 min	T–3 hr	Start 2–hr hold
0513	L–4 hr 20 min	T–3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T–3 hr	Perform ice/debris inspection (Ice Team to pad)
0613	L–3 hr 20 min	T–3 hr	End 2–hr hold
0628	L–3 hr 5 min	T–2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
0628	L–3 hr 5 min	T–2 hr 45 min	Verify no LCC violations
0743	L–1 hr 50 min	T–1 hr 30 min	*OPT 75 percent reading calibration check**
0753	L–1 hr 40 min	T–1 hr 20 min	Contingency hold point (GMT delta adjust)
0828	L–1 hr 5 min	T–45 min	SRB and ET range safety system closed loop test

Introduction

Key RSRM Countdown Events (Cont)

EDT	Actual Time Remaining	Countdown Clock Time	Event
0853	L–40 min	T–20 min	Start 10–min hold
		T–20 min	HSC launch readiness check (on OIS 263)
0903	L–30 min	T–20 min	End 10–min hold
0908	L–25 min	T–15 min	*Aft skirt GN_2 high flow rate cleansing purge*
0914	L–19 min	T–9 min	Start 10–min hold
		T–9 min	NSTS operations manager launch readiness status check (on SSPO)
		T–9 min	*Case acreage LCC expire (after status check)*
0923	L–10 min	T–9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T–5)*
0924	L–9 min	T–9 min	End 10–min hold
		T–9 min	Initiate GLS auto sequence
		T–7 min 30 sec	Contingency hold point (prior to OAA retract)
		T–5 min	Contingency hold point (prior to S&A arm and APU start)
0928	L–5 min	T–5 min	Nozzle–to–case and field joint LCC expires (prior to S&A arm)
		T–5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T–5 min	APU power up (orbiter)
		T–5 min	Radio Net silence
		T–4 min	Contingency hold point (prior to SSME purge)
		T–2 min 55 sec	Contingency hold point (prior to LO_2 prepressurization)
		T–1 min 57 sec	Contingency hold point (prior to LH_2 prepressurization)
0932	L–1 min	T–1 min	*Field joint heater power off*
		T–31 sec	Contingency hold point (prior to auto sequence start)
	L–31 sec	T–31 sec	Go for auto sequence start
	L–28 sec	T–28 sec	SRB APU power up
	L–21 sec	T–21 sec	SRB gimbal profile check
	L–17.5 sec	T–17.5 sec	SRM igniter PIC arm command
	L–16 sec	T–16 sec	Gimbal test complete, nozzle–to–launch configuration
		T–16 sec	H_2O sound suppression system start
	L–11 sec	T–11 sec	S&A device armed verification, system inhibits off
	L–10 sec	T–10 sec	Free H_2 burnoff system ignition
	L–6.6 sec	T–6.6 sec	SSME 3 start
	L–6.5 sec	T–6.5 sec	SSME 2 start
	L–6.4 sec	T–6.4 sec	SSME 1 start
0933#	L–0	T–0	*SRB Ignition*
			Launch period begins 0933 EDT (based on 20 June 1993 Launch)**

* OMRSD event—specifics in Component Section of Countdown Data Book
** Contingency Launch Schedule on following page
# Actual time of launch is estimated at 0937 EDT. The intercept of Eureca will determine time of launch and will be calculated on the day of launch. The extra time will be made up in an extended hold at T–9 minute.

Introduction

Launch Window

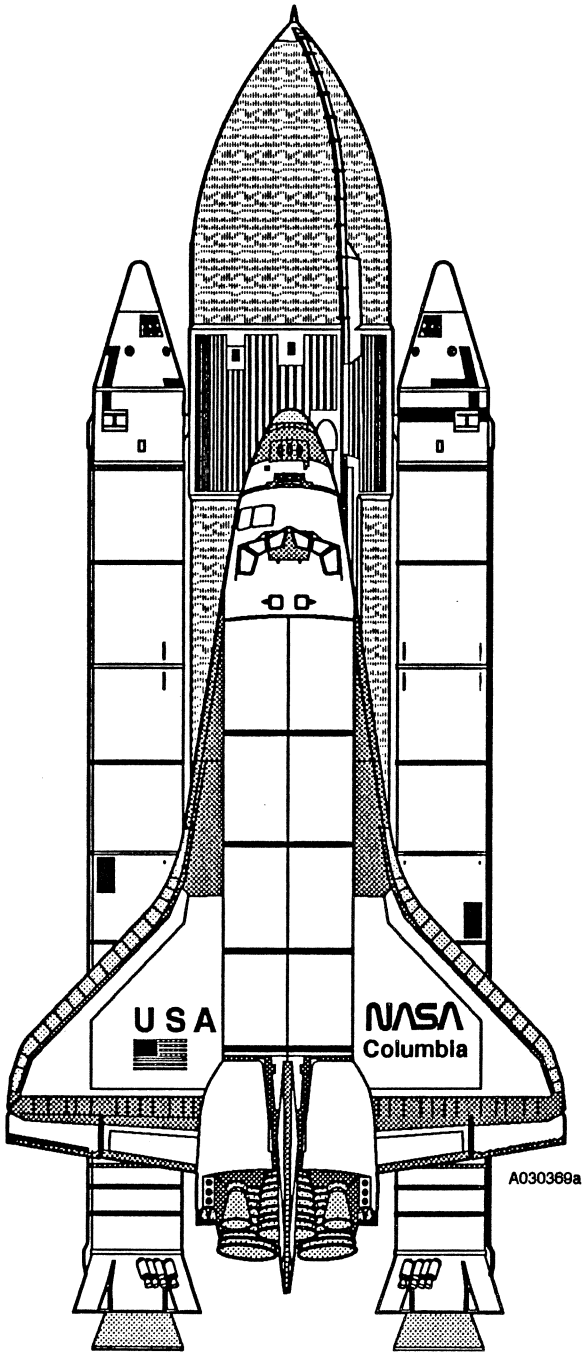
Launch Date	Launch Window Open (GMT)*	Launch Window Close (GMT)*
06/20/93	09:37	10:48
06/21/93	09:07	10:18
06/22/93	08:37	09:48
06/23/93	08:06	09:17
06/24/93	07:36	08:47
06/25/93	07:05	08:16
06/26/93	06:34	07:44
06/27/93	06:04	07:13

* Note: All times are in GMT unless otherwise specified.

EDT = GMT - 4 hours	EST = GMT - 5 hours
CDT = GMT - 5 hours	CST = GMT - 6 hours
MDT = GMT - 6 hours	MST = GMT - 7 hours
PDT = GMT - 7 hours	PST = GMT - 8 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)

TWR-63951 Rev. A
ECS SS5066



360T030 (STS-55) II Data Book

April 1993

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

Introduction

Mission Summary

Launch Date:	24 April 1993		**Orbiter:**	Columbia (OV-102)
			MLP:	3
Lift Off Time:	10:52 EDT		Launch Pad:	39A, KSC
Launch Window:	10:52-13:22 EDT		**Landing Sites:**	
			NOM EOM	KSC, Fla
Crew:	Commander:	Steve Nagel	TAL	Banjul, The Gambia
	Pilot:	Tom Henricks		Ben Guerir, Morroco
	MS1:	Jerry Ross		Moron, Spain
	MS2:	Charles Precourt	AOA	Edwards, AFB
	MS3:	Bernard Harris Jr.		
	PS1:	Walter Ulrich		
	PS2:	Hans Schlegel	**Landing Date:**	03-MAY-1993

Orbit/Inclination: 160 nm / 28.45 degrees

Cargo Bay Payloads: Spacelab D-2
Reaction Kinetic in Glass Melts / GAS

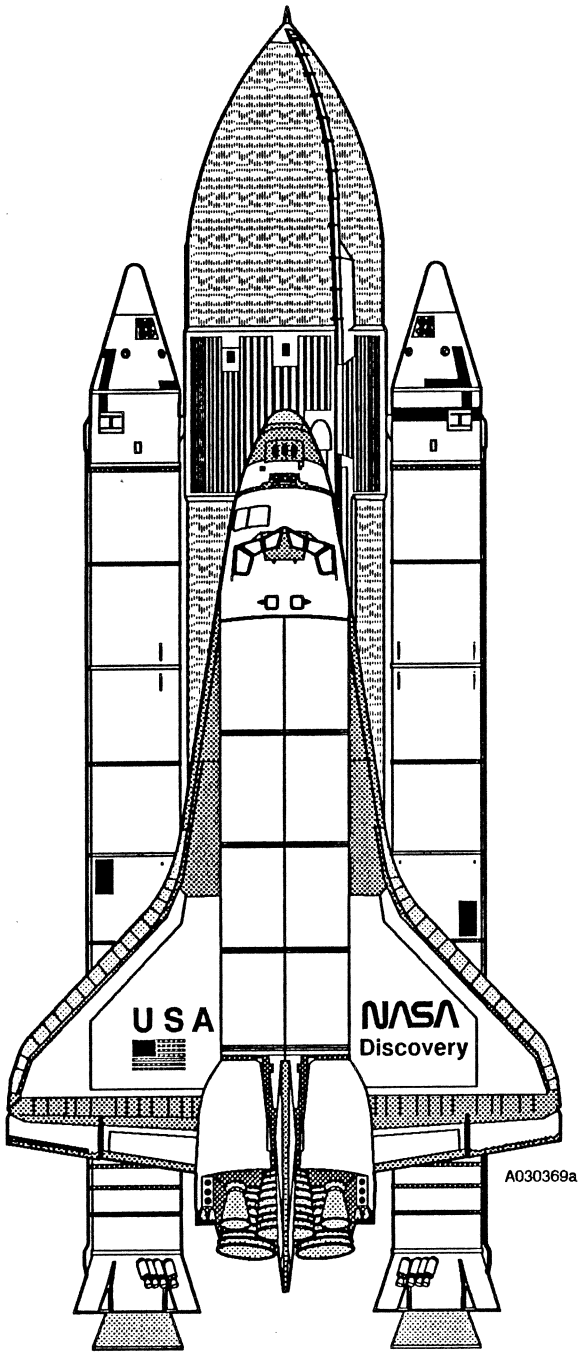
Next Mission

Designation:	360L032 (STS-57)
Current Launch Date:	May 19, 1993
Launch Time:	02:22 EDT
Orbiter:	Endeavour (OV-105)
Payload:	EURECA-1R
	SPACEHAB-01

Introduction

22-March-1993 Launch Abort Summary

- Hardware inspections performed per current OMRSD requirements
  - No anomalous conditions found
- All abort countdown data reviewed
  - All readings were normal, no anomalies noted
- Boosters were unaffected by the launch abort and are ready to fly



TWR-64846
ECS SS6036

360L031 (STS-56) Data Book

April 1993

Thiokol CORPORATION

SPACE OPERATIONS

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

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Introduction

Mission Summary

Launch Date:	06 April 1993		Orbiter:	Discovery (OV-103)
			MLP:	1
Lift Off Time:	01:32 EDT		Launch Pad:	39B, KSC
Launch Window:	01:32 - 03:58		Landing Sites:	
			NOM EOM	KSC, Fla
Crew:	Commander:	Kenneth D. Cameron	TAL	Zaragoza, Spain
	Pilot:	Stephen S. Oswald		Ben Guerir, Morroco
	MS1:	Michael C. Foale		Moron, Spain
	MS2:	Kenneth D. Cockrell	AOA	Edwards, AFB
	MS3:	Ellen Ochoa		
			Landing Date:	14 April 1993

Orbit/Inclination: 160 nm / 57.00 degrees

Cargo Bay Payloads:
ATLAS-2 (Atmospheric Lab for Applications and Science-2)
SSBUV-A (Shuttle Solar Backscatter Ultraviolet-A)
SPARTAN-201 (Solar Wind Generation Experiment)
SUVE (Solar Ultraviolet Experiment)

Next Mission

Designation:	360T030 (STS-55) - 2nd Attempt
Launch Date:	April 1993
Orbiter:	Columbia (OV-102)
Payload:	Spacelab D-2

Introduction

Key RSRM Countdown Events

ET	Actual Time Remaining	Countdown Clock Time	Event
0430 EST	L-68 hr 02 min		S0007 call to station 3-April at 0430 EST
0500	L-67 hr 32 min	T-43 hr	Start of Countdown
2100	L-51 hr 32 min	T-27 hr	Start 4 hr hold
0100	L-47 hr 32 min	T-27 hr	End 4 hr hold **Note: Daylight Savings begins at 02:00**
1000 EDT	L-39 hr 32 min	T-19 hr	Start 4 hr hold
1400	L-35 hr 32 min	T-19 hr	End 4 hr hold
2200	L-27 hr 32 min	T-11 hr	Start 13 hr 12 min hold
2232	L-27 hr	T-11 hr	*SRB aft skirt purge activated (if required)**
0132	L-24 hr	T-11 hr	*Verify RSRM PMBT is acceptable*
0732	L-18 hr	T-11 hr	*Igniter joint heater activated**(through T-9 min)*
1112	L-14 hr 20 min	T-11 hr	End 13 hr 12 min hold
1242	L-12 hr 50 min	T-9 hr 30 min	*SRB call to stations (CTS)*
1302	L-12 hr 30 min	T-9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
1332	L-12 hr 00 min	T-8 hr 40 min	SRB TVC power up
1412	L-11 hr 20 min	T-8 hr	*Joint heater system activated (through T-1 min)**
1612	L- 9 hr 20 min	T-6 hr	Start 1-hr hold
1612	L- 9 hr 20 min	T-6 hr	*Begin Level A support*
1612	L- 9 hr 20 min	T-6 hr	LCC verification
1712	L-8 hr 20 min	T-6 hr	End 1-hr hold
1757	L-7 hr 35 min	T-5 hr 15 min	Start LH_2, fast fill (continue for 1 hr 30 min)
1802	L-7 hr 30 min	T-5 hr 10 min	Start LO_2, fast fill (continue for 2 hr 5 min)
1912	L-6 hr 20 min	T-4 hr	Verify SIIs (PIC resistant test)
2012	L-5 hr 20 min	T-3 hr	Stable LO_2/LH_2 replenish
2012	L-5 hr 20 min	T-3 hr	Start 2-hr hold
2112	L-4 hr 20 min	T-3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T-3 hr	Perform ice/debris inspection (Ice Team to pad)
2212	L-3 hr 20 min	T-3 hr	End 2-hr hold
2227	L-3 hr 5 min	T-2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
2227	L-3 hr 5 min	T-2 hr 45 min	Verify no LCC violations
2342	L-1 hr 50 min	T-1 hr 30 min	*OPT 75 percent reading calibration check**
2352	L-1 hr 40 min	T-1 hr 20 min	Contingency hold point (GMT delta adjust)
0027	L-1 hr 5 min	T-45 min	SRB and ET range safety system closed loop test

Introduction

Key RSRM Countdown Events (Cont)

EDT	Actual Time Remaining	Countdown Clock Time	Event
0052	L-40 min	T-20 min	Start 10-min hold
		T-20 min	HSC launch readiness check (on OIS 263)
0102	L-30 min	T-20 min	End 10-min hold
0107	L-25 min	T-15 min	*Aft skirt GN_2 high flow rate cleansing purge*
0113	L-19 min	T-9 min	Start 10-min hold
		T-9 min	NSTS operations manager launch readiness status check (on SSPO)
		T-9 min	*Case acreage LCC expire (after status check)*
0122	L-10 min	T-9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T-5)*
0123	L-9 min	T-9 min	End 10-min hold
		T-9 min	Initiate GLS auto sequence
		T-7 min 30 sec	Contingency hold point (prior to OAA retract)
		T-5 min	Contingency hold point (prior to S&A arm and APU start)
0127	L-5 min	T-5 min	Nozzle-to-case and field joint LCC expires (prior to S&A arm)
		T-5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T-5 min	APU power up (orbiter)
		T-5 min	Radio Net silence
		T-4 min	Contingency hold point (prior to SSME purge)
		T-2 min 55 sec	Contingency hold point (prior to LO_2 prepressurization)
		T-1 min 57 sec	Contingency hold point (prior to LH_2 prepressurization)
0131	L-1 min	T-1 min	*Field joint heater power off*
		T-31 sec	Contingency hold point (prior to auto sequence start)
	L-31 sec	T-31 sec	Go for auto sequence start
	L-28 sec	T-28 sec	SRB APU power up
	L-21 sec	T-21 sec	SRB gimbal profile check
	L-17.5 sec	T-17.5 sec	SRM igniter PIC arm command
	L-16 sec	T-16 sec	Gimbal test complete, nozzle-to-launch configuration
		T-16 sec	H_2O sound suppression system start
	L-11 sec	T-11 sec	S&A device armed verification, system inhibits off
	L-10 sec	T-10 sec	Free H_2 burnoff system ignition
	L-6.6 sec	T-6.6 sec	SSME 3 start
	L-6.5 sec	T-6.5 sec	SSME 2 start
	L-6.4 sec	T-6.4 sec	SSME 1 start
0132	L-0	T-0	*SRB Ignition*
			Launch period begins 0132 EDT (based on 06 April 1993 Launch)**

* OMRSD event—specifics in Component Section of Countdown Data Book
** Contingency Launch Schedule on following page

Introduction

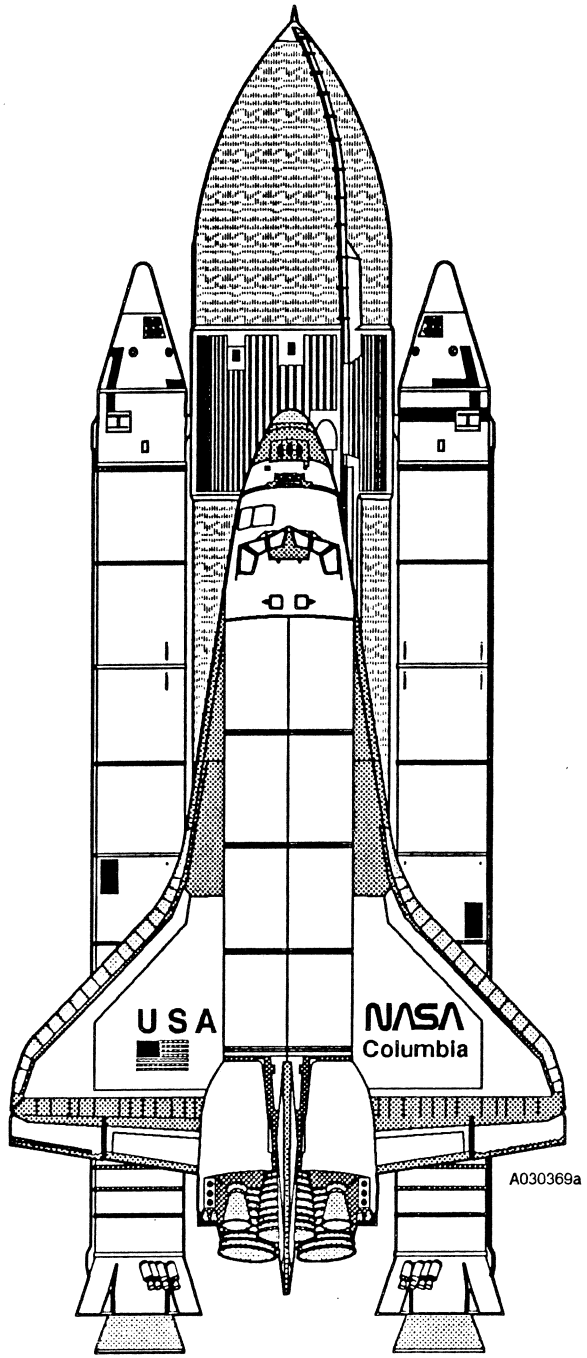
Launch Window

Launch Date	Launch Window Open (GMT)*	Launch Window Close (GMT)*
04/06/93	05:32	07:58
04/07/93	05:31	07:57
04/08/93	05:29	07:57
04/09/93	05:28	07:56
04/10/93	05:27	07:56
04/11/93	05:26	07:56
04/12/93	05:25	07:56
04/13/93	05:23	07:56

* Note: All times are in GMT unless otherwise specified.

EDT = GMT - 4 hours	EST = GMT - 5 hours
CDT = GMT - 5 hours	CST = GMT - 6 hours
MDT = GMT - 6 hours	MST = GMT - 7 hours
PDT = GMT - 7 hours	PST = GMT - 8 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)



TWR-63951
ECS SS5066

360T030 (STS-55) Data Book

March 1993

Thiokol CORPORATION
SPACE OPERATIONS

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

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Introduction

Mission Summary

Launch Date:	21 March 1993		Orbiter:	Columbia (OV-102)
			MLP:	3
Lift Off Time:	09:52 EST		Launch Pad:	39A, KSC
Launch Window:	09:52-12:22 EST		Landing Sites:	
			NOM EOM	KSC, Fla
Crew:	Commander:	Steve Nagel	TAL	Banjul, The Gambia
	Pilot:	Tom Henricks		Ben Guerir, Morroco
	MS1:	Jerry Ross		Moron, Spain
	MS2:	Charles Precourt	AOA	Edwards, AFB
	MS3:	Bernard Harris Jr.		
	PS1:	Walter Ulrich		
	PS2:	Hans Schlegel	Landing Date:	31 March 1993

Orbit/Inclination: 160 nm / 28.45 degrees

Cargo Bay Payloads: Spacelab D-2
Reaction Kinetic in Glass Melts / GAS

Next Mission

Designation:	360L031 (STS-56)
Current Launch Date:	April 1993
Orbiter:	Discovery (OV-103)
Payload:	Atlas-02
	Spartan

Introduction

Key RSRM Countdown Events

EST	Actual Time Remaining	Countdown Clock Time	Event
1530	L–66 hr 22 min		**S0007 call to station (CTS) 15:30 on 18–March**
1600	L–65 hr 52 min	T–43 hr	**Start of Countdown**
0800	L–49 hr 52 min	T–27 hr	*SRB aft skirt purge activated (if required)**
0800	L–49 hr 52 min	T–27 hr	**Start 4 hr hold**
1200	L–45 hr 52 min	T–27 hr	**End 4 hr hold**
2000	L–37 hr 52 min	T–19 hr	**Start 4 hr hold**
0000	L–33 hr 52 min	T–19 hr	**End 4 hr hold**
0652	L–27 hr	T–12 hr 8 min	*SRB aft skirt purge activated (if required)**
0800	L–25 hr 52 min	T–11 hr	**Start 11 hr 32 min hold**
0952	L–24 hr	T–11 hr	*Verify RSRM PMBT is acceptable**
1552	L–18 hr	T–11 hr	*Igniter joint heater activated***(through T–9 min)*
1932	L–14 hr 20 min	T–11 hr	**End 11 hr 32 min hold**
2102	L–12 hr 50 min	T–9 hr 30 min	*SRB call to stations (CTS)*
2122	L–12 hr 30 min	T–9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
2152	L–12 hr 00 min	T–8 hr 40 min	**SRB TVC power up**
2232	L–11 hr 20 min	T–8 hr	*Joint heater system activated (through T–1 min)**
0032	L– 9 hr 20 min	T–6 hr	**Start 1–hr hold**
0032	L– 9 hr 20 min	T–6 hr	*Begin Level A support*
0032	L– 9 hr 20 min	T–6 hr	**LCC verification**
0132	L–8 hr 20 min	T–6 hr	**End 1–hr hold**
0217	L–7 hr 35 min	T–5 hr 15 min	**Start LH_2, fast fill (continue for 1 hr 30 min)**
0222	L–7 hr 30 min	T–5 hr 10 min	**Start LO_2, fast fill (continue for 2 hr 5 min)**
0332	L–6 hr 20 min	T–4 hr	**Verify SIIs (PIC resistant test)**
0432	L–5 hr 20 min	T–3 hr	**Stable LO_2/LH_2 replenish**
0432	L–5 hr 20 min	T–3 hr	**Start 2–hr hold**
0532	L–4 hr 20 min	T–3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T–3 hr	**Perform ice/debris inspection (Ice Team to pad)**
0632	L–3 hr 20 min	T–3 hr	**End 2–hr hold**
0647	L–3 hr 5 min	T–2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
0647	L–3 hr 5 min	T–2 hr 45 min	**Verify no LCC violations**
0802	L–1 hr 50 min	T–1 hr 30 min	*OPT 75 percent reading calibration check**
0812	L–1 hr 40 min	T–1 hr 20 min	**Contingency hold point (GMT delta adjust)**
0847	L–1 hr 5 min	T–45 min	**SRB and ET range safety system closed loop test**

Key RSRM Countdown Events (Cont)

EST	Actual Time Remaining	Countdown Clock Time	Event
0912	L–40 min	T–20 min	Start 10–min hold
		T–20 min	HSC launch readiness check (on OIS 263)
0922	L–30 min	T–20 min	End 10–min hold
0927	L–25 min	T–15 min	*Aft skirt GN_2 high flow rate cleansing purge*
0933	L–19 min	T–9 min	Start 10–min hold
		T–9 min	NSTS operations manager launch readiness status check (on SSPO)
		T–9 min	*Case acreage LCC expire (after status check)*
0942	L–10 min	T–9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T–5)*
0943	L–9 min	T–9 min	End 10–min hold
		T–9 min	Initiate GLS auto sequence
		T–7 min 30 sec	Contingency hold point (prior to OAA retract)
		T–5 min	Contingency hold point (prior to S&A arm and APU start)
0947	L–5 min	T–5 min	Nozzle–to–case and field joint LCC expires (prior to S&A arm)
		T–5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T–5 min	APU power up (orbiter)
		T–5 min	Radio Net silence
		T–4 min	Contingency hold point (prior to SSME purge)
		T–2 min 55 sec	Contingency hold point (prior to LO_2 prepressurization)
		T–1 min 57 sec	Contingency hold point (prior to LH_2 prepressurization)
0951	L–1 min	T–1 min	*Field joint heater power off*
		T–31 sec	Contingency hold point (prior to auto sequence start)
	L–31 sec	T–31 sec	Go for auto sequence start
	L–28 sec	T–28 sec	SRB APU power up
	L–21 sec	T–21 sec	SRB gimbal profile check
	L–17.5 sec	T–17.5 sec	SRM igniter PIC arm command
	L–16 sec	T–16 sec	Gimbal test complete, nozzle–to–launch configuration
		T–16 sec	H_2O sound suppression system start
	L–11 sec	T–11 sec	S&A device armed verification, system inhibits off
	L–10 sec	T–10 sec	Free H_2 burnoff system ignition
	L–6.6 sec	T–6.6 sec	SSME 3 start
	L–6.5 sec	T–6.5 sec	SSME 2 start
	L–6.4 sec	T–6.4 sec	SSME 1 start
0952	L–0	T–0	*SRB Ignition*
			Launch period begins 0952 EST (based on 21 March 1993 Launch)**

* OMRSD event—specifics in Component Section of Countdown Data Book
** Contingency Launch Schedule on following page

Introduction

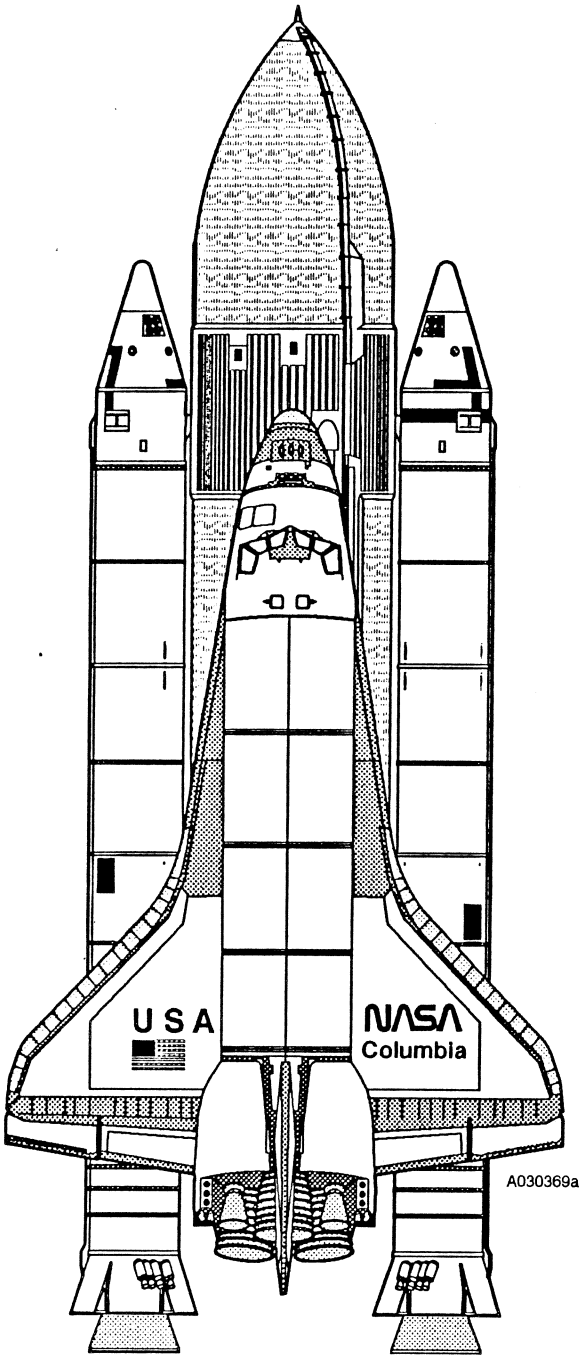
Launch Window

Launch Date	Launch Window Open (GMT)*	Launch Window Close (GMT)*
03/21/93	14:52	17:22
03/22/93	14:51	17:21
03/23/93	14:50	17:20
03/24/93	14:49	17:19
03/25/93	14:48	17:18
03/26/93	14:47	17:17

* Note: All times are in GMT unless otherwise specified.

EDT = GMT - 4 hours	EST = GMT - 5 hours
CDT = GMT - 5 hours	CST = GMT - 6 hours
MDT = GMT - 6 hours	MST = GMT - 7 hours
PDT = GMT - 7 hours	PST = GMT - 8 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)



TWR-63948
ECS SS5063

360T027 (STS-52) Data Book

October 1992

Thiokol CORPORATION
SPACE OPERATIONS

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

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Introduction

Mission Summary

Launch Date:	22 October 1992		Orbiter:	Columbia (OV-102)
			MLP:	3
Lift Off Time:	11:16 EDT		Launch Pad:	39B, KSC
Launch Window:	2 Hours 13 Minutes		Landing Sites:	
			NOM EOM	KSC, Florida
Crew:	Commander:	James Wetherbee	TAL	Banjul, The Gambia
	Pilot:	Michael Baker		Ben Guerir, Morroco
	MS1:	Charles Veach	AOA	Edwards AFB, CA
	MS2:	William Shephard		
	MS3:	Tamara Jernigan		
	PS1:	Steven MacLean	Landing Time:	08:02 EST
			Date:	01 November 1992

Orbit/Inclination: 160 x 163 Nautical Miles/28.45 degrees

Cargo Bay Payloads:
- Laser Geodynamics Satellite (LAGEOS)
- U.S. Microgravity Payload (USMP-1)
- Canadian Experiments (CANEX-2)
- Attitude Sensor Package (ASP)
- Tank Pressure Control Exp (TPCE)

Middeck Payloads:
- Commercial Protein Crystal Growth (CPCG)
- Commercial Materials ITA Exp (CMIX)
- Crystals by Vapor Transport Exp (CVTE)
- Heatpipe Performance Exp (HPP)
- Physiological Systems Exp (PSE)
- Shuttle Plume Impingement Exp (SPIE)

Introduction

Key RSRM Countdown Events

EDT	Actual Time Remaining	Countdown Clock Time	Event
15:30	L–67 hr 46 min		**S0007 call to station (CTS) 15:30 EDT, 19 October 1992**
16:00	L–67 hr 16 min	T–43 hr	**Start of Countdown**
08:00	L–51 hr 16 min	T–27 hr	**Start 4 hr hold**
	L–60 hr	T–27 hr	*SRB aft skirt purge activated (if required)**
12:00	L–47 hr 16 min	T–27 hr	**End 4 hr hold**
20:00	L–39 hr 16 min	T–19 hr	**Start 4 hr hold**
00:00	L–35 hr 16 min	T–19 hr	**End 4 hr hold**
08:00	L–27 hr 16 min	T–11 hr	**Start 12 hr 56 min hold**
	L–24 hr	T–11 hr	*Verify RSRM PMBT is acceptable**
	L–18 hr	T–11 hr	*Igniter joint heater activated** *(through T–9 min)*
20:56	L–14 hr 20 min	T–11 hr	**End 12 hr 56 min hold**
	L–12 hr 50 min	T–9 hr 30 min	*SRB call to stations (CTS)*
	L–12 hr 30 min	T–9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
	L–12 hr 00 min	T–8 hr 40 min	**SRB TVC power up**
	L–11 hr 20 min	T–8 hr	*Joint heater system activated (through T–1 min)**
01:56	L– 9 hr 20 min	T–6 hr	**Start 1–hr hold**
	L– 9 hr 20 min	T–6 hr	*Begin Level A support*
	L– 9 hr 20 min	T–6 hr	**LCC verification**
02:56	L–8 hr 20 min	T–6 hr	**End 1–hr hold**
	L–7 hr 35 min	T–5 hr 15 min	**Start LH_2, fast fill (continue for 1 hr 30 min)**
	L–7 hr 30 min	T–5 hr 10 min	**Start LO_2, fast fill (continue for 2 hr 5 min)**
	L–6 hr 20 min	T–4 hr	**Verify SIIs (PIC resistant test)**
	L–5 hr 20 min	T–3 hr	**Stable LO_2/LH_2 replenish**
05:56	L–5 hr 20 min	T–3 hr	**Start 2–hr hold**
	L–4 hr 20 min	T–3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T–3 hr	**Perform ice/debris inspection (Ice Team to pad)**
07:56	L–3 hr 20 min	T–3 hr	**End 2–hr hold**
	L–3 hr 5 min	T–2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
	L–3 hr 5 min	T–2 hr 45 min	**Verify no LCC violations**
	L–1 hr 50 min	T–1 hr 30 min	*OPT 75 percent reading calibration check**
	L–1 hr 40 min	T–1 hr 20 min	**Contingency hold point (GMT delta adjust)**
	L–1 hr 5 min	T–45 min	**SRB and ET range safety system closed loop test**

Introduction

Key RSRM Countdown Events (Cont)

EDT	Actual Time Remaining	Countdown Clock Time	Event
09:36	L–40 min	T–20 min	**Start 10–min hold**
		T–20 min	**HSC launch readiness check (on OIS 263)**
09:46	L–30 min	T–20 min	**End 10–min hold**
09:51	L–25 min	T–15 min	*Aft skirt GN_2 high flow rate cleansing purge*
10:57	L–19 min	T–9 min	**Start 10–min hold**
		T–9 min	**NSTS operations manager launch readiness status check (on SSPO)**
		T–9 min	*Case acreage LCC expire (after status check)*
	L–10 min	T–9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T–5)*
11:07	L–9 min	T–9 min	**End 10–min hold**
		T–9 min	**Initiate GLS auto sequence**
		T–7 min 30 sec	**Contingency hold point (prior to OAA retract)**
		T–5 min	**Contingency hold point (prior to S&A arm and APU start)**
	L–5 min	T–5 min	**Nozzle–to–case and field joint LCC expires (prior to S&A arm)**
		T–5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T–5 min	**APU power up (orbiter)**
		T–5 min	**Radio Net silence**
		T–4 min	**Contingency hold point (prior to SSME purge)**
		T–2 min 55 sec	**Contingency hold point (prior to LO_2 prepressurization)**
		T–1 min 57 sec	**Contingency hold point (prior to LH_2 prepressurization)**
	L–1 min	T–1 min	*Field joint heater power off*
		T–31 sec	**Contingency hold point (prior to auto sequence start)**
	L–31 sec	T–31 sec	**Go for auto sequence start**
	L–28 sec	T–28 sec	**SRB APU power up**
	L–21 sec	T–21 sec	**SRB gimbal profile check**
	L–17.5 sec	T–17.5 sec	**SRM igniter PIC arm command**
	L–16 sec	T–16 sec	**Gimbal test complete, nozzle–to–launch configuration**
		T–16 sec	**H_2O sound suppression system start**
	L–11 sec	T–11 sec	**S&A device armed verification, system inhibits off**
	L–10 sec	T–10 sec	**Free H_2 burnoff system ignition**
	L–6.6 sec	T–6.6 sec	**SSME 3 start**
	L–6.5 sec	T–6.5 sec	**SSME 2 start**
	L–6.4 sec	T–6.4 sec	**SSME 1 start**
11:16	L–0	T–0	*SRB Ignition*
			Launch period begins 11:16 EDT(based on 22 October 1992 Launch)**

* OMRSD event—specifics in Component Section of Countdown Data Book
** Contingency Launch Schedule on following page

Introduction

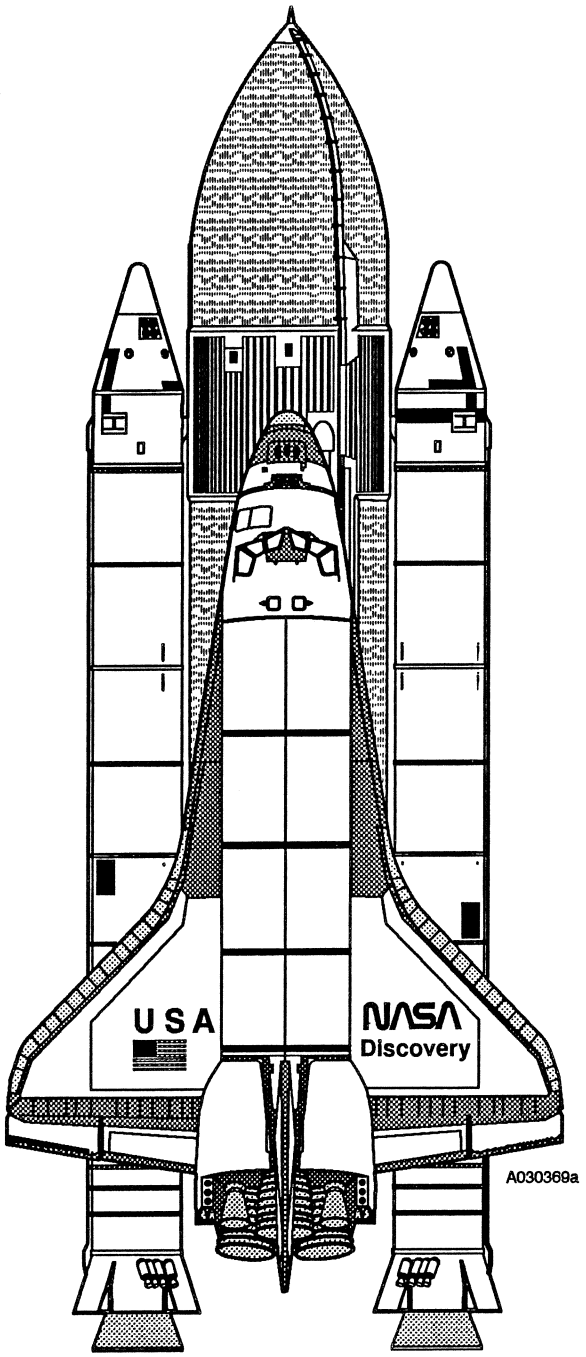
Launch Window

Launch Date	Launch Window Open (GMT)*	Launch Window Close (GMT)*
10/15/92	15:10	17:37
10/16/92	15:10	17:35
10/17/92	15:11	17:34
10/18/92	15:12	17:33
10/19/92	15:13	17:32
10/20/92	15:14	17:31
10/21/92	15:15	17:30
10/22/92	15:16	17:29
10/23/92	15:17	17:28
10/24/92	15:18	17:27
10/25/92	15:19	17:26
10/26/92	15:20	17:25
10/27/92	15:20	17:24
10/28/92	15:21	17:23
10/29/92	15:22	17:22
10/30/92	15:23	17:21
10/31/92	15:24	17:20

* Note: All times are in GMT unless otherwise specified.

EDT = GMT - 4 hours	EST = GMT - 5 hours
CDT = GMT - 5 hours	CST = GMT - 6 hours
MDT = GMT - 6 hours	MST = GMT - 7 hours
PDT = GMT - 7 hours	PST = GMT - 8 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)



TWR-63949
ECS SS5064

360L028 (STS-53) Data Book

December 1992

Thiokol CORPORATION

SPACE OPERATIONS

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

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Introduction

Mission Summary

Launch Date:	13 January 1993		Orbiter:	Endeavour (OV-105)
			MLP:	2
Lift Off Time:	08:52 EST		Launch Pad:	39B, KSC
Launch Window:	11:22 EST		Landing Sites:	
			NOM EOM	KSC, Fla
Crew:	Commander:	John Casper	TAL	Banjul, The Gambia
	Pilot:	Don McMonagle	AOA	Edwards, AFB
	MS1:	Mario Runco		
	MS2:	Greg Harbaugh	Landing Time:	08:34 EST
	MS3:	Susan Helms	Date:	19 January 1993

Orbit/Inclination: 160 nm / 28.45 degrees

Cargo Bay Payloads:
TDRS-F
Diffuse X-ray Spectrometer

Middeck Payloads:
Commercial Generic Bioprocessing Apparatus
Chromosome and Plant Cell Division in Space Experiment
Physiology and Anatomical Rodent Experiment
Space Acceleration Measurement System
Solid Surface Combustion Experiment

Next Mission

Designation:	360T030 (STS-55)
Current Launch Date:	25 February 1993
Orbiter:	Columbia (OV-102)
Payload:	SL-T2

Introduction

Key RSRM Countdown Events

EST	Actual Time Remaining	Countdown Clock Time	Event
0830	L–72 hr 22 min		S0007 call to station (CTS)
0900	L–71 hr 52 min	T–43 hr	Start of Countdown
2052	L–60 hr	T–27 hr	*SRB aft skirt purge activated (if required)**
0100	L–55 hr 52 min	T–27 hr	Start 4 hr hold
0500	L–51 hr 52 min	T–27 hr	End 4 hr hold
1300	L–43 hr 52 min	T–19 hr	Start 8 hr hold
2100	L–35 hr 52 min	T–19 hr	End 8 hr hold
0500	L–27 hr 52 min	T–11 hr	Start 13 hr 32 min hold
0552	L–27 hr	T–11 hr	*SRB aft skirt purge activated (if required)**
0852	L–24 hr	T–11 hr	*Verify RSRM PMBT is acceptable**
1452	L–18 hr	T–11 hr	*Igniter joint heater activated* *(through T–9 min)*
1832	L–14 hr 20 min	T–11 hr	End 13 hr 32 min hold
2002	L–12 hr 50 min	T–9 hr 30 min	*SRB call to stations (CTS)*
2022	L–12 hr 30 min	T–9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
2052	L–12 hr 00 min	T–8 hr 40 min	SRB TVC power up
2132	L–11 hr 20 min	T–8 hr	*Joint heater system activated (through T–1 min)**
2332	L– 9 hr 20 min	T–6 hr	Start 1–hr hold
2332	L– 9 hr 20 min	T–6 hr	*Begin Level A support*
2332	L– 9 hr 20 min	T–6 hr	LCC verification
0032	L–8 hr 20 min	T–6 hr	End 1–hr hold
0117	L–7 hr 35 min	T–5 hr 15 min	Start LH_2, fast fill (continue for 1 hr 30 min)
0122	L–7 hr 30 min	T–5 hr 10 min	Start LO_2, fast fill (continue for 2 hr 5 min)
0232	L–6 hr 20 min	T–4 hr	Verify SIIs (PIC resistant test)
0332	L–5 hr 20 min	T–3 hr	Stable LO_2/LH_2 replenish
0332	L–5 hr 20 min	T–3 hr	Start 2–hr hold
0432	L–4 hr 20 min	T–3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T–3 hr	Perform ice/debris inspection (Ice Team to pad)
0532	L–3 hr 20 min	T–3 hr	End 2–hr hold
0547	L–3 hr 5 min	T–2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
0547	L–3 hr 5 min	T–2 hr 45 min	Verify no LCC violations
0702	L–1 hr 50 min	T–1 hr 30 min	*OPT 75 percent reading calibration check**
0712	L–1 hr 40 min	T–1 hr 20 min	Contingency hold point (GMT delta adjust)
0747	L–1 hr 5 min	T–45 min	SRB and ET range safety system closed loop test

Introduction

Key RSRM Countdown Events (Cont)

EST	Actual Time Remaining	Countdown Clock Time	Event
0812	L–40 min	T–20 min	**Start 10–min hold**
		T–20 min	**HSC launch readiness check (on OIS 263)**
0822	L–30 min	T–20 min	**End 10–min hold**
0827	L–25 min	T–15 min	*Aft skirt GN_2 high flow rate cleansing purge*
0833	L–19 min	T–9 min	**Start 10–min hold**
		T–9 min	**NSTS operations manager launch readiness status check (on SSPO)**
		T–9 min	*Case acreage LCC expire (after status check)*
0842	L–10 min	T–9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T–5)*
0843	L–9 min	T–9 min	**End 10–min hold**
		T–9 min	**Initiate GLS auto sequence**
		T–7 min 30 sec	**Contingency hold point (prior to OAA retract)**
		T–5 min	**Contingency hold point (prior to S&A arm and APU start)**
0847	L–5 min	T–5 min	**Nozzle–to–case and field joint LCC expires (prior to S&A arm)**
		T–5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T–5 min	**APU power up (orbiter)**
		T–5 min	**Radio Net silence**
		T–4 min	**Contingency hold point (prior to SSME purge)**
		T–2 min 55 sec	**Contingency hold point (prior to LO_2 prepressurization)**
		T–1 min 57 sec	**Contingency hold point (prior to LH_2 prepressurization)**
0851	L–1 min	T–1 min	*Field joint heater power off*
		T–31 sec	**Contingency hold point (prior to auto sequence start)**
	L–31 sec	T–31 sec	**Go for auto sequence start**
	L–28 sec	T–28 sec	**SRB APU power up**
	L–21 sec	T–21 sec	**SRB gimbal profile check**
	L–17.5 sec	T–17.5 sec	**SRM igniter PIC arm command**
	L–16 sec	T–16 sec	**Gimbal test complete, nozzle–to–launch configuration**
		T–16 sec	**H_2O sound suppression system start**
	L–11 sec	T–11 sec	**S&A device armed verification, system inhibits off**
	L–10 sec	T–10 sec	**Free H_2 burnoff system ignition**
	L–6.6 sec	T–6.6 sec	**SSME 3 start**
	L–6.5 sec	T–6.5 sec	**SSME 2 start**
	L–6.4 sec	T–6.4 sec	**SSME 1 start**
0852	L–0	T–0	*SRB Ignition*
			Launch period begins 0852 EST (based on 13 January 1992 Launch)**

* OMRSD event—specifics in Component Section of Countdown Data Book
** Contingency Launch Schedule on following page

Introduction

Launch Window

Launch Date	Launch Window Open (GMT)*	Launch Window Close (GMT)*
01/13/93	13:52	16:22
01/14/93	13:52	16:22
01/15/93	13:52	16:22
01/16/93	13:51	16:21
01/17/93	13:51	16:21
01/18/93	13:50	16:20
01/19/93	13:50	16:20

* Note: All times are in GMT unless otherwise specified.

EDT = GMT - 4 hours	EST = GMT - 5 hours
CDT = GMT - 5 hours	CST = GMT - 6 hours
MDT = GMT - 6 hours	MST = GMT - 7 hours
PDT = GMT - 7 hours	PST = GMT - 8 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)

Introduction

Mission Summary

Launch Date:	02 December 1992		**Orbiter:**	Discovery (OV-103)
			MLP:	1
Lift Off Time:	06:59 EST		**Launch Pad:**	39A, KSC
Launch Window:	3 Hours 08 Minutes		**Landing Sites:**	
			NOM EOM	KSC, Florida
Crew:	**Commander:**	David Walker	TAL	Zaragoza, Spain
	Pilot:	Robert Cabana	AOA	Edwards AFB, CA
	MS1:	Guy Bluford		
	MS2:	James Voss	**Landing Time:**	12:56 EST
	MS3:	Rich Clifford	**Date:**	09 December 1992

Orbit/Inclination: 200 Nautical Miles/57 degrees

Cargo Bay Payloads: Department of Defense (DOD-1)

Middeck Payloads:
STL
Hercules
BLAST
RME-3, VFT
MIS-1
CREAM, FARE
CLOUDS-1A

Next Mission

Designation: 360L029 (STS-53)
Current Launch Date: 13 January 1993
Orbiter: Endeavour (OV-105)
Payload: TDRS-F

Introduction

Key RSRM Countdown Events

EST	Actual Time Remaining	Countdown Clock Time	Event
10:30	L–68 hr 29 min		S0007 call to station (CTS) 10:30 EST, 29 November 1992
11:00	L–67 hr 59 min	T–43 hr	Start of Countdown
	L–60 hr	T–27 hr	*SRB aft skirt purge activated (if required)**
03:00	L–51 hr 59 min	T–27 hr	Start 4 hr hold
07:00	L–47 hr 59 min	T–27 hr	End 4 hr hold
15:00	L–39 hr 59 min	T–19 hr	Start 4 hr hold
19:00	L–35 hr 59 min	T–19 hr	End 4 hr hold
03:00	L–27 hr 59 min	T–11 hr	Start 13 hr 39 min hold
	L–27 hr	T–11 hr	*SRB aft skirt purge activated (if required)**
	L–24 hr	T–11 hr	*Verify RSRM PMBT is acceptable**
	L–18 hr	T–11 hr	*Igniter joint heater activated***(through T–9 min)*
16:39	L–14 hr 20 min	T–11 hr	End 13 hr 39 min hold
	L–12 hr 50 min	T–9 hr 30 min	*SRB call to stations (CTS)*
	L–12 hr 30 min	T–9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
	L–12 hr 00 min	T–8 hr 40 min	SRB TVC power up
	L–11 hr 20 min	T–8 hr	*Joint heater system activated (through T–1 min)**
21:39	L– 9 hr 20 min	T–6 hr	Start 1–hr hold
	L– 9 hr 20 min	T–6 hr	*Begin Level A support*
	L– 9 hr 20 min	T–6 hr	LCC verification
22:39	L–8 hr 20 min	T–6 hr	End 1–hr hold
	L–7 hr 35 min	T–5 hr 15 min	Start LH_2, fast fill (continue for 1 hr 30 min)
	L–7 hr 30 min	T–5 hr 10 min	Start LO_2, fast fill (continue for 2 hr 5 min)
	L–6 hr 20 min	T–4 hr	Verify SIIs (PIC resistant test)
	L–5 hr 20 min	T–3 hr	Stable LO_2/LH_2 replenish
01:39	L–5 hr 20 min	T–3 hr	Start 2–hr hold
	L–4 hr 20 min	T–3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T–3 hr	Perform ice/debris inspection (Ice Team to pad)
03:39	L–3 hr 20 min	T–3 hr	End 2–hr hold
	L–3 hr 5 min	T–2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
	L–3 hr 5 min	T–2 hr 45 min	Verify no LCC violations
	L–1 hr 50 min	T–1 hr 30 min	*OPT 75 percent reading calibration check**
	L–1 hr 40 min	T–1 hr 20 min	Contingency hold point (GMT delta adjust)
	L–1 hr 5 min	T–45 min	SRB and ET range safety system closed loop test

Introduction

Key RSRM Countdown Events (Cont)

EST	Actual Time Remaining	Countdown Clock Time	Event
06:19	L–40 min	T–20 min	Start 10–min hold
		T–20 min	HSC launch readiness check (on OIS 263)
06:29	L–30 min	T–20 min	End 10–min hold
06:34	L–25 min	T–15 min	*Aft skirt GN_2 high flow rate cleansing purge*
06:40	L–19 min	T–9 min	Start 10–min hold
		T–9 min	NSTS operations manager launch readiness status check (on SSPO)
		T–9 min	*Case acreage LCC expire (after status check)*
	L–10 min	T–9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T–5)*
06:50	L–9 min	T–9 min	End 10–min hold
		T–9 min	Initiate GLS auto sequence
		T–7 min 30 sec	Contingency hold point (prior to OAA retract)
		T–5 min	Contingency hold point (prior to S&A arm and APU start)
	L–5 min	T–5 min	Nozzle–to–case and field joint LCC expires (prior to S&A arm)
		T–5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T–5 min	APU power up (orbiter)
		T–5 min	Radio Net silence
		T–4 min	Contingency hold point (prior to SSME purge)
		T–2 min 55 sec	Contingency hold point (prior to LO_2 prepressurization)
		T–1 min 57 sec	Contingency hold point (prior to LH_2 prepressurization)
	L–1 min	T–1 min	*Field joint heater power off*
		T–31 sec	Contingency hold point (prior to auto sequence start)
	L–31 sec	T–31 sec	Go for auto sequence start
	L–28 sec	T–28 sec	SRB APU power up
	L–21 sec	T–21 sec	SRB gimbal profile check
	L–17.5 sec	T–17.5 sec	SRM igniter PIC arm command
	L–16 sec	T–16 sec	Gimbal test complete, nozzle–to–launch configuration
		T–16 sec	H_2O sound suppression system start
	L–11 sec	T–11 sec	S&A device armed verification, system inhibits off
	L–10 sec	T–10 sec	Free H_2 burnoff system ignition
	L–6.6 sec	T–6.6 sec	SSME 3 start
	L–6.5 sec	T–6.5 sec	SSME 2 start
	L–6.4 sec	T–6.4 sec	SSME 1 start
06:59	L–0	T–0	*SRB Ignition*
			Launch period begins 06:59 EST (based on 02 December 1992 Launch)**

* OMRSD event—specifics in Component Section of Countdown Data Book
** Contingency Launch Schedule on following page

Introduction

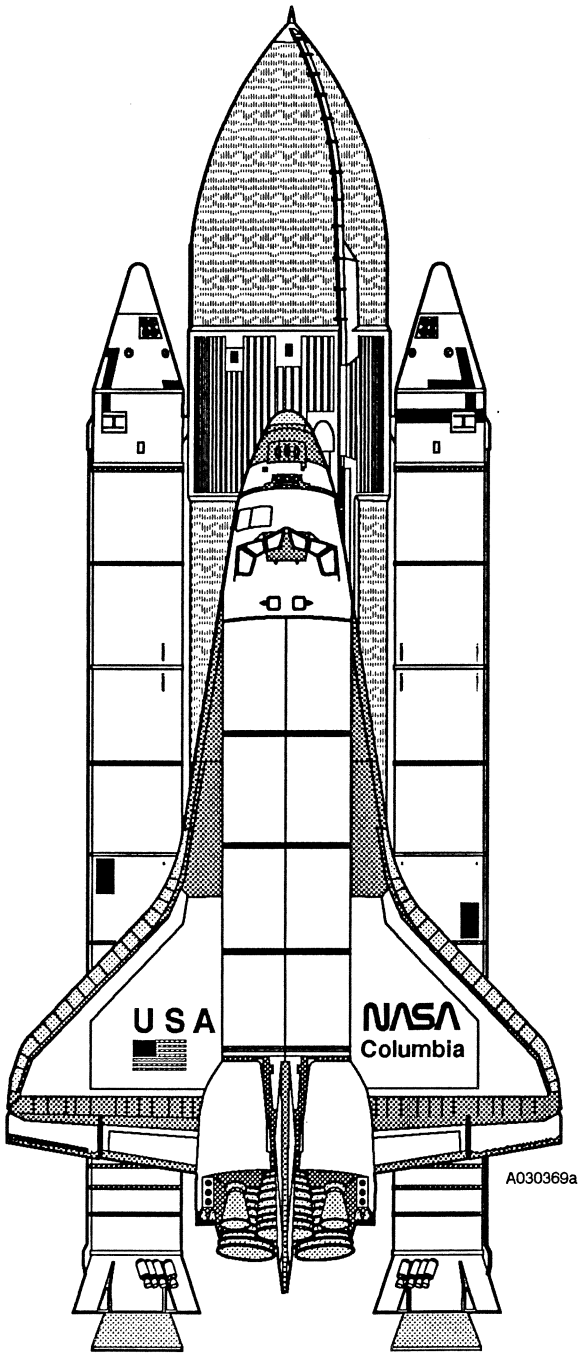
Launch Window

Launch Date	Launch Window Open (GMT)*	Launch Window Close (GMT)*
11/28/92	11:56	15:07
11/29/92	11:57	15:07
11/30/92	11:58	15:07
12/01/92	11:59	15:07
12/02/92	11:59	15:07
12/03/92	12:00	15:08
12/04/92	12:01	15:08
12/05/92	12:02	15:08
12/06/92	12:02	15:09
12/07/92	12:03	15:09
12/08/92	12:04	15:09
12/09/92	12:05	15:10
12/10/92	12:05	15:10
12/11/92	12:06	15:10
12/12/92	12:07	15:11
12/13/92	12:07	15:11
12/14/92	12:08	15:12

* Note: All times are in GMT unless otherwise specified.

EDT = GMT - 4 hours	EST = GMT - 5 hours
CDT = GMT - 5 hours	CST = GMT - 6 hours
MDT = GMT - 6 hours	MST = GMT - 7 hours
PDT = GMT - 7 hours	PST = GMT - 8 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)



TWR-60614
ECS No. 4731

360T024 (STS-50) Data Book

June 1992

Thiokol CORPORATION

SPACE OPERATIONS

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

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Introduction

Mission Summary

Launch Date: 25 June 1992

Lift Off Time: 16:07 GMT

Launch Window: 2 Hours 30 Minutes

Crew:
- Commander: Dick Richards
- Pilot: Ken Bowersox
- MS1: Bonnie Dunbar
- MS2: Ellen Baker
- MS3: Carl Meade
- PS1: Larry DeLucas
- PS2: Gene Trinh

Inclination: 28.5 Degrees

Orbiter: Columbia (OV-102)
MLP: 3
Launch Pad: 39A, KSC

Landing Sites:
NOM EOM: EAFB, California
TAL: Banjul, Gambia

AOA: EAFB, California

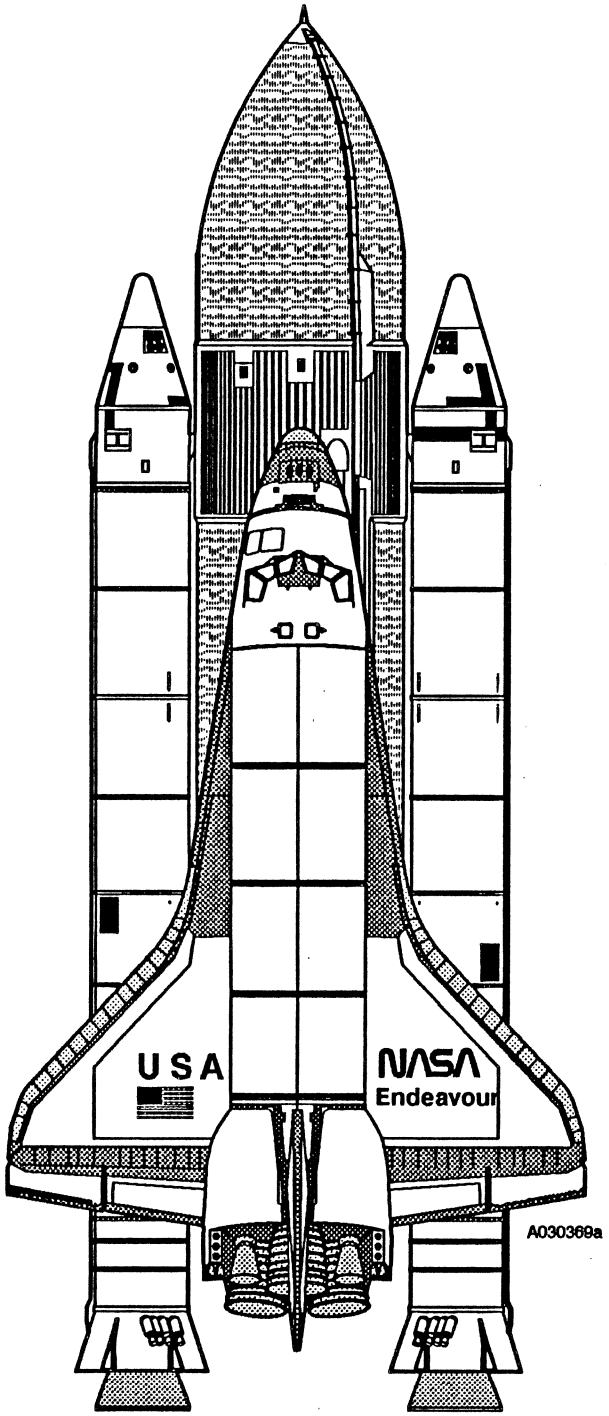
Flight Duration: 12 days 20 hrs 28 min

Altitude: 297 Nautical Miles

Cargo Bay: U.S. Microgravity Laboratory-1 (USML-1), Crystal Growth Furnance, Drop Physics Module, Surface Tension Driven Convection, Solid Surface Combustion Experiment (SSCE), Space Acceleration Measurement System

Middeck Payloads: Astroculture-1 (ASC-1), Generic Bioprocessing Apparatus (GBA), Commercial Protein Crystal Growth (CPCG), Zeolite Crystal Growth (ZCG)

Secondary Payloads:
Extended Duration Orbiter Medical Project (EDOMP)
Investigations into Polymer Membrane Processing (IPMP)
Orbital Acceleration Research Experiment (OARE)
Shuttle Amateur Radio Experiment-II (SAREX-II)
Ultraviolet Plume Instrument (UVPI)



TWR-63947
ECS SS 5062

360T026 (STS-47) Data Book

September 1992

Thiokol CORPORATION

SPACE OPERATIONS

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

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Introduction

Mission Summary

Launch Date: 12 September 1992

Lift Off Time: 10:23 EDT

Launch Window: 3 Hours 33 Minutes

Crew:

Commander:	Robert Gibson
Pilot:	Curtis Brown
MS1:	Mark Lee
MS2:	Jay Apt
MS3:	Jan Davis
MS4:	Mae Jemison
PS1:	Mamoru Mohri

Orbiter: Endeavour (OV-105)
MLP: 2
Launch Pad: 39A, KSC

Landing Sites:

NOM EOM	KSC, Florida
TAL	Zaragoza, Spain
	Ben Guerir, Morroco
AOA	White Sands Space Harbor, NM

Flight Duration: 6 days 20 hrs 36 min

Altitude: 163 Nautical Miles

Cargo Bay: Spacelab-J, GAS Bridge

Middeck Payloads:
Israel Space Agency Investigation About Hornets (ISAIAH)
Solid Surface Combustion Experiment (SSCE)
Shuttle Amateur Radio Experiiment II (SAREX-II)

Next Mission:
360T027 (STS-52) currently scheduled for 15 October 1992
Payload: LAGEOS-2, USMP-1
Orbiter: Columbia

Key RSRM Countdown Events

EDT	Actual Time Remaining	Countdown Clock Time	Event
02:30	L–79 hr 53 min		S0007 call to station (CTS) 02:30 EDT Wednesday, 9 September
03:00	L–79 hr 23 min	T–43 hr	Start of Countdown
19:00	L–63 hr 23 min	T–27 hr	Start 8 hr hold
03:00	L–55 hr 23 min	T–27 hr	End 8 hr hold
11:00	L–47 hr 23 min	T–19 hr	Start 4 hr hold
15:00	L–43 hr 23 min	T–19 hr	End 4 hr hold
23:00	L–35 hr 23 min	T–11 hr	Start 21 hr 03 min hold
10:23	L–24 hr	T–11 hr	*Verify RSRM PMBT is acceptable***
16:23	L–18 hr	T–11 hr	*Igniter joint heater activated**(through T–9 min)*
20:03	L–14 hr 20 min	T–11 hr	End 21 hr 03 min hold
21:03	L–13 hr 20 min	T–10 hr	*SRB aft skirt purge activated (if required)***
21:33	L–12 hr 50 min	T–9 hr 30 min	*SRB call to stations (CTS)*
21:53	L–12 hr 30 min	T–9 hr 10 min	*SRB OI bus A&B power up (for OPTs 1300,1301,2300, & 2301)*
22:23	L–12 hr 00 min	T–8 hr 40 min	SRB TVC power up
23:03	L–11 hr 20 min	T–8 hr	*Joint heater system activated (through T–1 min)***
01:03	L– 9 hr 20 min	T–6 hr	Start 1–hr hold
01:03	L– 9 hr 20 min	T–6 hr	*Begin Level A support*
01:03	L– 9 hr 20 min	T–6 hr	LCC verification
02:03	L–8 hr 20 min	T–6 hr	End 1–hr hold
02:48	L–7 hr 35 min	T–5 hr 15 min	Start LH_2, fast fill (continue for 1 hr 30 min)
02:53	L–7 hr 30 min	T–5 hr 10 min	Start LO_2, fast fill (continue for 2 hr 5 min)
04:03	L–6 hr 20 min	T–4 hr	Verify SIIs (PIC resistant test)
05:03	L–5 hr 20 min	T–3 hr	Stable LO_2/LH_2 replenish
05:03	L–5 hr 20 min	T–3 hr	Start 2–hr hold
06:03	L–4 hr 20 min	T–3 hr	*SRB OI bus C power up (for OPTs 1302 and 2302)*
		T–3 hr	Perform ice/debris inspection (Ice Team to pad)
07:03	L–3 hr 20 min	T–3 hr	End 2–hr hold
07:18	L–3 hr 5 min	T–2 hr 45 min	*Ice/debris inspection report (Ice Team) on OIS 245*
07:18	L–3 hr 5 min	T–2 hr 45 min	Verify no LCC violations
08:33	L–1 hr 50 min	T–1 hr 30 min	*OPT 75 percent reading calibration check***
08:43	L–1 hr 40 min	T–1 hr 20 min	Contingency hold point (GMT delta adjust)
09:18	L–1 hr 5 min	T–45 min	SRB and ET range safety system closed loop test

Key RSRM Countdown Events (Cont)

EDT	Actual Time Remaining	Countdown Clock Time	Event
09:43	L-40 min	T-20 min	Start 10-min hold
		T-20 min	HSC launch readiness check (on OIS 263)
09:53	L-30 min	T-20 min	End 10-min hold
09:58	L-25 min	T-15 min	*Aft skirt GN_2 high flow rate cleansing purge*
10:04	L-19 min	T-9 min	Start 10-min hold
		T-9 min	NSTS operations manager launch readiness status check (on SSPO)
		T-9 min	*Case acreage LCC expire (after status check)*
	L-10 min	T-9 min	*Igniter heater power off, Igniter LCC expire (prior to S&A arm at T-5)*
10:14	L-9 min	T-9 min	End 10-min hold
		T-9 min	Initiate GLS auto sequence
		T-7 min 30 sec	Contingency hold point (prior to OAA retract)
		T-5 min	Contingency hold point (prior to S&A arm and APU start)
	L-5 min	T-5 min	Nozzle-to-case and field joint LCC expires (prior to S&A arm)
		T-5 min	*Arm SRB ignition S&A (and all SRSS S&As)*
		T-5 min	APU power up (orbiter)
		T-5 min	Radio Net silence
		T-4 min	Contingency hold point (prior to SSME purge)
		T-2 min 55 sec	Contingency hold point (prior to LO_2 prepressurization)
		T-1 min 57 sec	Contingency hold point (prior to LH_2 prepressurization)
	L-1 min	T-1 min	*Field joint heater power off*
		T-31 sec	Contingency hold point (prior to auto sequence start)
	L-31 sec	T-31 sec	Go for auto sequence start
	L-28 sec	T-28 sec	SRB APU power up
	L-21 sec	T-21 sec	SRB gimbal profile check
	L-17.5 sec	T-17.5 sec	SRM igniter PIC arm command
	L-16 sec	T-16 sec	Gimbal test complete, nozzle-to-launch configuration
		T-16 sec	H_2O sound suppression system start
	L-11 sec	T-11 sec	S&A device armed verification, system inhibits off
	L-10 sec	T-10 sec	Free H_2 burnoff system ignition
	L-6.6 sec	T-6.6 sec	SSME 3 start
	L-6.5 sec	T-6.5 sec	SSME 2 start
	L-6.4 sec	T-6.4 sec	SSME 1 start
10:23	L-0	T-0	*SRB Ignition*
			Launch period begins 10:23 EDT(based on 12 Sep 1992 Launch)***

** OMRSD event—specifics in Component Section of Countdown Data Book
***Contingency Launch Schedule on following page

Introduction

Launch Window

Launch Date	Launch Window Open (GMT)*	Launch Window Close (GMT)*
9/11/92	14:23	17:56
9/12/92	14:23	17:54
9/13/92	14:24	17:52
9/14/92	14:24	17:50
9/15/92	14:25	17:49

* Note: All times are in GMT unless otherwise specified.
EDT = GMT - 4 hours
CDT = GMT - 5 hours
MDT = GMT - 6 hours
PDT = GMT - 7 hours

Crew Constraints typically call for a launch scrub 2.5 hours after the launch window opening (4 hours after loading the crew into the orbiter)

Launch Commit Criteria (LCC) Summary

LCC Title	Effectivity Period	MIN.	MAX.	Number of Sensors
S&A Device Safed	T-6 hrs to T-5 min	Safe on	Arm off	2 of 2 per booster
S&A Device Armed	T-5 min to T-0	Safe off	Arm on	2 of 2 per booster
OPT Ambient Pressure	T-1.5 hrs to T-31 sec	-7 psi	33 psi	3 of 3 per booster
Igniter Joint Temp.	T-6 hrs to T-9 min	74 °F	125 °F	1 of 2 per booster
Field Joint Temp.	T-6 hrs to T-5 min	80 °F	123 °F	2 of 4 per joint; 2 of 3 at 285 per SRM
Nozzle-to-Case Joint Temperature	T-6 hrs to T-5 min	75 °F	115 °F	2 of 3 per booster
Case Acreage Temperature	T-6 hrs to T-9 min	34 °F	N/A	3 of 5 per booster

Operation/Maintenance Requirement Specifications (OMRSD) Summary

OMRSD Component/Action	Time Period	Requirements/Comments
Flex Bearing Mean Bulk Temperature	L-96 hrs	Extended conditioning required if less than 60°F; purge set point 115°F until first sensor reaches 95°F +/- 5°F.
Propellant Mean Bulk Temperature	L-24 hrs	Verify in range from 44° to 86°F
Igniter Joint Heater Activation	L-18 hrs	Set point 100 +/- 1°F
Field Joint Heater Activation	T-8 hrs	Set point 97.5 +/- 1°F (set point rounds up to 98°F)
Chamber Pressure (Ambient)	T-1 hr 30 min	Verify ambient readings within -7 to 33 psia
Chamber Pressure (75% CALIBRATION)	T-1 hr 30 min	Verify 75% calibration readings within 729 to 799 psia
Igniter Joint Heater Deactivation	T-9 min to T-5 min	Prior to S & A rotation to arm (Agreement to resume heating if an extended hold is encountered prior to T-5 min)
Field Joint Heater Deactivation	T- 1 min	

RSRM Support Personnel
Wasatch—MIC I

MIC 1 Personnel Key Positions and Contact Points					
Responsibility	**Name**	**Call Sign**	**Location**	**Office No.***	**Home Phone No.**
Program Management	Ralston, C. Foulger, K. Johnson, T. Munson, S.	HSRM—Wasatch	MIC 1	2258 5732 3192 3959	(801)782-8471 (801) 782-5279 (801) 458-3868 (801) 752-2632
Engineering	Bailey, L.			3681	(801)723-3806
Mission Readiness Case Engineering PLI Engineering Nozzle Engineering Final Assembly Engrg	Sutton, J. Call, V. Petty, P. Wilks, R. Patterson, J.			3813 6618 3017 3945 4072	(801) 745-0709 (801) 723-1597 (801) 723-3665 (801) 782-5843 (801) 723-7867
Engineering Analysis Aero/Thermal Ballistics Heaters	Ketner, D. Eckhardt, K. Speas, K. St.Jean, P.			2125 3312 3255 4082	(801) 723-7534 (801) 723-5527 (801) 854-3931 (801) 774-6938
Project Integration	Henderson, S.			3261	(801) 720-0258†
Quality Assurance	Graves, S.			6945	(801) 476-1461
Alternate Phones			Projector Room MIC 1 Annex MIC 1 Annex Booth	3350 4830 4831	
FAX			Program Office Flight Support A-2 FAX Room A-2 FAX Room NASA Resident	9555 6149 2234 3536 3918	
Status Recorder				3366	
* Thiokol Network 522-xxxx Commercial/FTS (801) 863-xxxx † Cellular phone (prefer) Home: (801) 753-5765			Online Communications MIC 1 MIC 2	 3400 3357	

RSRM Support Personnel
MSFC—HOSC

HOSC Team Members
Key Positions and Contact Points

Responsibility	Name	Call Sign	Location	Console No.*	Hotel
NASA SRM Project Office	Caddy, L	HSRM-Caddy	Shuttle Action Center (SAC)	9748	N/A
NASA SRM Engineering	Trenkle, J.	HSRM-Trenkle	Shuttle Action Center (SAC)	9748	N/A
Thiokol Chief Engineer	Daines, J.	HSRM-Daines	Shuttle Action Center (SAC)	9722	Holiday Inn Express
Thiokol Console Manager	March, S. Pottorff, S.	HSRM-Console	Shuttle Engineering Console Room (SECR)	5753 (prefer) 9715	Holiday Inn Express
Thiokol Design Engineering	Maw, J. Drendel, A.	HSRM-CWA	SRM CWA/ FEWG Room	9732/43	Holiday Inn Express
Alternate Phones			Console Black Phone	5753	N/A
			Above CDS Terminal SECR	5056	N/A
FAX Numbers FAX in HOSC			SAC Room A273 Room A201 Room A209 Room A286	3003 (prefer) 5859 5868 5891 2409	N/A
Status Recorder				2160	N/A

*Commercial/FTS (205) 544-xxxx

Amberly Suites	(205) 837-4070	Marriott	(205)830-2222
Holiday Inn (Res Park)	(205) 830-0600	Holiday Inn Express	(205)
Marriott Courtyd	(205) 837-1400		
Radisson	(205) 882-9400		
Residence Inn	(205) 837-8907		
Hilton	(205) 533-1400		

Key Positions and Contact Points

Responsibility	Name	Office No.*	Home No.
SRM Project Office	Henson, K. Caddy, L.	3535 0721	(205) 830-9111 (205) 232-2887
SRM Engineering	Jones, K. Davis, M. Ross, M. Trenkle, J.	5553 5264 5587 2214	(205) 461-7901 (205) 883-0815 (205) 574-1430 (205) 461-7821
SRB Chief Engineer	Smith, J.	6562	(205) 881-8633
Chief Engineer	Schwinghamer, R.	2481	(205) 881-7805
Project Manager	J. Ellis	0721	(205) 539-0994
Shuttle Action Center (SAC) Personnel	Funderburk, B. Barnes, D. Sproles, B.	0880 (205) 971-3080 (205) 971-3041	(205) 881-0795 (205) 772-8602
Marshall Com		5300	
SYSCON		9804	
Marshall Data		1851/2404	
SAC		2183	

* Commercial/FTS (205) 544-xxxx

Thiokol Resident Office Key Personnel/Phone No.

Responsibility	Name	Phone No.*
Program Management	Roth, R.	Office: 4956 Home: (205) 534-1218
	Pinkerman, T.	Office: 4944 Home: (205) 830-6580
	Trausch, A.	Office: 4950 Home: (205) 430-0759
FAX		Office: 4976/8

* Thiokol Network 7-441-xxxx / Commercial (205) 722-xxxx

RSRM Support Personnel
KSC

KSC Team Members
Key Positions and Contact Points

Responsibility	Name	Call Sign	Location	Console No.*	Hotel
NASA Management	Hensen, K.	MSRM-Hensen	Firing Room No. 1	2480/2481/2482/3	Holiday Inn
	Jones, K.	MSRM-Jones	Firing Room No. 2	4373/8637/3525	Holiday Inn
Thiokol Management	Lombardo, J	MSRM-Lombardo	Room 4P8	7793	Howard Johnson (Cocoa Beach)
	Honeywill, T.	MSRM-Honeywill	Room 4P8		
	Ralston, C.	MSRM-Ralston	Firing Room No. 1	2480/2481/2482	Howard Johnson (Cocoa Beach)
	Parsons, K Shaffner, T.	MSRM-Parsons MSRM-Shaffner	Firing Room No. 2	4373/8637/3525	Howard Johnson (Cocoa Beach)
Thiokol Engineering	Kulkarni, S.	MSRM-Kulkarni	Firing Room No. 2	4373/8637/3525	Howard Johnson (Cocoa Beach)
	Sherard, H. St. Aubin, B.	MSRM-Console	ESA	3310/3329/3379	
Ice Team	Nowling, M. Hillard, B. Cook, J.		Firing Room No. 2	5980 (prefer) 3318/3319	
FAX			Room 4R23 ESA	7106 4417	
Status Recorder				2525/3900	
Communications	Stirling, J.		JIPC (Press Site)	(407) 799-9308 (JIPC) (407) 268-4813 (Office)	

*Commercial/FTS (407) 867-xxxx

Cape Winds	(407) 783-6226	Radisson	(407) 784-0000
Howard Johnson (Cocoa Beach)	(407) 783-9222	Royal Mansions	(407) 784-8484
Howard Johnson (Titusville)	(407) 267-7900		
Holiday Inn	(407) 783-2271		
Inn by the Beach	(407) 799-3460		
Sand Castles	(407) 783-4200		
Thiokol Condo (1101)	(407) 784-8988		
Thiokol Condo (803)	(407) 784-2913		
Hyatt (Orlando Airport)	(407)825-1234		
Wakulla Motel	(407) 783-2230		

Thiokol Resident Office
Key Personnel/Phone No.

Responsibility	Name	Office No.	Home No.
LSS Office Personnel	Honeywill, T.	268-1308	(407) 454-4443
	Shaffner, T.	867-3144	(407) 268-5936
	Sherard, H.	861-6980	(407) 453-4151
	St Aubin, B.	861-6286	(407) 269-7001
	Jenson, L.	867-2130/4064	(407) 452-1709
	Hillard, B.	867-2704/4099	(407) 383-1816
FAX	Program/LSS Office: (407) 453-2179		

Commercial/FTS (407) 867-xxxx
Commercial/FTS (407) 861-xxxx

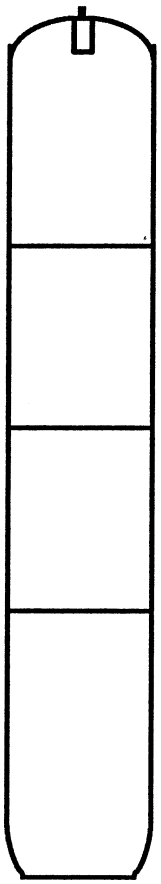
Key Personnel / Phone No.

Responsibility	Name	Office No.
MESA Manager	Houston, C.	867-3250
JPS Heater Console	Atkinson, L.	861-4311
Aft Skirt Purge Console	Quandt, P.	861-4894
Instrumentation	Crimi, T.	861-4262

Commercial/FTS (407) 867-xxxx
Commercial/FTS (407) 861-xxxx

As-Built Information

LCC Contingency Temperatures



Heater Location	LCC	Minimum Allowable Sensor Temperature *	
		LH (A)	RH (B)
Igniter	74°F	72°F †	72°F †
Forward Field Joint	80°F	66°F	66°F
Center Field Joint	80°F	67°F	70°F
Aft Field Joint	80°F	65°F	70°F
Nozzle-to-Case Joint	75°F	65°F	65°F

* LCC contingency temperature in the event of heater failure

† Minimum seal temperature of 70°F plus 2° instrumentation uncertainty (Ref: TWR-63712 or NSTS 16007 SSID: SRM-10)

Thiokol CORPORATION
SPACE OPERATIONS

George C. Alford
Vice President and RSRM Program Manager

October 28, 1993
E000-FY94-248A

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

Attention Mr. V. K. Henson, SA51

Gentlemen:

Subject: 360L023 (STS-61) Transmittal of Actual Field and Case-to-Nozzle Joint Seal Temperature Requirements Based on "As Built" Hardware Configuration Including Standard Repairs

This letter officially documents the actual field and case-to-nozzle joint seal temperature requirements for motor set 360L023 (STS-61). After concurrence to these temperature values is obtained, a copy of this letter will be included in the Prelaunch Countdown Data Book for reference. These same temperature values will be used to write launch commit criteria (LCC) waivers in the event of failure and/or problems with the aft end purge heater, or redundant field joint heater failure.

These temperature values were extracted from Table 5 of TWR-63650-23, which documents the analysis method and conditions used to determine the required temperature range of all seals in motor set 360L023, including identified standard repairs to seal surface areas and 21% ultrasonic error for nozzle-to-case joint. (Table 5 is also included in the flight specific portion of the countdown data book.)

In the event of redundant field joint heater failure, 3°F should be added to the limiting field joint seal temperature to derive a contingency "heater out" LCC. This 3° is to account for the combined effect of circumferential temperature variation (away from the sensors) and electronic sensor error, as defined in the thermal analysis TWR-19731.

In the event of failure and/or problems with the aft end purge heater, 2°F should be added to the limiting nozzle/case joint seal temperature to derive a contingency LCC. This 2° is to account for electronic sensor error.

MOTOR	360L023A (LH)				360L023B (RH)			
JOINT	FWD	CTR	AFT	N/C	FWD	CTR	AFT	N/C
LIMITING SEAL TEMP	63°F	64°F	62°F	63°F	63°F	67°F	67°F	63°F
CONTINGENCY LCC TEMP	66°F	67°F	65°F	65°F	66°F	70°F	70°F	65°F

Very truly yours,

G. C. Alford

L. G. Bailey
RSRM Chief Engineer

Concurrence

Manager, RSRM Project

Chief Engineer, RSRM Project

P.O. Box 707, Brigham City, UT 84302-0707 (801)863-3954

As-Built Information

LCC Contingency Temperatures (Cont)

Number: WK??????
Element/File/Volume: SRB NSTS 16007
Exception/Waiver Title: Revise Minimum LCC Temp for Igniter Joint
Exception/Waiver Effectivity End Item BI063, Flight 01 (X) One Flight Only STS-61

Req No. Eff Code Crit Code	Description	Technical Rationale for Exception/Waiver
NSTS 16007 Page 2.4-06	LCC requires that one of two temperature sensors be functional and reflect joint temperatures within the redline limits of 74-to-125 °F	The purpose of the min/max igniter joint temperature limits are to assure that the gasket seals satisfy the 1.4 tracking factor per the RSRM specification CPW1-3600A. Current LCC limits have been established for a worst-case scenario of minimum gasket crown height and maximum expected displacement. It also includes worst-case cooldown condition prior to launch.
Assoc PR# and Date of Occurrence	Problem Description	
TBD	Primary and secondary heater failure on Igniter joint of (RH/LH) booster	The ability of the gasket seals to track and maintain a seal during flight has been tested (dynamic and resiliency). The gasket seal is tested for worst-case condition it is expected to see during flight.
		For a heater-out condition, the minimum seal temperature remains unchanged at 70 °F. The heater-out contingency igniter minimum temperature is calculated for T-0 and does not include the sensor cooldown. Net result of eliminating the sensor cooldown is approximately 2 °F. (The results of the heater-out contingency analysis is documented in TWR-63712.)
		The minimum allowable LCC temperature limit for the igniter joint on the LH/RH booster is 72 °F.

As-Built Information

LCC Contingency Temperatures (Cont)

Number: WK??????
Element/File/Volume: SRB NSTS 16007
Exception/Waiver Title: Revise Minimum LCC Temp for Field Joint
Exception/Waiver Effectivity End Item BI063, Flight 01 (X) One Flight Only STS-61

Req No.
Eff Code
Crit Code

NSTS 16007
Page 2.4-06

Assoc PR#
and Date of
Occurrence

TBD

Description

LCC requires that two of four temperature sensors be functional and reflect joint temperatures within the redline limits of 80-to-123 °F

Problem Description

Primary and secondary heater failure on (Fwd/Ctr/Aft) joint of (RH/LH) booster

Technical Rationale for Exception/Waiver

The purpose of the min/max field joint temperature limits are to assure that the primary and secondary seals satisfy the 2.0 tracking factor per the RSRM specification CPW1-3600A. Current LCC limits have been established for a worst-case scenario of minimum O-ring and deepest gland. For each field joint on STS-61, the actual O-ring squeeze has been calculated using actual hardware and O-ring dimensions.

O-rings have been tested for recovery tracking force for different squeeze values and temperatures over varying lengths of storage time and temperature. Testing was conducted using the maximum predicted gap opening. From these data, minimum acceptable seal temperature limits have been established for each joint of STS-61.

The minimum allowable LCC contingency temperature limit for the (Fwd/Ctr/Aft) field joint on the LH/RH booster is (____°F)

NOTE: For RSRM-023 STS-61

	LH	RH
Fwd	66 °F	66 °F
Ctr	67 °F	70 °F
Aft	65 °F	70 °F

As-Built Information

LCC Contingency Temperatures (Cont)

Number: WK??????
Element/File/Volume: SRB NSTS 16007
Exception/Waiver Title: Revise Minimum LCC Temp for Nozzle-to-Case Joint
Exception/Waiver Effectivity End Item BI063, Flight 01 (X) One Flight Only STS-61

Req No. Eff Code Crit Code	Description
NSTS 16007	Launch commit criteria requires that two of three temperature sensors be functional and reflect joint temperatures within the redline limits of 75-to-115 °F
Assoc PR# and Date of Occurrence	Problem Description
TBD	Failure of heater in the (RH/LH) aft skirt nitrogen purge system

Technical Rationale for Exception/Waiver

The purpose of the min/max nozzle-to-case joint temperature limits are to assure that the primary and secondary seals satisfy the 2.0 tracking factor per the RSRM specification CPW1-3600A. Current LCC limits have been established for a worst-case scenario of minimum O-ring and deepest gland. For each nozzle-to-case joint on STS-61, the actual O-ring squeeze has been calculated using actual hardware and O-ring dimensions.

O-rings have been tested for recovery tracking force for different squeeze values and temperatures over varying lengths of storage time and temperature. Testing was conducted using the maximum predicted gap opening. From these data, minimum acceptable seal temperature limits have been established for each joint of STS-61.

The minimum allowable LCC temperature limit for the nozzle-to-case joint on the LH booster is (____°F) and is (____°F) on the RH booster

NOTE: For RSRM-023	STS-61	
	LH	RH
N/C	65 °F	65 °F

As-Built Information

O-ring Squeeze and Seal Temperature Requirements

Field Joint Seals

Motor	Joint	Required Minimum* Squeeze (%)	Actual Minimum Squeeze (%)	Interference (PMD Values) (in.)	Actual O-ring Cross Section (in.)	Maximum Expected Gap Opening (in.)	Required Seal Temperature (°F)
34A	Forward/primary	15.1	21.4	0.003	0.2892	0.0084	62-to-130
	Forward/secondary	15.1	20.9	0.003	0.2877	0.0084	63-to-130
	Center/primary	15.1	20.5	0.007	0.2873	0.0084	64-to-130
	Center/secondary	15.1	20.5	0.007	0.2889	0.0084	64-to-130
	Aft/primary	15.1	21.1	0.014	0.2880	0.0084	62-to-130
	Aft/secondary	15.1	21.4	0.014	0.2875	0.0084	62-to-130
34B	Forward/primary	15.1	21.0	0.015	0.2869	0.0084	63-to-130
	Forward/secondary	15.1	20.8	0.015	0.2890	0.0084	63-to-130
	Center/primary	15.1	19.6	0.006	0.2892	0.0084	66-to-130
	Center/secondary	15.1	19.2	0.006	0.2879	0.0084	67-to-130
	Aft/primary	15.1	19.2	0.014	0.2878	0.0084	67-to-130
	Aft/secondary	15.1	20.0	0.014	0.2895	0.0084	65-to-130

Igniter System Seals

Motor	Joint		Required Minimum Squeeze (%)	Actual Squeeze (%)	Maximum Expected Gap Opening (in.)	Required Seal Temperature (°F)
34A & B	Inner Gasket		N/A	N/A	0.00166	70-to-130
	S&A Gasket		N/A	N/A	0.0010	57-to-130
	Outer Gasket		N/A	N/A	CLOSES	33-to-130
34A	B-B Rotor Shaft Primary	#1	10	>10†	N/A	50-to-130
		#2	10	>10†	N/A	50-to-130
	B-B Rotor Shaft Secondary	#1	10	>10†	N/A	50-to-130
		#2	10	>10†	N/A	50-to-130
34B	B-B Rotor Shaft Primary	#1	10	>10†	N/A	50-to-130
		#2	10	>10†	N/A	50-to-130
	B-B Rotor Shaft Secondary	#1	10	>10†	N/A	50-to-130
		#2	10	>10†	N/A	50-to-130

* 16.5% Nominal squeeze, and maximum allowable standard repair to seal surface areas

† New 1U50228-49 O-Ring guarantees an actual squeeze in excess of 10% (Data will no longer be tracked in future publications)

As-Built Information

O-ring Squeeze and Seal Temperature Requirements (Cont)

Nozzle-to-Case Joint Seals

Motor	Joint	Required Minimum Squeeze (%)	Actual Minimum Squeeze (%)	Actual O-ring Cross Section (in.)	Maximum Expected Gap Opening (in.)	Required Seal Temperature (°F)
34A	Primary	14.2	20.0	0.2886	0.0081	63-to-130
	Secondary	14.0	20.4	0.2725	0.0055	63-to-130
34B	Primary	14.2	19.6	0.2884	0.0081	63-to-130
	Secondary	14.0	19.6	0.2724	0.0055	63-to-130

Internal Nozzle Joint Seals

Motor	Joint	Required Minimum Squeeze (%)	Nominal O-ring Cross Section (in.)	Maximum Expected Gap Opening (in.)	Required Seal Temperature (°F)
34A and 34B	1 Primary	10	0.210	STATIC	33-to-130
	1 Secondary	10	0.275	STATIC	33-to-130
	2 Primary	10	0.156	STATIC	33-to-130
	2 Secondary	10	0.295	0.0010	33-to-130
	3 Primary	10	0.210	STATIC	33-to-130
	3 Secondary	10	0.210	STATIC	33-to-130
	4 Primary	10	0.210	CLOSES	33-to-130
	4 Secondary	10	0.295	STATIC	33-to-130
	5 Primary	10	0.275	STATIC	33-to-130
	5 Secondary	10	0.275	STATIC	33-to-130

As-Built Information

Hardware Reuse Summary (LH)

		Previous Use	360L023 Total Proofs	360L023 Total Tests	360L023 Total Flights	Inventory Total Proofs	Inventory Total Tests	Inventory Total Flights
Forward Dome P/N 1U51473-03	S/N 0000046R2	RSRM-4B, -13A	5	0	2	9	3	5
Cylinder, Standard Weight P/N 1U50131-13	S/N 0000066R4	SRM-1B, -8A, -17B, TEM-6	5	1	3	12	3	6
Capture Cylinder, Standard Weight P/N 1U52983-02	S/N 0000031	New	3	0	0	8	2	3
Cylinder, Lightweight P/N 1U50717-05	S/N 0000121R3	QM-6, RSRM-4B, FSM-1	12	2	1	12	4	5
Capture Cylinder, Lightweight P/N 1U52982-03	S/N 0000067	New	3	0	0	8	2	3
Cylinder, Lightweight P/N 1U50717-05	S/N 0000083R1	SRM-19A	3	0	1	12	4	5
Capture Cylinder, Lightweight P/N 1U52982-03	S/N 0000030R1	RSRM-3A	4	0	1	8	2	3
Attach, Lightweight P/N 1U50716-09	S/N 0000044	New	3	0	0	19	2	5
Stiffener, Lightweight P/N 1U50715-06	S/N 0000082	New	3	0	0	10	2	4
Stiffener, Lightweight P/N 1U50715-05	S/N 0000027R3	SRM-20A, TEM-2, RSRM-13A	4	1	2	10	2	4
Aft Dome P/N 1U50129-11	S/N 0000056	New	3	0	0	17	4	5

Requirements: Proof tests, 22 maximum; flights/static tests, 10 maximum
Conclusion: All hardware, new or used, satisfies all engineering requirements and is safe to fly
Note: Shading indicates inventory leader; inventory totals are based on current engineering configuration

As-Built Information

Case Reuse and Dimensions

360L023—Case Dimensions and Safety Factors (LH)

Case	S/N	Minimum Material Ultimate Strength (ksi)^^^	Required Minimum Membrane (in.)	Actual^ Minimum Membrane (in.)	Maximum Expected Operating Pressure (MEOP) (psig)	MS at MEOP without Arcing ~	FS at MEOP without Arcing ~	MS at MEOP with Arcing ~~	FS at MEOP with Arcing ~~	MOP at 74 °F (psig)^^	MOP ~ MS ***	MOP ~ FS ***	MS at MOP ~~ with Arcing ***	FS at MOP~~ with Arcing ***
1U51473	046	203.3	Variable	Variable	1,004	—	—	—	—	909	—	—	—	—
1U50131	066	203.8	0.477	0.470 *	1,001	0.01	1.41	-0.06	1.32	906	0.11	1.56	0.04	1.45
1U52983	031	219.9	0.477	0.498	955	0.21	1.69	0.13	1.58	865	0.33	1.87	0.25	1.75
1U50717	121	213.9	0.450	0.445 *	945	0.06	1.49	-0.01	1.38	856	0.17	1.64	0.09	1.52
1U52982	067	212.1	0.450	0.471	937	0.12	1.57	0.05	1.47	848	0.24	1.74	0.16	1.62
1U50717	083	217.3	0.450	0.469 *	919	0.17	1.64	0.09	1.52	832	0.29	1.81	0.20	1.68
1U52982	030	219.0	0.450	0.459 *	911	0.16	1.63	0.08	1.51	825	0.28	1.80	0.19	1.67
1U50716	044	218.2	0.450	0.448 *	900	0.14	1.60	0.06	1.49	815	0.26	1.77	0.17	1.64
1U50715	082	211.3	0.450	0.452 *	897	0.12	1.57	0.04	1.46	812	0.24	1.74	0.15	1.61
1U50715	027	211.1	0.450	0.474	902	0.17	1.64	0.09	1.53	817	0.29	1.81	0.20	1.69
1U50129	056	212.8	Variable	Variable	920	—	—	—	—	833	—	—	—	—

* Membrane thickness is due to a documented thin spot

^ Values reported are the smallest actual refurbishment values unless otherwise noted
^^ MOP pressures were calculated at 74°F from the Left Hand MOP Headend Pressure, 907.7 psia, which was reported in TWR-60577 and derived at 60°F
^^^ Minimum Ultimate Strength from Coupon Testing in Vendor Inspection Plan

~ Safety values are calculated with the following equations:

$$MS = \frac{(\text{Material Ultimate Strength})\ (\text{Biaxial Improvement})}{(\text{Maximum Stress})\ (1.4)} - 1.0$$

Where:

Biaxial Improvement = 1.071

$$\text{Maximum Stress} = \frac{(\text{Pressure})\ (\text{Case Radius})}{(\text{Actual Minimum Membrane} - \text{Maximum Arc Pit})}$$

Pressure = Either MEOP or MOP
Case Radius = 72.57 in.
Max Arc Pit = 0.032

$$FS = 1.4\ (MS + 1.0)$$

MEOP = maximum expected operating pressure

~~ Safety values, which incorporate a maximum pitting due to arcing, are calculated with the following equations:

$$MS = \frac{(\text{Material Ultimate Strength})\ (\text{Biaxial Improvement})}{(\text{Maximum Stress})\ (1.4)} - 1.0$$

Where:

Biaxial Improvement = 1.071

$$\text{Maximum Stress} = \frac{(\text{Pressure})\ (\text{Case Radius})}{(\text{Actual Minimum Membrane})}$$

Pressure = Either MEOP or MOP
Case Radius = 72.57 in.

$$FS = 1.4\ (MS + 1.0)$$

MOP = maximum operating pressure

*** Margin of safety and factor of safety calculations should be based on MEOP in accordance with CEI requirement 3.3.6.3 (CPW1-3600a). Use of margin of safety or factor of safety values based on any other pressure should be approved using the deviation/waiver procedures.

As-Built Information

Hardware Reuse History (RH)

		Previous Use	360L023 Total Proofs	360L023 Total Tests	360L023 Total Flights	Inventory Total Proofs	Inventory Total Tests	Inventory Total Flights
Forward Dome P/N 1U51473-03	S/N 0000047R3	RSRM-3B, -12A, -24B	8	0	3	9	3	5
Cylinder, Standard Weight P/N 1U50131-13	S/N 0000056R7	QM-1, SRM-3B, -13A, -22A, RSRM-4B, -13A, -24B	9	1	6	12	3	6
Capture Cylinder, Standard Weight P/N 1U52983-02	S/N 0000022R2	RSRM-13A, -24B	5	0	2	8	2	3
Cylinder, Lightweight P/N 1U50717-05	S/N 0000111R1	TEM-3	3	1	0	12	4	5
Capture Cylinder, Lightweight P/N 1U52982-03	S/N 0000037R2	RSRM-5A, -13B	5	0	2	8	2	3
Cylinder, Lightweight P/N 1U50717-05	S/N 0000093R3	SRM-20B, RSRM-3A, -13A	6	0	3	12	4	5
Capture Cylinder, Lightweight P/N 1U52982-03	S/N 0000034R2	RSRM-4A, -13B	5	0	2	8	2	3
Attach, Lightweight P/N 1U50716-09	S/N 0000046	New	3	0	0	19	2	5
Stiffener, Lightweight P/N 1U50715-06	S/N 0000081	New	3	0	0	10	2	4
Stiffener, Lightweight P/N 1U50715-06	S/N 0000066R1	RSRM-12A	4	0	1	10	2	4
Aft Dome P/N 1U50129-11	S/N 0000057	New	3	0	0	17	4	5

Requirements: Proof tests, 22 maximum; flights/static tests, 10 maximum
Conclusion: All hardware, new or used, satisfies all engineering requirements and is safe to fly
Note: Inventory totals are based on current engineering configuration

As-Built Information

Case Reuse and Dimensions

360L023—Case Dimensions and Safety Factors (RH)

Case	S/N	Minimum Material Ultimate Strength (ksi)^^^	Required Minimum Membrane (in.)	Actual^ Minimum Membrane (in.)	Maximum Expected Operating Pressure (MEOP) (psig)	MS at MEOP without Arcing~	FS at MEOP without Arcing~	MS at MEOP with Arcing~~	FS at MEOP with Arcing~~	MOP at 74 °F (psig)^^	MOP ~ MS ***	MOP ~ FS ***	MS at MOP ~~ with Arcing ***	FS at MOP ~~ with Arcing ***
1U51473	047	210.8	Variable	Variable	1,004	—	—	—	—	907	—	—	—	—
1U50131	056	200.2	0.477	0.480	1,001	0.01	1.42	-0.06	1.32	904	0.12	1.57	0.05	1.46
1U52983	022	214.4	0.477	0.474 *	955	0.12	1.57	0.05	1.46	863	0.24	1.74	0.16	1.62
1U50717	111	213.7	0.450	0.461 *	945	0.10	1.54	0.02	1.43	854	0.22	1.70	0.13	1.58
1U52982	037	220.2	0.450	0.449 *	937	0.11	1.56	0.03	1.45	846	0.23	1.72	0.14	1.60
1U50717	093	212.1	0.450	0.444 *	919	0.08	1.51	0.00	1.40	830	0.20	1.67	0.11	1.55
1U52982	034	220.9	0.450	0.442 *	911	0.13	1.58	0.05	1.47	823	0.25	1.75	0.16	1.62
1U50716	046	212.6	0.450	0.473	900	0.18	1.65	0.10	1.54	813	0.30	1.83	0.22	1.70
1U50715	081	212.6	0.450	0.464	897	0.16	1.62	0.08	1.51	810	0.28	1.80	0.20	1.67
1U50715	066	213.3	0.450	0.448 *	902	0.12	1.56	0.04	1.45	815	0.24	1.73	0.15	1.61
1U50129	057	210.5	Variable	Variable	920	—	—	—	—	831	—	—	—	—

* Membrane thickness is due to a documented thin spot

^ Values reported are the smallest actual refurbishment values unless otherwise noted
^^ MOP pressures were calculated at 74°F from the Right Hand MOP Headend Pressure, 905.7 psia, which was reported in TWR-60577 and derived at 60°F
^^^ Minimum Ultimate Strength from Coupon Testing in Vendor Inspection Plan

~ Safety values are calculated with the following equations:

$$MS = \frac{(\text{Material Ultimate Strength})\ (\text{Biaxial Improvement})}{(\text{Maximum Stress})\ (1.4)} - 1.0$$

Where:

Biaxial Improvement = 1.071

$$\text{Maximum Stress} = \frac{(\text{Pressure})\ (\text{Case Radius})}{(\text{Actual Minimum Membrane} - \text{Maximum Arc Pit})}$$

Pressure = Either MEOP or MOP
Case Radius = 72.57 in.
Max Arc Pit = 0.032

$$FS = 1.4\ (MS + 1.0)$$

MEOP = maximum expected operating pressure

~~ Safety values, which incorporate a maximum pitting due to arcing, are calculated with the following equations:

$$MS = \frac{(\text{Material Ultimate Strength})\ (\text{Biaxial Improvement})}{(\text{Maximum Stress})\ (1.4)} - 1.0$$

Where:

Biaxial Improvement = 1.071

$$\text{Maximum Stress} = \frac{(\text{Pressure})\ (\text{Case Radius})}{(\text{Actual Minimum Membrane})}$$

Pressure = Either MEOP or MOP
Case Radius = 72.57 in.

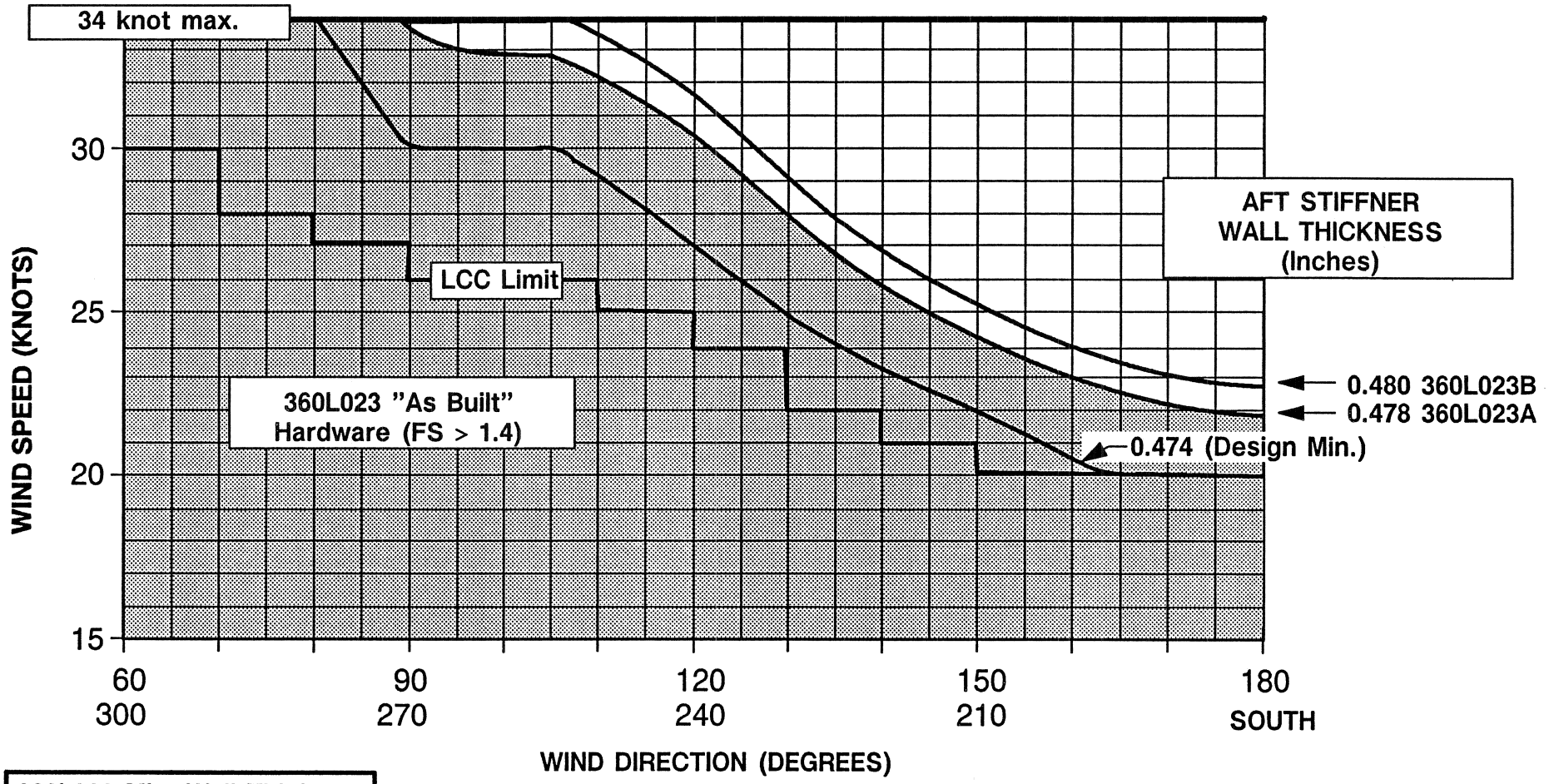
$$FS = 1.4\ (MS + 1.0)$$

MOP = maximum operating pressure

*** Margin of safety and factor of safety calculations should be based on MEOP in accordance with CEI requirement 3.3.6.3 (CPW1-3600a). Use of margin of safety or factor of safety values based on any other pressure should be approved using the deviation/waiver procedures.

As-Built Information
Case Buckling Constraints

WIND SPEED -VS- WIND DIRECTION CURVES



360L023 Min. Wall Thickness	
LH	RH
0.478	0.480

As-Built Information

Nozzle-to-Case Joint Temperature LCC

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-07

LCC VIOLATION CALL: SRM NOZZLE-TO-CASE JOINT TEMP ANOMALY | EMERG COND NONE

MEAS NO.	MEASUREMENT DESCRIPTION	CAT.	MIN	MAX	UNITS	CODE
B06T7091A	LH Nozzle-to-Case Joint Temps PRI LH SRB STA 1876.6/50 Temp		75	115	deg F	CI
B06T7092A	PRI LH SRB STA 1876.6/130 Temp		75	115	deg F	CI
B06T7093A	PRI LH SRB STA 1876.6/270 Temp		75	115	deg F	CI
B06T8091A	RH Nozzle-to-Case Joint Temps PRI RH SRB STA 1876.6/50 Temp		75	115	deg F	CI
B06T8092A	PRI RH SRB STA 1876.6/130 Temp		75	115	deg F	CI
B06T8093A	PRI RH SRB STA 1875/270 Temp		75	115	deg F	CI

TIME PERIOD: From Start of ET Cryo Tanking (T-6 hrs) to Go for APU Start (T-5 min)

REQUIREMENTS: Drawing:

(1) Two of three sensors per motor required functional. All functional sensors must be within the redlines.

PREPLANNED CONTINGENCY PROCEDURE:

(2) In the event the minimum redline is exceeded, a change will be processed which will specify the minimum redline for the affected joint, thereby allowing the countdown to continue. This change will be consistent with the temperature data presented at the Space Shuttle Program FRR (CoFR6).
(3) In the event of instrumentation failure for more than 1 sensor on a given motor, the following flex bearing aft end ring sensors may be used as backup measurements to allow the countdown to continue. The minimum redline for these backup measurements is +3 deg F greater than the redline for the nozzle-to-case joint sensors to allow for differential temperatures. The maximum redline remains at 115 deg F.

MEAS NO.	DESCRIPTION	IDENTIFIED AS (REF. OMRSD S00FA0.776)
B06T7043A	PRI LH SRB Sta 1847/0 Temp	B06T7087A
B06T7045A	PRI LH SRB Sta 1847/120 Temp	B06T7088A
B06T7047A	PRI LH SRB Sta 1847/240 Temp	B06T7089A
B06T8043A	PRI RH SRB Sta 1847/0 Temp	B06T8087A
B06T8045A	PRI RH SRB Sta 1847/120 Temp	B06T8088A
B06T8047A	PRI RH SRB Sta 1847/240 Temp	B06T8089A

NOTES:
(4) Manual hold - Do not automate

REDLINE DERIVATION: CRITICALITY:

(5) Redline development:	Min	Max
Basic Redline (6) (7)	75.0 deg F	115 deg F
O-ring/RTD Differential (8) (9)	+0.0 deg F	NA
Cooldown	NA	N/A
Circumferential Joint Temp (10)	+0.0 deg F	+0.0 deg F
Heater Gap Depression	NA	N/A
Instrumentation error	NA	NA
Redline (Rounded)	75.0 deg F	115.0 deg F

REDLINE DERIVATION (CONT):

(6) The minimum redline ensures nozzle-to-case joint O-ring seals are at least 75 deg F to assure a 2.0 tracking safety factor based on worst-case tolerances.
(7) The maximum redline ensures the nozzle bondlines are below 115 deg F for proper bondline adhesive strength at launch.
(8) RTD = Resistance temperature detector
(9) Assumes same seal/sensor temperature due to high heat conductive nature of aft dome and fixed housing steel.
(10) Empirical data review and model analysis indicate minimal circumferential variation once steady-state condition is achieved; variations occur during warmup/cooldown periods, only.
(11) Instrumentation error is absorbed in conservative 2.0 safety factors.

CONSEQUENCES OF EXCEEDING REDLINE:

(12) Nozzle-to-case joint O-ring seals will not meet the required seal tracking safety factor at temperatures below 75 deg F.
(13) Adhesive temperatures above 115 deg F will result in loss of redundancy in nozzle phenolic bondline margins of safety.

CAUSES OF EXCEEDING REDLINE:

(14) Extreme ambient air temperature
(15) Cryogenic leakage
(16) Instrumentation failure
(17) Aft skirt purge heater failure

BIT VALUE	PCM RANGE LOW	PCM RANGE HIGH	METER RANGE LOW	METER RANGE HIGH	C AND W MIN	C AND W MAX	SM MIN	SM MAX
1.6	-211	+188.8						

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO. SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO. VS72-948099 SHEET 24 ZONE I

NASA: MSFC, S. Thornton CONTRACTOR: TC, D. Nisonger

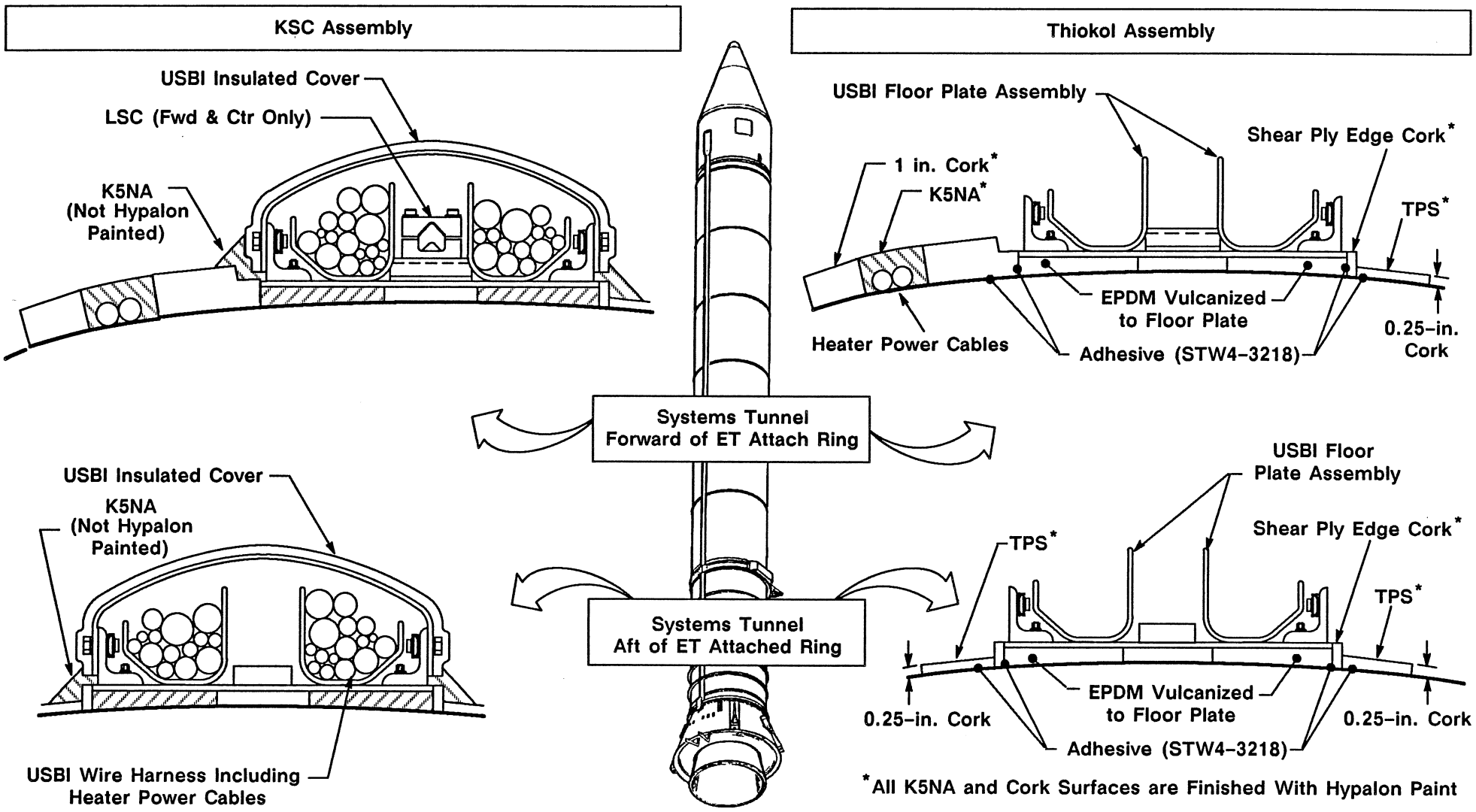
ELEMENT: SRM SUBSYSTEM: SRM MISSION: STS-61

As-Built Information

Nozzle-to-Case Joint OMRSD (RSRM-23)

NUMBER		DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FA0.776	1	RSRM NOZZLE FLEX BEARING TEMP LIMIT		HAZL03	A:B063 B: C: C-1: RSRM NOZZLE TO CASE GEI TEMPERATURE SENSOR AND THE NOZZLE FLEX BEARING GEI TEMPERATURE SENSORS SHALL BE A MAXIMUM OF 115 DEGREES F.
	0-000				
	0-001	VERIFY THE RSRM NOZZLE FLEX BEARING			
	0-002	IS AT AN ACCEPTABLE TEMPERATURE AS			
	0-003	FOLLOWS:			
	0-004				
	0-005				
	0-006				
	0-007				
	0-008				
	0-009				
	0-010	A. FROM 85 HOURS PRIOR TO T-6 HOURS	B06T7043A	AVERAGE	
	0-011	UNTIL START OF AFT END PURGE	B06T8043A	TEMPERATURE 60	
	0-012	VERIFY NOZZLE FLEX BEARING AVERAGE	B06T7045A	DEG F MINIMUM	
	0-013	TEMPERATURE	B06T8045A	(SEE C-2)	
	0-014	OR	B06T7047A		
	0-015		B06T8047A		
	0-016				
	0-017	B. THERMALLY CONDITION AFT END WITH		REFERENCE TABLE	
	0-018	AFT END PURGE FOR THE SPECIFIED		S00FA0776-1	
	0-019	TIME PERIOD			
	0-020				
	0-021				
	0-022				
	0-023				
	0-024				C-2: THE AVERAGE RSRM NOZZLE FLEX BEARING TEMPERATURE IS OBTAINED BY AVERAGING RSRM NOZZLE FLEX BEARING LOWEST GEI TEMPERATURE SENSOR READING (ONE POINT EVERY 3 HOURS) FOR THE PREVIOUS TWO WEEKS.
	0-025				
	0-026				
	0-027				
	0-028				
	0-029				
	0-030				
	0-031				
	0-032				
	0-033				
	0-034				
	0-035				
	0-036				
	0-037				
	0-038				
	0-039				
	0-040				C-3: THE GN2 FLOW PRESSURE SHALL BE A MINIMUM OF 35 PSIG.
	0-041				
	0-042				
	0-043				
	0-044				
	0-045				C-4: A MINIMUM OF 2 OUT OF 3 GEI TEMPERATURE SENSORS FOR BOTH THE NOZZLE TO CASE AND THE FLEX BEARING SHALL BE OPERATIVE.
	0-046				
	0-047				
	0-048				
	0-049				
	0-050				
	0-051				
	0-052				
	0-053				
	0-054				
	0-055				
	0-056				
	0-057				
	0-058				R-1: NOTED GN2 SPECIFICATIONS ARE AT THE GROUND PANEL SUPPLY.
	0-059				
	0-060				
	0-061				R-2: THE PURGE GAS GN2 TEMPERATURE (GHYT8013A) WILL BE SET AT 115 DEGREES F UNTIL THE FIRST NOZZLE TO CASE OR NOZZLE FLEX BEARING GEI TEMPERATURE SENSOR REACHES 95 DEGREES F. THE PURGE GAS GN2 TEMPERATURE WILL THEN BE SET AT 95+/-5 DEGREES F UNTIL LAUNCH.
	0-062				
	0-063				
	0-064				
	0-065				
	0-066				
	0-067				
	0-068				
	0-069				
	0-070				
	0-071				
	0-072				
	0-073				R-3. THE FOLLOWING GEI TEMPERATURE SENSORS WILL BE IDENTIFIED AS FOLLOWS: IS — IDENTIFIED AS B06T7043A — B06T7087A B06T8043A — B06T8087A B06T7045A — B06T7088A B06T8045A — B06T8088A B06T7047A — B06T7089A B06T8047A — B06T8089A
	0-074				
	0-075				
	0-076				
	0-077				
	0-078				
	0-079				
	0-080				
	0-081				
	0-082				
	0-083				
	0-084				
	0-085				D: CRIT 1 ICD-2-0A002, ICD-3-44005 HAZ #: RSRM BC-04, BN-04, BN-06, BN-08

As-Built Information



Aft Looking Forward

As-Built Information

Ballistic Performance Predictions

Predicted Burn Rate Properties

	Left-Hand Motor		Right-Hand Motor	
	60 °F	74°F*	60 °F	74°F*
Target Burn Rate at 625 psia (in./sec)	0.3680	0.3717	0.3680	0.3717
Predicted Burn Rate at 625 psia (in./sec)	0.3659	0.3696	0.3654	0.3691
Burn Rate Exponent (n)	0.35	0.35	0.35	0.35
Temperature Sensitivity Coefficient at Constant K_n (/°F)	0.0011	0.0011	0.0011	0.0011
5-in. CP to SRM Burn Rate Scale Factor at 625 psia**	1.0149	1.0149	1.0149	1.0149
5-in. CP Average Burn Rate at 625 psia (in./sec)	0.3605	0.3644	0.3600	0.3639

* Predicted L-9 day PMBT

** The scale factor is based on the average of 18 flight motors. (RSRM-1 to RSRM-18).

As-Built Information

Ballistic Performance Predictions (Cont)

Performance Predictions Summary

	CEI Specification Limits (60 °F)	Predicted Individual Motor Performance				Predicted (matched set) Flight Set Performance	
		Left-Hand Motor		Right-Hand Motor		Allowable Specification Difference (%)	Predicted Difference (%)
		60 °F	74 °F	60 °F	74 °F		
Web Time (sec)	105.5 to 116.7	112.2	110.5	112.4	110.8	2.0	0.2
Action Time (sec)	115.2 to 131.2	124.2	122.4	124.5	122.7	3.0	0.2
Web Time Avg Pressure (psia)	629.6 to 700.0	657.4	667.6	656.0	666.1	2.0	0.2
MOP Headend (psia)	854.8 to 973.6	907.7	921.8	905.7	919.7	N/A	N/A
Maximum Sea Level Thrust (Mlbf)	2.88 to 3.26	3.04	3.09	3.03	3.08	N/A	N/A
Web Time Avg Vacuum Thrust (Mlbf)	2.46 to 2.74	2.57	2.61	2.57	2.61	2.0	0.2
I_{SP} Avg Delivered (lbf-sec/lbm)	266.5 to 270.3	268.4	268.6	268.4	268.6	1.0	0.0
Web Time Total Impulse (Mlbf-sec)	286.3 to 292.1	288.8	289.0	288.8	289.0	1.4	0.0
Action Time Impulse (Mlbf-sec)	293.9 to 299.9	296.4	296.6	296.4	296.6	1.4	0.0
Ignition Interval (sec)*	0.202 to 0.262	0.232	0.232	0.232	0.232	N/A	N/A
Max Pressure Rise Rate (psi/10 ms)*	70.9 to 115.9	90.4	90.4	90.4	90.4	N/A	N/A
Loaded Propellant Weight (lb) (Lightweight)	X > 1,104,714	1,105,181		1,105,094			

* These predictions are based on historical data of flights and static tests

As-Built Information

S&A Arm Cycle Times (sec)

Flight	S&A S/N		At Bench Checkout		At Forward Skirt Closeout						At Launch			
			First Cycle		Days After Bench Checkout		First Cycle		Tenth Cycle		Days After Fwd Skirt Closeout	Date of Launch	Arm Cycle	
	LH (A)	RH (B)	LH (A)	RH (B)	LH (A)	RH (B)	LH (A)	RH (B)	LH (A)	RH (B)			LH (A)	RH (B)
STS-50 (24)	055	050	0.72	0.69	68	68	0.87	0.75	0.75	0.83	4	06/25/92	0.88	0.77
STS-46 (25)	001	002	0.68	0.70	65	65	0.87	0.75	0.67	0.75	7	07/31/92	0.80	0.89
STS-47 (26)**	003	004	0.72	0.84	64 69	64 69	0.91 0.87	0.79 0.95	0.75 --	0.83 --	-- 2	09/12/92	0.77	1.05
STS-52 (27)**	006	008	0.68	0.78	53 56	53 56	0.83 0.71	0.91 0.99	0.83 --	0.71 --	5	10/22/92	0.81	1.09
STS-53 (28)	009	010	0.70	0.69	67	67	0.83	0.71	0.79	0.67	10	12/02/92	0.88	0.73
STS-54 (29)	007	011	0.70	0.69	65	65	0.83	0.71	0.75	0.79	6	1/13/93	0.89	0.77
STS-56 (31) *	001	002	0.68	0.65	70	70	0.81	0.69	0.77	0.65	6 8	4/6/93 4/8/93	0.77 0.85	0.85 0.73
STS-55 (30) *	013	012	0.74	0.72	91 124	91 124	0.75 0.89	0.83 0.77	0.83 0.85	0.71 0.69	6 42	3/22/93 4/26/93	0.92 † 0.81	0.80 † 0.88
STS-57 (32)	005	003	0.68	0.74	98	98	0.75	0.83	0.87	0.75	5	6/21/93	0.85	0.93
STS-51 (33) *	004	006	0.77	0.68	88 98 107 140	88 98 107 140	0.86 0.91 0.82 0.91	0.70 0.79 0.71 0.79	0.82 0.82 0.87 0.79	0.86 0.86 0.75 0.87	6 3 13 11	7/17/93 7/24/93 8/12/93 9/12/93	†† 0.89 0.85 † 0.97	†† 0.93 0.93 † 0.85
STS-58 (34) *	007	008	0.70	0.71	147	147	0.75	0.83	0.75	0.87	5 9 13	10/11/93 10/14/93 10/18/93	0.75 0.84 0.88	0.83 0.93 0.96
STS-61 (23)	001	002	0.71	0.79	76	76	0.83	0.81	0.71	0.79				

S&A cycle times for earlier flights are documented on page 2.0-4 of the countdown data book

*Additional cycle times due to launch scrub/delay
**Second Closeout due to electrical repair/troubleshooting
† Launch Abort
†† Launch scrub prior to S&A Rotation

Note: Flight Set 360W011 and subsequent use Dupont Krytox grease

Notes

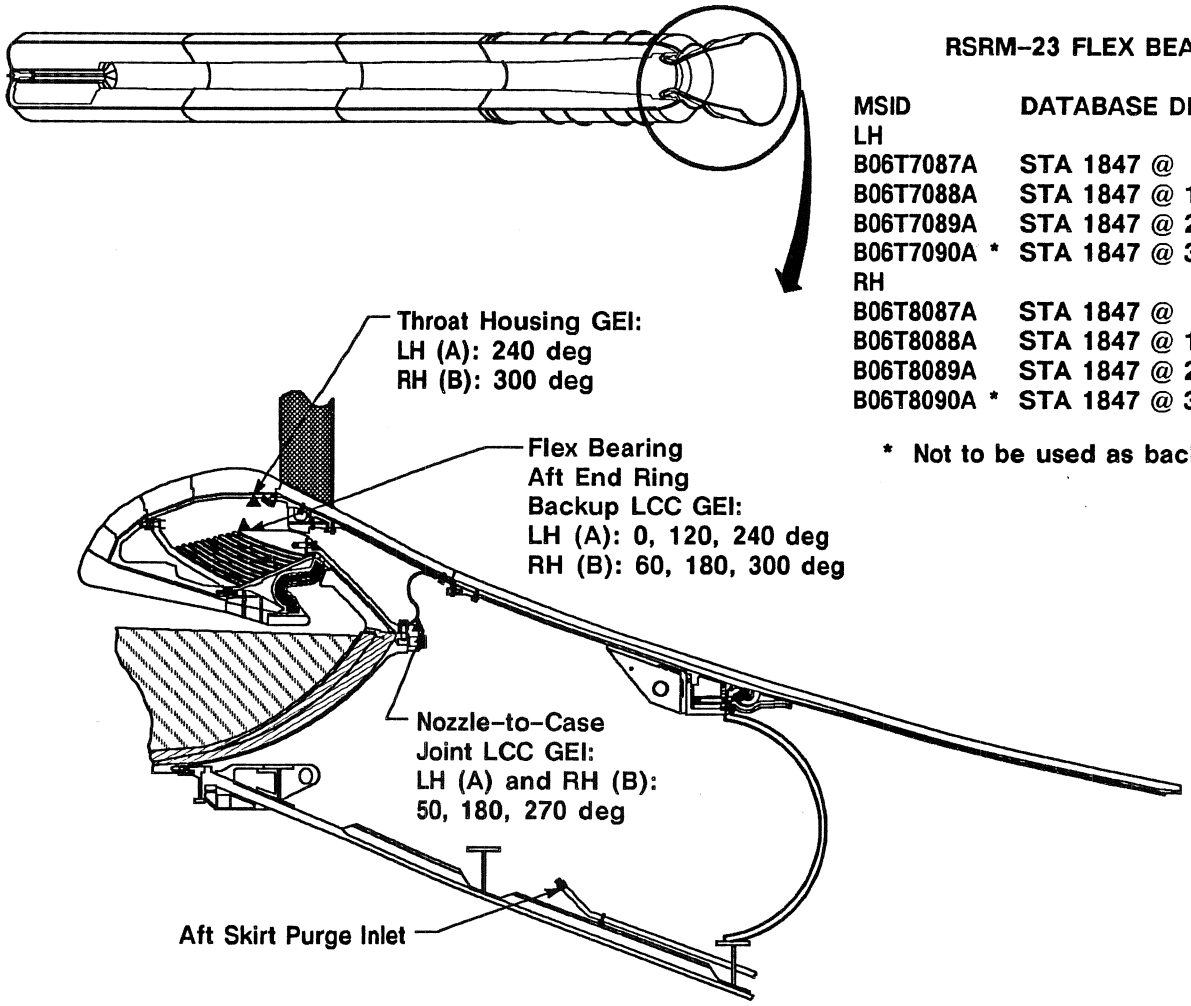
A major reduction of Ground Environmental Instrumentation (GEI) which was part of the RSRM-35 block change is effective for this flight. Since the instrumentation was installed prior to motor assignment, all case instrumentation remain as installed. Cabling in the MLP is configured for the reduced GEI design. Only the instruments included in the new configuration will be connected to the data collection system.

Aft skirt instrumentation is similar except that nozzle to case joint instruments have been moved to the locations designated in the new design (see following pages). Flex bearing sensors and forward exit cone sensors are inaccessible requiring connection of the three existing sensors to the new cables. Data from these sensors will be identified by MSID numbers associated with the new configuration. A table mapping the new numbers to the existing location is found on page 29.

All GEI instrumentation performed nominally during pre-launch testing with the following exceptions:

Shuttle Interface Test (SIT) / Terminal Countdown Demonstration Test (TCDT):
B06T7071A read 5-8°F *HIGH (LH AFT field joint @ 285°)*
B06T8086A read 6-7°F *LOW (RH igniter joint @ 184.5°)*

As-Built Information
Instrumentation



RSRM-23 FLEX BEARING SENSOR LOCATION

MSID	DATABASE DESCRIPTION	ACTUAL LOCATION
LH		
B06T7087A	STA 1847 @ 50 deg	STA 1847 @ 0 deg
B06T7088A	STA 1847 @ 130 deg	STA 1847 @ 120 deg
B06T7089A	STA 1847 @ 230 deg	STA 1847 @ 240 deg
B06T7090A *	STA 1847 @ 310 deg	Nozzle Throat
RH		
B06T8087A	STA 1847 @ 50 deg	STA 1847 @ 180 deg
B06T8088A	STA 1847 @ 130 deg	STA 1847 @ 60 deg
B06T8089A	STA 1847 @ 230 deg	STA 1847 @ 300 deg
B06T8090A *	STA 1847 @ 310 deg	Nozzle Throat

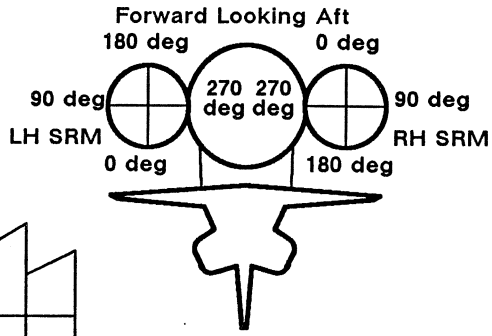
* Not to be used as backup LCC sensor on RSRM-23

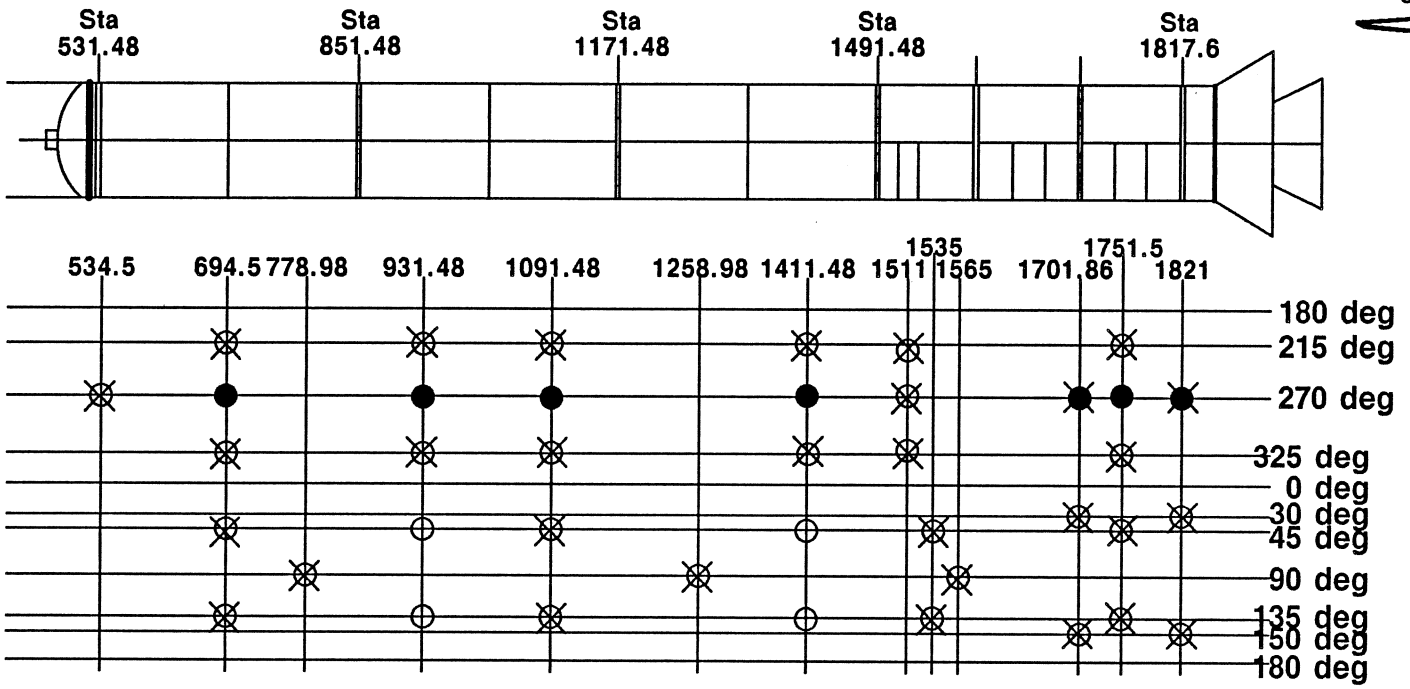
STS-61 (360T023) Nozzle Region GEI Locations

As-Built Information

Instrumentation

Present and Future Case Ground Environmental Instrumentation (GEI)





○ Denotes Case GEI Temperature Sensors Needed for Sky Temperature Radiation Effect
● Denotes Case GEI Temperature Sensors Required for Inboard Cooling Effect
⊗ Denotes Non-LCC Case GEI Temperature Sensors to be Deleted
⊗ Denotes LCC Case GEI Temperature Sensors to be Relocated (Sensor @ 1701.86 moved to 694.5, Sensor @ 1821 moved to 1091.48)

A017800a R8

As-Built Information

Instrumentation (Cont)

EVENT/ DATE	INSTRUMENT No. (MSID No.) S/N	AMBIENT * MEASURED	AMBIENT EXPECTED	AMBIENT DELTA	75% * MEASURED	75% EXPECTED	75% DELTA
TCDT (S0017) (11/5/93)	B47P1300C / 423	10.6	12.6	-2.0	761.8	763.8	-2.0
	B47P1301C / 23R3	18.6	18.6	0.0	765.8	767.8	-2.0
	B47P1302C / 85R4	16.6	14.6	2.0	765.8	763.8	2.0
	B47P2300C / 187R1	20.6	20.6	0.0	767.8	769.8	-2.0
	B47P2301C / 202R1	12.6	10.6	2.0	757.8	757.8	0.0
	B47P2302C / 189R1	16.6	16.6	0.0	763.8	765.8	-2.0
LAUNCH COUNTDOWN (__/__/93)	B47P1300C / 423		12.6			763.8	
	B47P1301C / 23R3		18.6			767.8	
	B47P1302C / 85R4		14.6			763.8	
	B47P2300C / 187R1		20.6			769.8	
	B47P2301C / 202R1		10.6			757.8	
	B47P2302C / 189R1		16.6			765.8	
LAUNCH COUNTDOWN (__/__/93)	B47P1300C / 423		12.6			763.8	
	B47P1301C / 23R3		18.6			767.8	
	B47P1302C / 85R4		14.6			763.8	
	B47P2300C / 187R1		20.6			769.8	
	B47P2301C / 202R1		10.6			757.8	
	B47P2302C / 189R1		16.6			765.8	

OPT Sample Rates:

MSID	Rate (sps)
B47P1300C, B47P2300C	5
B47P1301C, B47P2301C	1
B47P1302C, B47P2302C	12.5

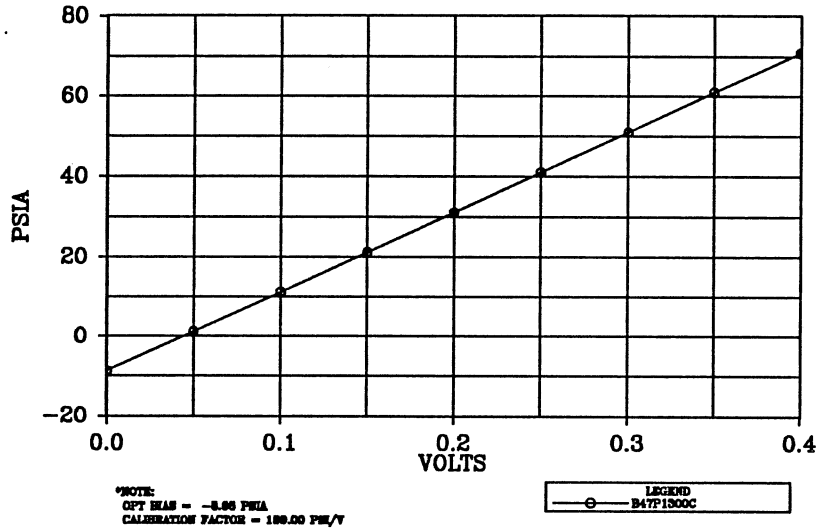
* OMRSD LIMITS

Ambient -7 to +33 psia

75 % +729 to +799 psia

As-Built Information
Instrumentation (Cont)

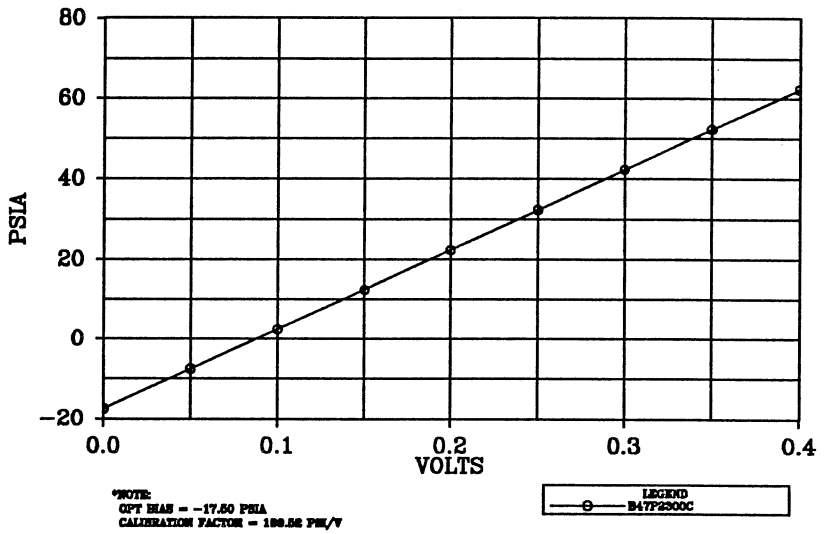
PLOT 5



C.E.C.	1U50188-10	3862	0000423	04 Jun 92
MFG	MODEL	MFG SN	THIOKOL SN:	CALIB DATE
1000 PSIA	74	12.41 PSIA	5.025	28
RANGE	TEMP °F	BAROMETER IN HG	SPAN—VOLTS DC	EXCITATION VDC

Electrical Simulation	PSIG VDC Output	Linearity	Hysteresis
PINS E&F:	100% = 5.131	100% = 100.00	
Open: VDC = 0.106	80% = 4.126	80% = 80.01	80% = -0.07
Shorted: VDC = 3.863	60% = 3.121	60% = 60.00	60% = -0.09
Difference = 3.757	40% = 2.116	40% = 40.00	40% = -0.09
	20% = 1.111	20% = 20.00	20% = -0.11
% = 74.77	0% = 0.106	0% = 0.00	0% = -0.02

PLOT 6

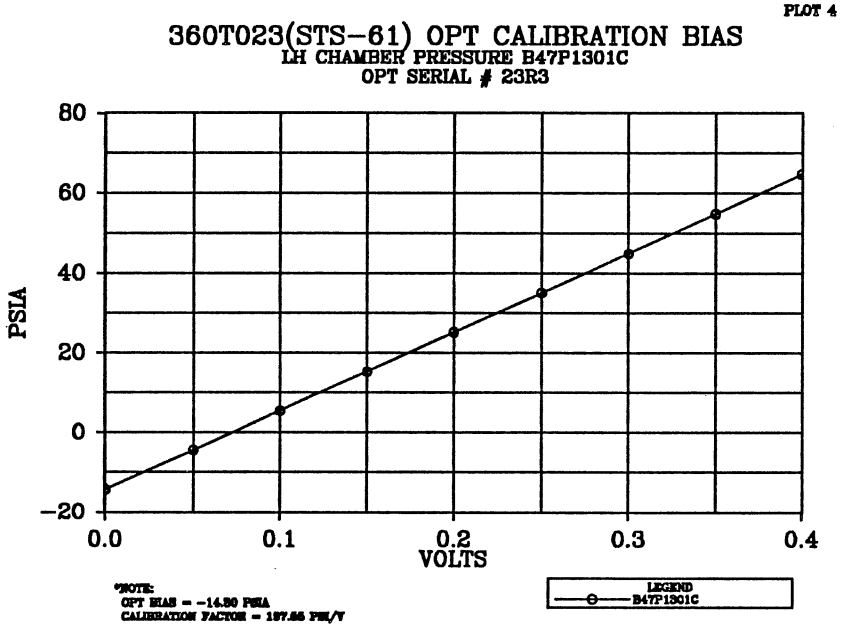


C.E.C.	1U50188-10	3603	0000187R1	01 Jul 92
MFG	MODEL	MFG SN	THIOKOL SN:	CALIB DATE
1000 PSIA	74	12.43 PSIA	5.012	28
RANGE	TEMP °F	BAROMETER IN HG	SPAN—VOLTS DC	EXCITATION VDC

Electrical Simulation	PSIG VDC Output	Linearity	Hysteresis
PINS E&F:	100% = 5.162	100% = 100.00	
Open: VDC = 0.150	80% = 4.159	80% = 79.99	80% = -0.02
Shorted: VDC = 3.902	60% = 3.156	60% = 59.98	60% = -0.02
Difference = 3.752	40% = 2.154	40% = 39.99	40% = -0.02
	20% = 1.152	20% = 20.00	20% = -0.02
% = 74.86	0% = 0.150	0% = 0.00	0% = -0.01

As-Built Information
Instrumentation (Cont)

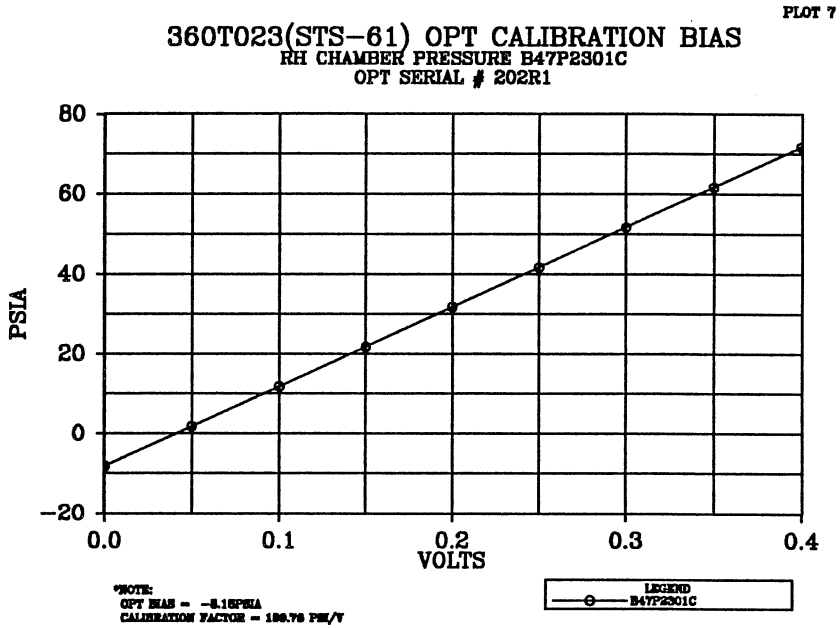
PLOT 4



C.E.C.	1U50188-10	2820	0000023R3	29 Jun 92
MFG	MODEL	MFG SN	THIOKOL SN:	CALIB DATE
1000 PSIA	74	12.37 PSIA	5.062	28
RANGE	TEMP °F	BAROMETER IN HG	SPAN—VOLTS DC	EXCITATION VDC

Electrical Simulation	PSIG VDC Output	Linearity	Hysteresis
PINS E&F:	100% = 5.197	100% = 100.00	
Open: VDC = 0.135	80% = 4.184	80% = 79.99	80% = -0.07
Shorted: VDC = 3.883	60% = 3.171	60% = 59.97	60% = -0.09
Difference = 3.748	40% = 2.158	40% = 39.97	40% = -0.08
	20% = 1.147	20% = 19.99	20% = -0.05
% = 74.05	0% = 0.135	0% = 0.00	0% = -0.01

PLOT 7

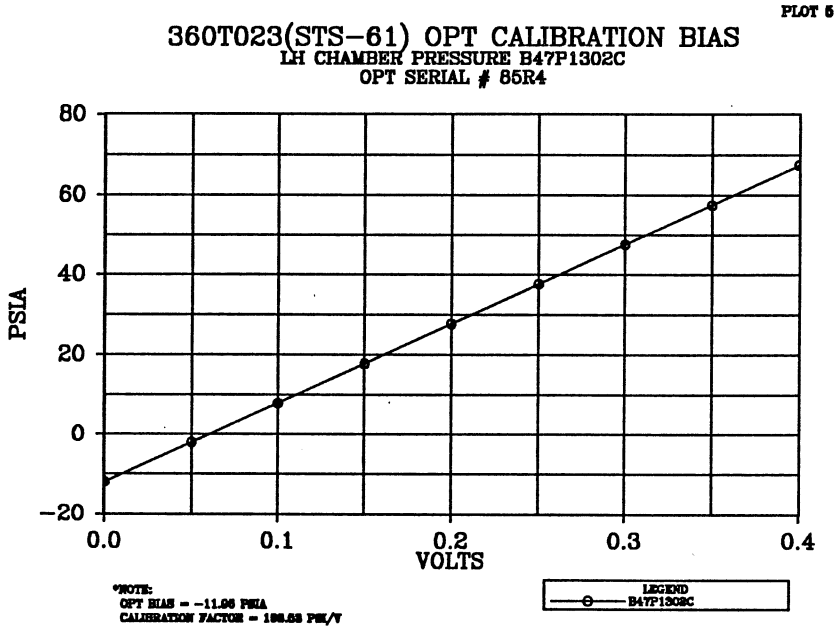


C.E.C.	1U50188-10	3551	0000202R1	30 Jun 92
MFG	MODEL	MFG SN	THIOKOL SN:	CALIB DATE
1000 PSIA	74	12.40 PSIA	5.006	28
RANGE	TEMP °F	BAROMETER IN HG	SPAN—VOLTS DC	EXCITATION VDC

Electrical Simulation	PSIG VDC Output	Linearity	Hysteresis
PINS E&F:	100% = 5.110	100% = 100.00	
Open: VDC = 0.103	80% = 4.108	80% = 80.00	80% = -0.17
Shorted: VDC = 3.844	60% = 3.108	60% = 60.01	60% = -0.25
Difference = 3.741	40% = 2.108	40% = 40.04	40% = -0.26
	20% = 1.107	20% = 20.05	20% = -0.18
% = 74.72	0% = 0.103	0% = 0.00	0% = -0.00

As-Built Information
Instrumentation (Cont)

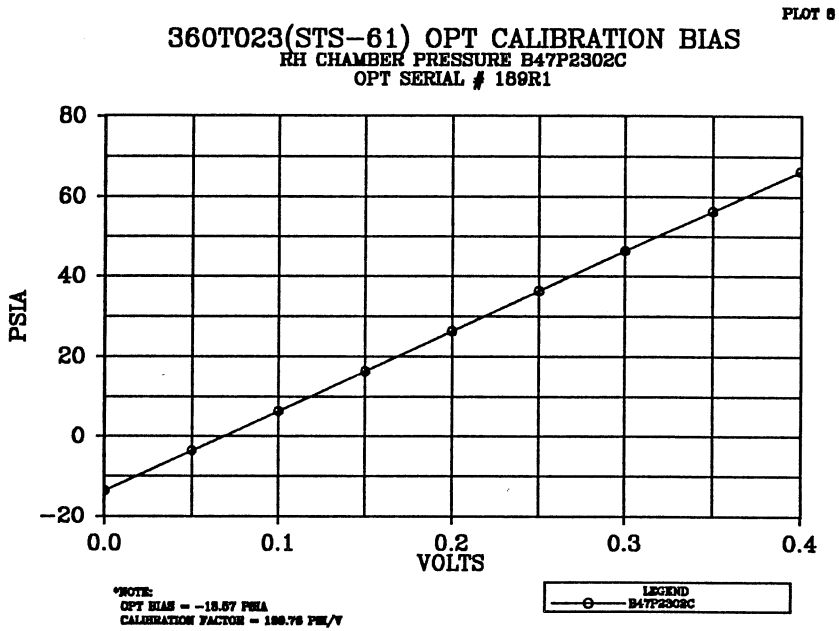
PLOT 5



C.E.C.	1U50188-10	3455	0000085R4	24 Jun 92
MFG	MODEL	MFG SN	THIOKOL SN:	CALIB DATE
1000 PSIA	74	12.46 PSIA	5.037	28
RANGE	TEMP °F	BAROMETER IN HG	SPAN—VOLTS DC	EXCITATION VDC

Electrical Simulation	PSIG VDC Output	Linearity	Hysteresis
PINS E&F:	100% = 5.161	100% = 100.00	
Open: VDC = 0.123	80% = 4.165	80% = 80.24	80% = -0.09
Shorted: VDC = 3.875	60% = 3.160	60% = 60.29	60% = -0.14
Difference = 3.752	40% = 2.151	40% = 40.25	40% = -0.15
	20% = 1.137	20% = 20.12	20% = -0.09
% = 74.48	0% = 0.123	0% = 0.00	0% = -0.02

PLOT 6



C.E.C.	1U50188-10	3605	0000189R1	30 Jun 92
MFG	MODEL	MFG SN	THIOKOL SN:	CALIB DATE
1000 PSIA	75	12.40 PSIA	5.006	28
RANGE	TEMP °F	BAROMETER IN HG	SPAN—VOLTS DC	EXCITATION VDC

Electrical Simulation	PSIG VDC Output	Linearity	Hysteresis
PINS E&F:	100% = 5.136	100% = 100.00	
Open: VDC = 0.130	80% = 4.133	80% = 79.96	80% = -0.01
Shorted: VDC = 3.878	60% = 3.131	60% = 59.94	60% = -0.04
Difference = 3.748	40% = 2.130	40% = 39.95	40% = -0.03
	20% = 1.129	20% = 19.96	20% = -0.01
% = 74.87	0% = 0.130	0% = 0.00	0% = 0.01

DRAWING TREES

RSRM(FLIGHT)
X014–X023

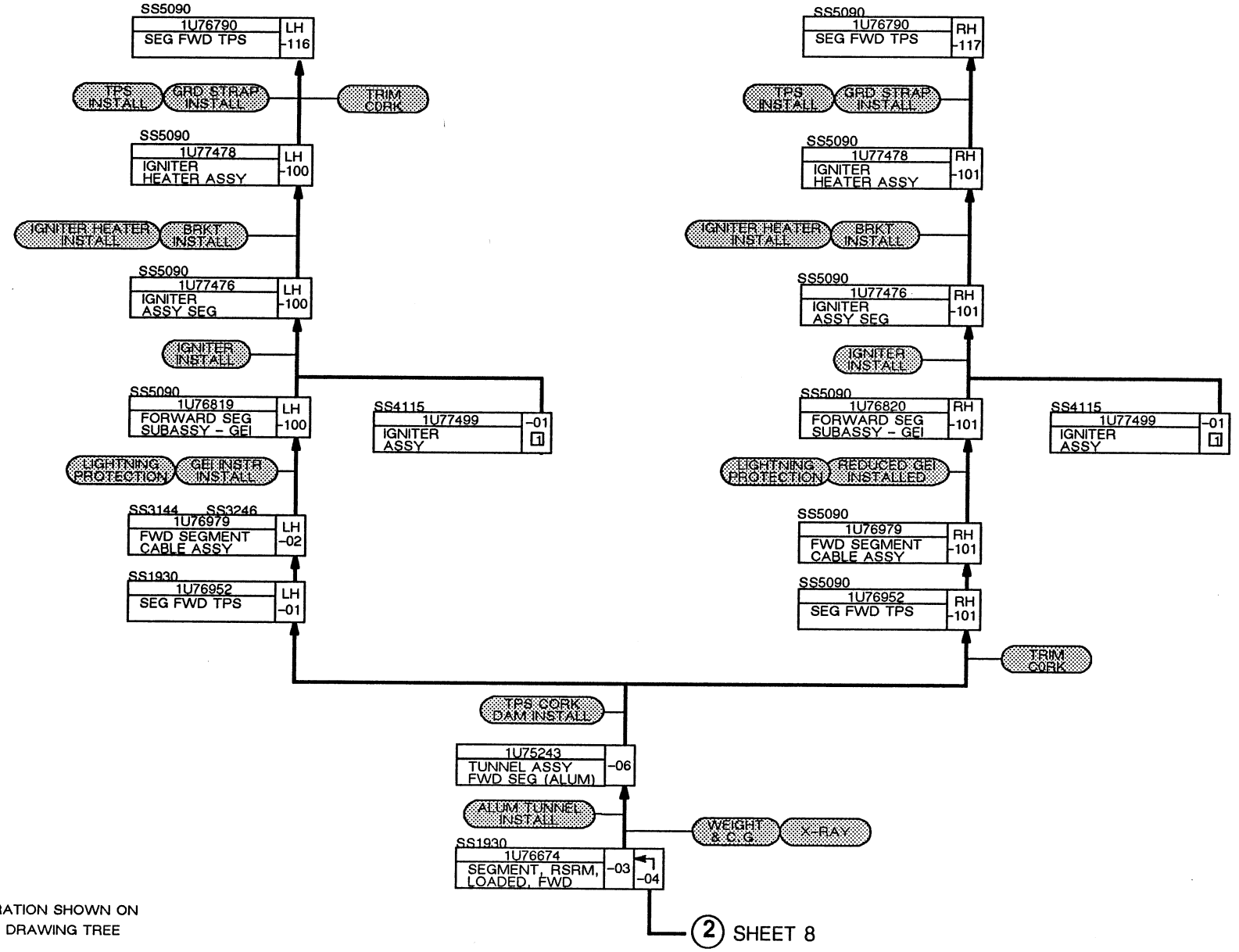
REV AU **DATE 18 JUNE 1993**

APPROVED BY: 6/18/93
INTEGRATION DESIGN

APPROVED BY: 6-21-93
CMT PROJECT ENGINEER

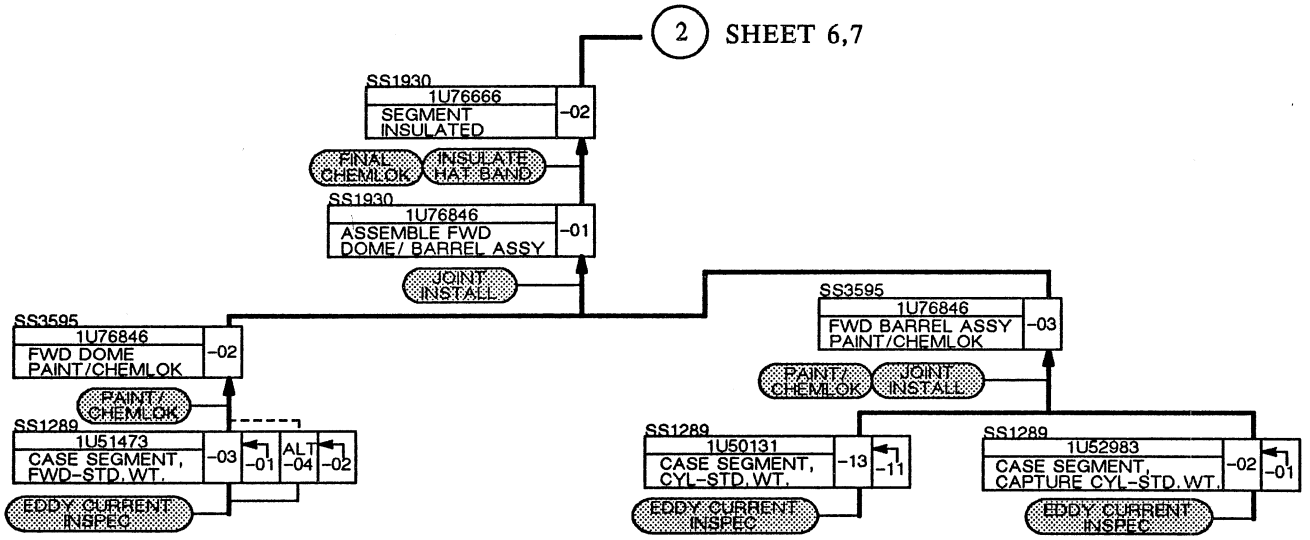
NOTE: FOR RSRMs 360X024 AND SUBQ –
SEE SEPARATE DRAWING TREE

FORWARD SEGMENT ▲

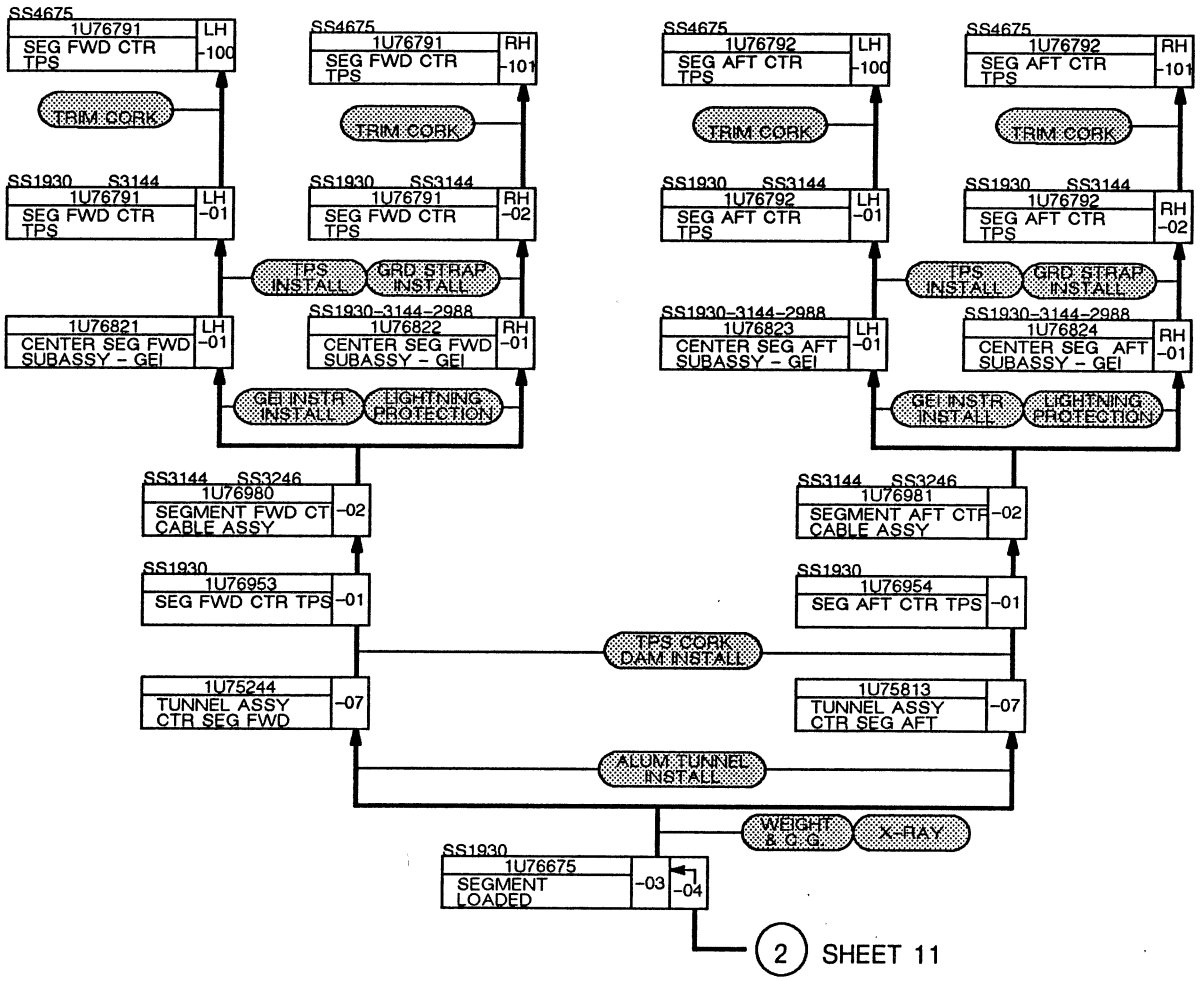


[1] IGNITER CONFIGURATION SHOWN ON IGNITER REDESIGN DRAWING TREE

FORWARD SEGMENT ▲

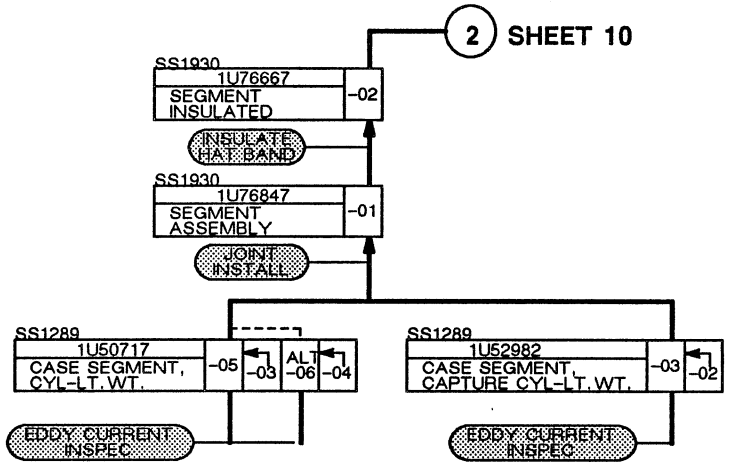


CENTER SEGMENT▲

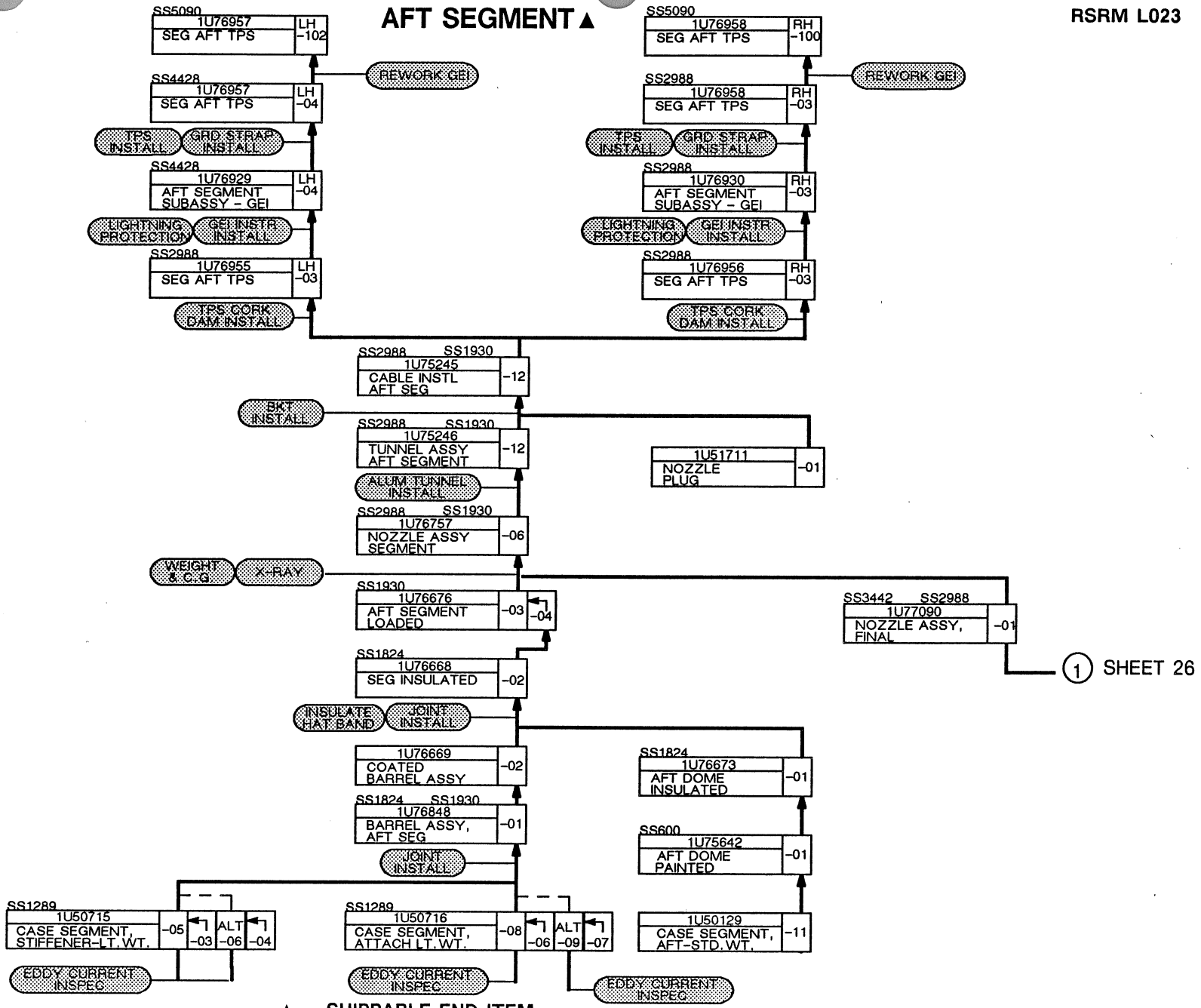


▲ = SHIPPABLE END ITEM

CENTER SEGMENT ▲

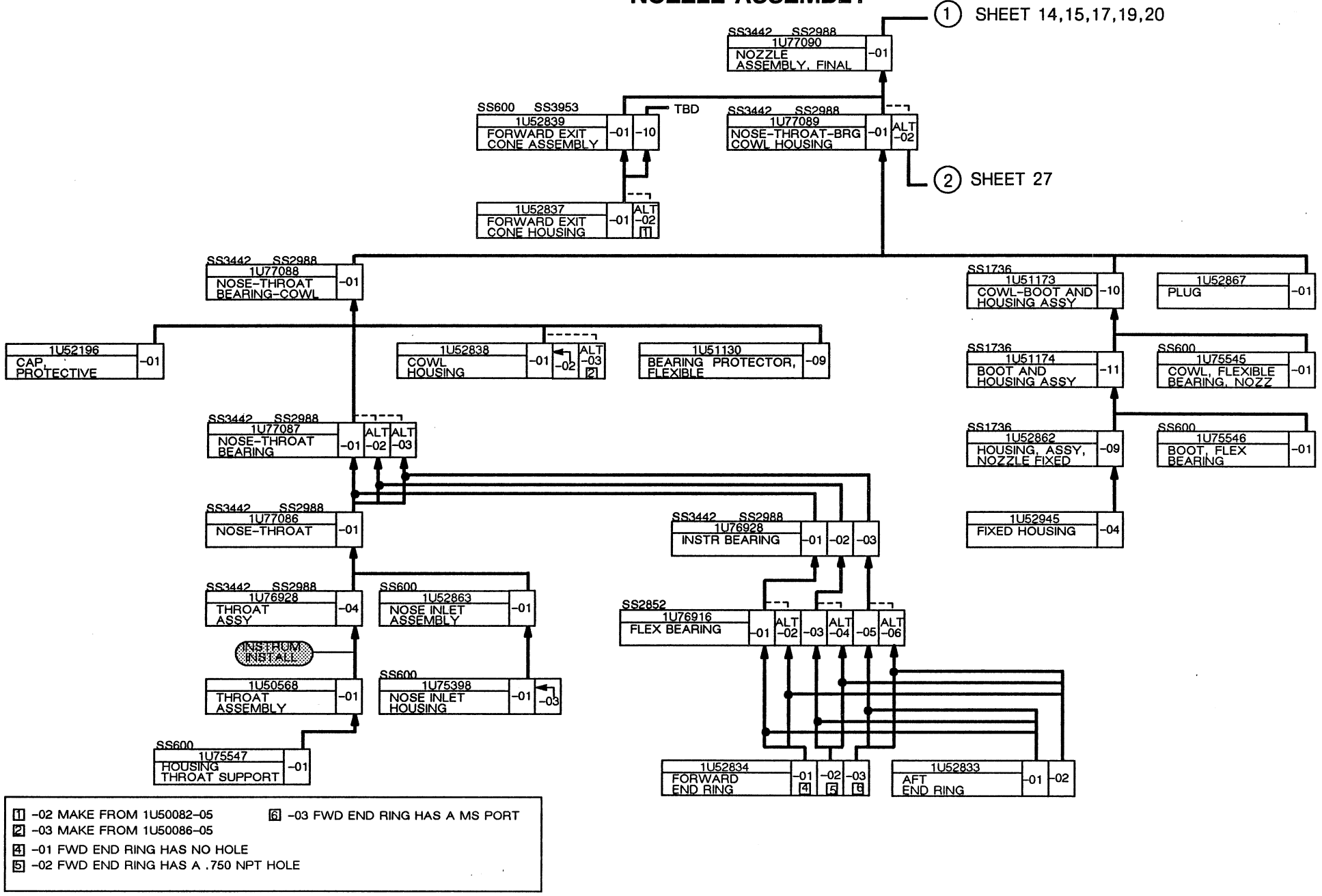


AFT SEGMENT▲



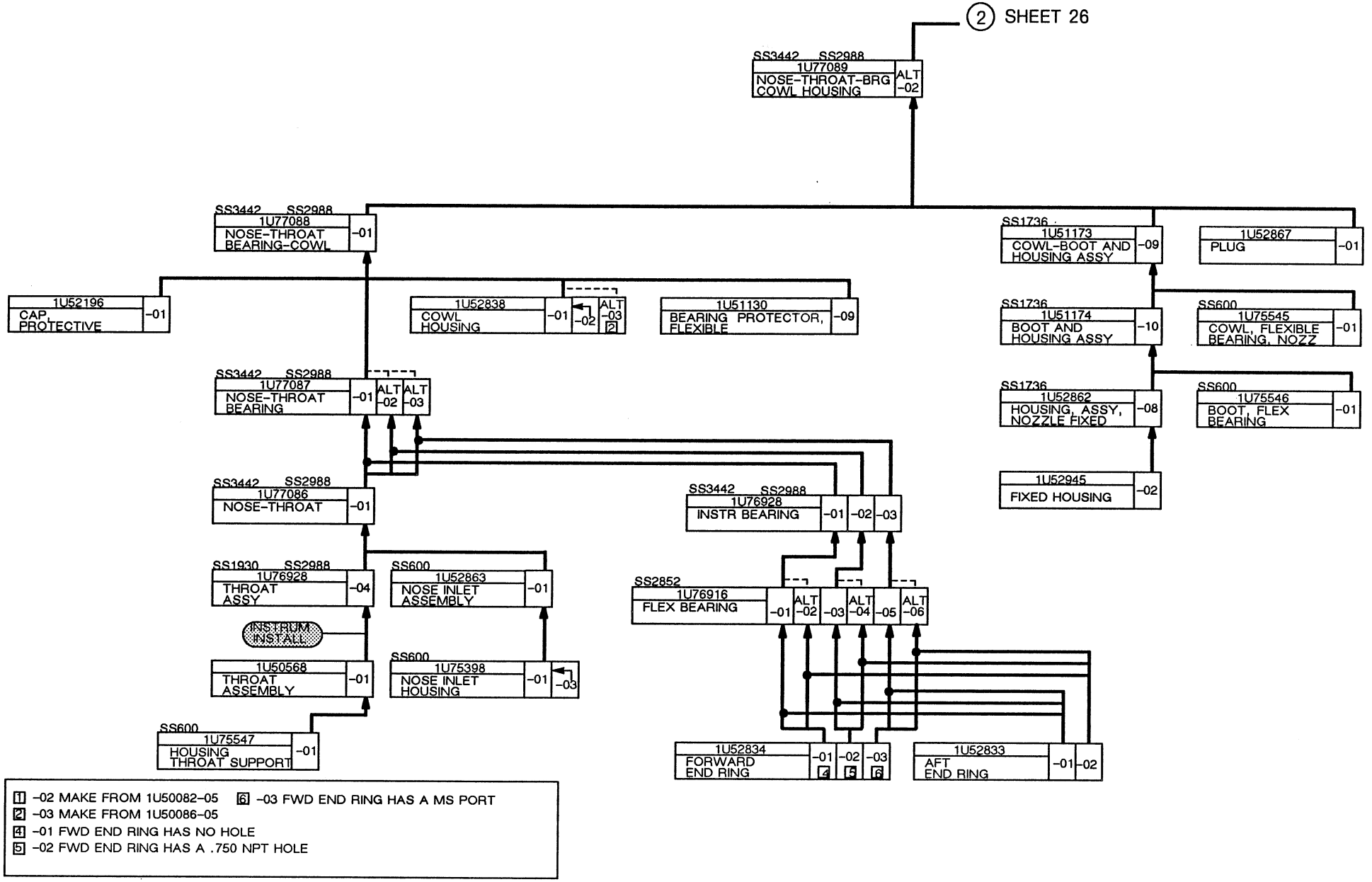
▲ = SHIPPABLE END ITEM

NOZZLE ASSEMBLY



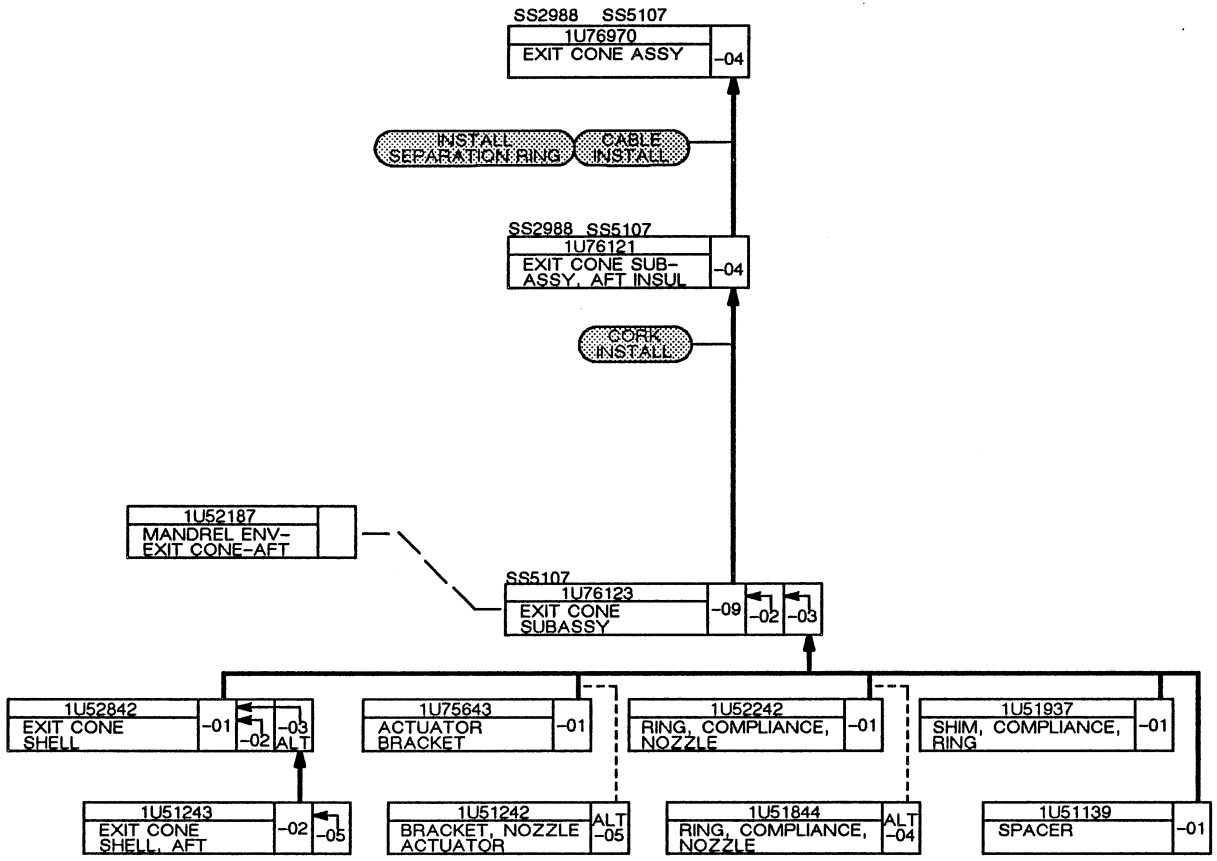
[1] -02 MAKE FROM 1U50082-05
[2] -03 MAKE FROM 1U50086-05
[4] -01 FWD END RING HAS NO HOLE
[5] -02 FWD END RING HAS A .750 NPT HOLE
[6] -03 FWD END RING HAS A MS PORT

NOSE-THROAT-BEARING-COWL HOUSING ASSY (ALTERNATE)



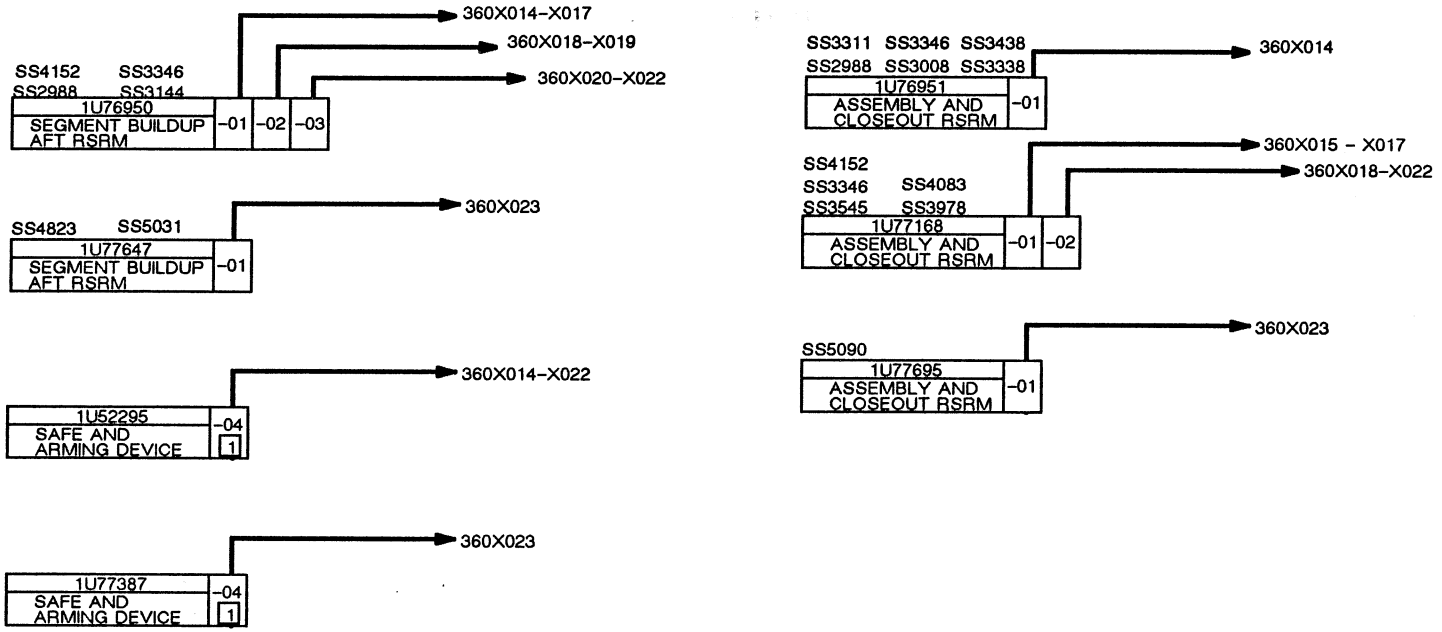
[1] -02 MAKE FROM 1U50082-05
[2] -03 MAKE FROM 1U50086-05
[4] -01 FWD END RING HAS NO HOLE
[5] -02 FWD END RING HAS A .750 NPT HOLE
[6] -03 FWD END RING HAS A MS PORT

EXIT CONE ▲



▲ = SHIPPABLE END ITEM

RSRM ASSEMBLY AND CLOSEOUT



[1] SEE SAFE AND ARM DRAWING TREE

FLIGHT 19-23 (AU)
POST SHIPMENT DOCUMENTATION

FECs*	FLIGHT EFFTY	DESCRIPTION/PARTS AFFECTED	MOD INDEX DRAWINGS	TCTIs	MOD KITS	DESCRIPTION	MOD INDEX DRAWINGS
RSRM-089	19 0NLY	ADD NEW HEATER SENSOR CABLES	1U76950				
RSRM-090	19-21	TRIM TPS CORK AGAINST SYSTEM TUNNEL	1U76790 1U76791 1U76792				
RSRM-091R1	21-22	MODIFY RSRM POST JOINT CLOSEOUT PAINTING REQUIREMENTS	1U77168				
RSRM-092R2	22RH	ADD ADAPTER CABLE ASSY AT RSRM FWD JOINT	1U77168				
(AU) RSRM-096	23	REVISE RSRM LEAK TEST SYSTEM	1U77647 1U77695				

*FIELD ENGINEERING CHANGES

Reference Information

Waivers / Deviations against Requirements

RWW Number	Description
0506R4	Contamination of fixed housing may reduce bond safety factor
0509	Nozzle joint 5 secondary seal may be compromised
0518R1	Ineffective NDE of forward Y-joint region
0519	Lot AAF LSC
0520	Case segment magnetic particle testing for cracks (all clevis pinholes)
0521R1	Shelf life minor waiver
0523	Potential crack masking by Molykote® during dye penetrant inspection of nozzle/case bolts

RDW Number	Description
0601R3	Outer boot ring-to-cowl adhesive bond has negative margins of safety
0630R1	Hardware built before completion of contamination control plan TWR-16564
0631R1	Protective finishes applied to the RSRM are not in accordance with MIL-F-18264
0639	Requirements of STW7-3449 have not been incorporated into RSRM production processes
0641R1	Manufacturing tools for KSC not built to 8U drawings
0643R1	Materials do not meet 5-year storage life requirement
0646	Propellant humidity analysis and test not complete; Propellant and propellant liner bond SF not met
0647	Hardware reuse / fracture mechanics requirements not met

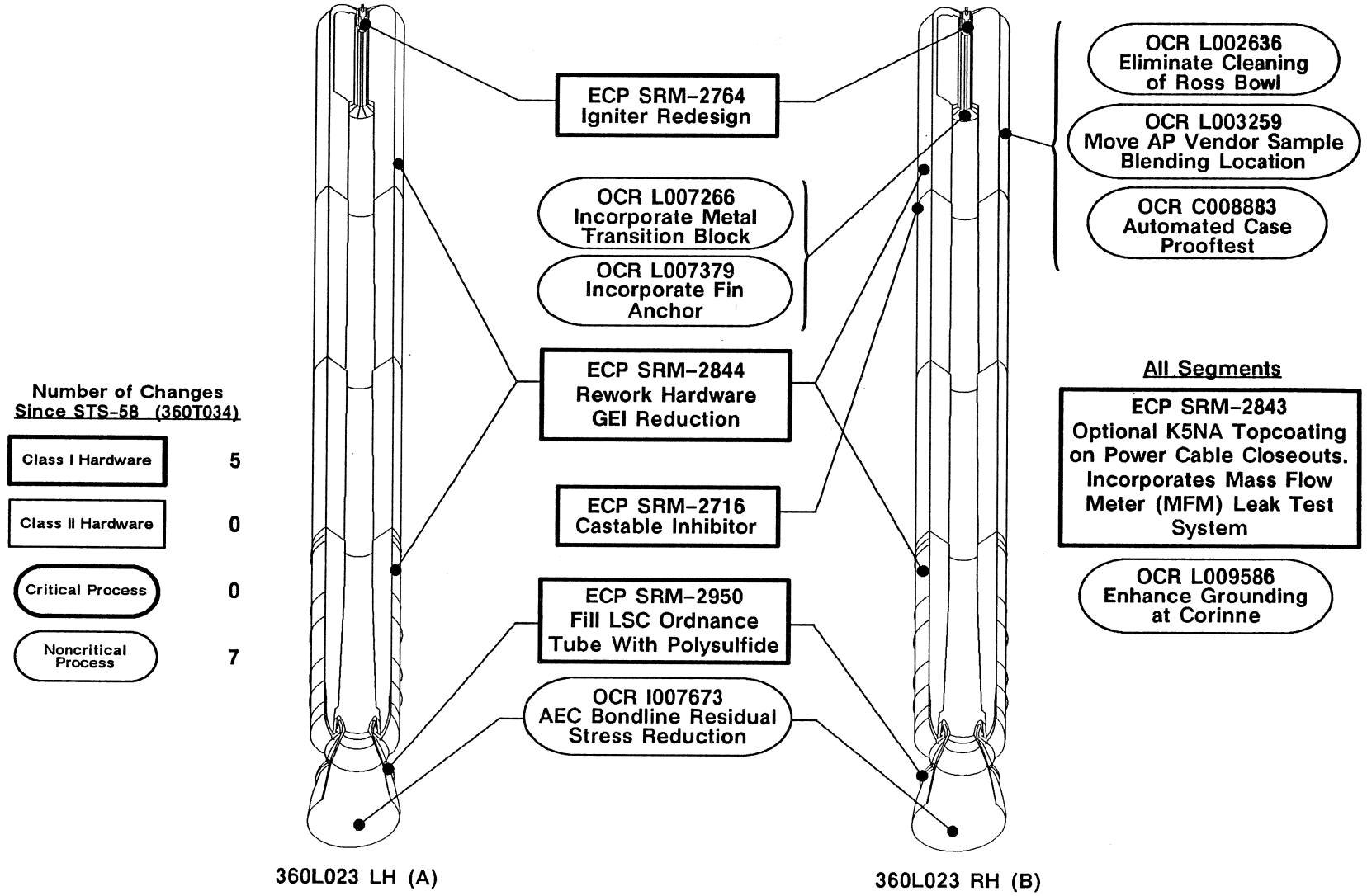
Reference Information

Reference Documents

Component	Document No.	Title
Seals/Thermal	TWR-63650-23	O-ring Squeeze Calculations and Temperature Requirements—360L023
	TWR-63518-A	Redesigned Solid Rocket Motors 360L023 Seal Leak Test Results
	TWR-60577	Predicted Ballistic Performance Characteristics for 360L023 (RSRM-23) STS-60
	TWR-60589	Mass Property History Log for 360L023A
	TWR-60601	Mass Property History Log for 360L023B
FRR	TWR-64081	RSRM Acceptance Review
	TWR-64084	RSRM Flight Readiness Review (Level 3)
	TWR-64085	RSRM Flight Readiness Review (Level 1)
	TWR-64086	RSRM Technical Issues Review
	TWR-60661	FET 2-hr Report

Reference Information

Changes Affecting Countdown Activities

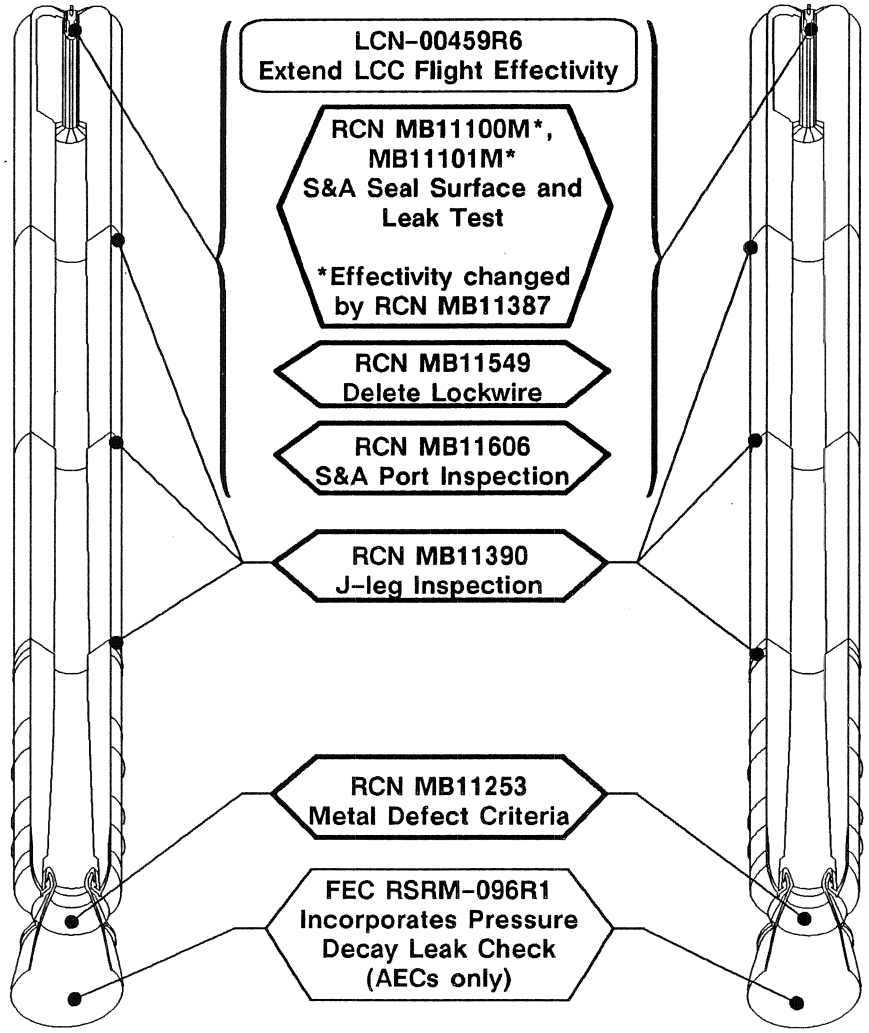


Reference Information

Changes Affecting Countdown Activities

Number of Changes
Since STS-58 (360T034)

LCC	2
OMRSD	11
FEC	1



360L023 LH (A)

360L023 RH (B)

All Segments

LCN-00471R2
LCC Sensor Numbers

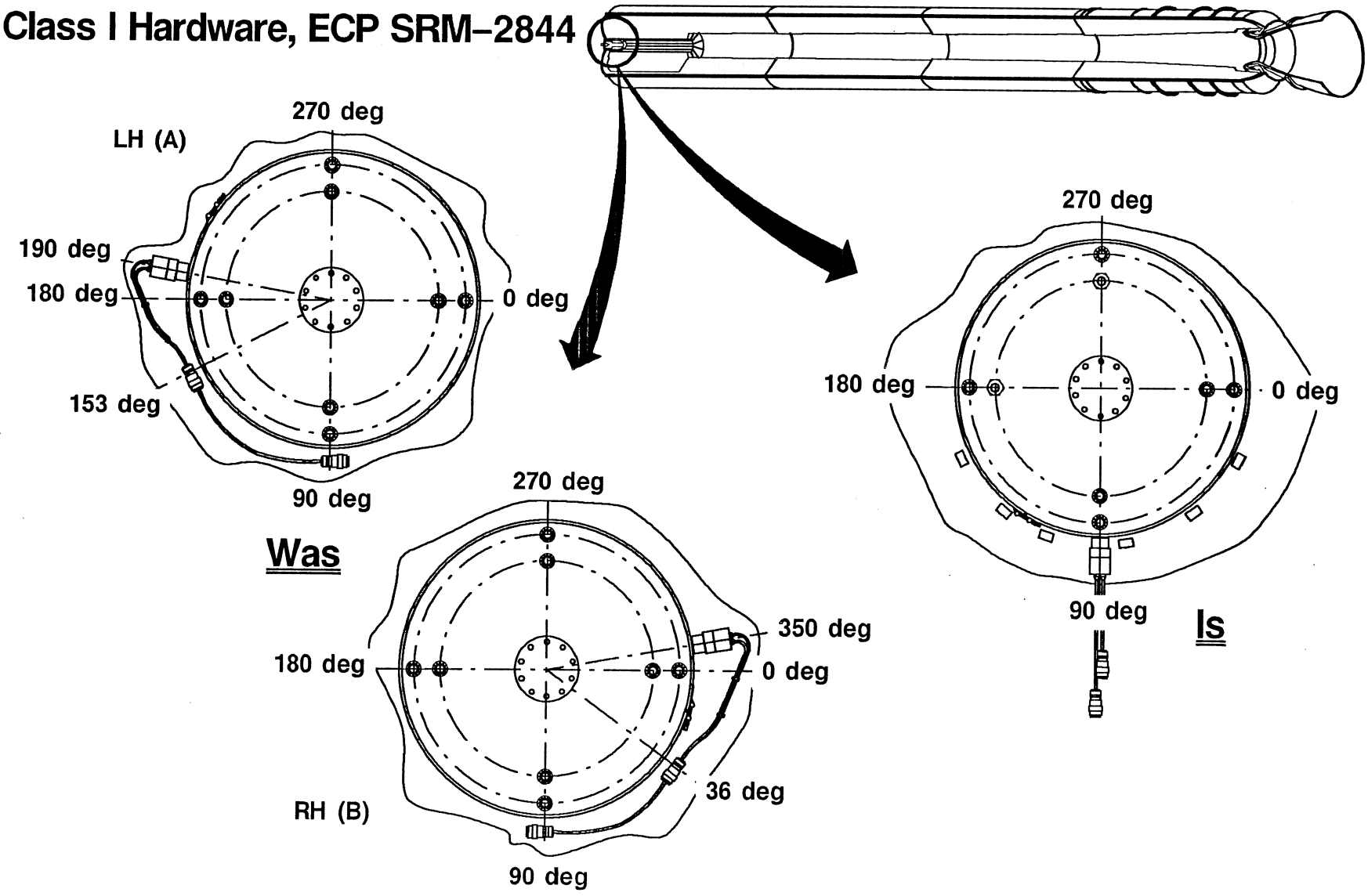
RCN MB11406, MS11407
GEI Sensor Numbers

RCN MB11492, MG01734M
Incorporates MFM Leak Test System

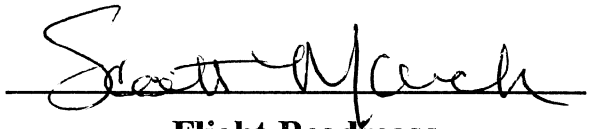
Reference Information

Changes Affecting Countdown Activities

Class I Hardware, ECP SRM-2844

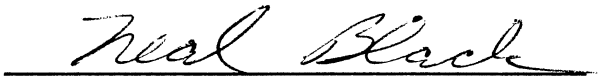


Prepared by:

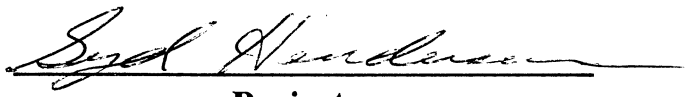


Flight Readiness

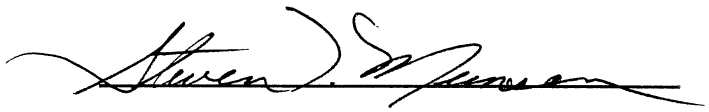
Approved by:



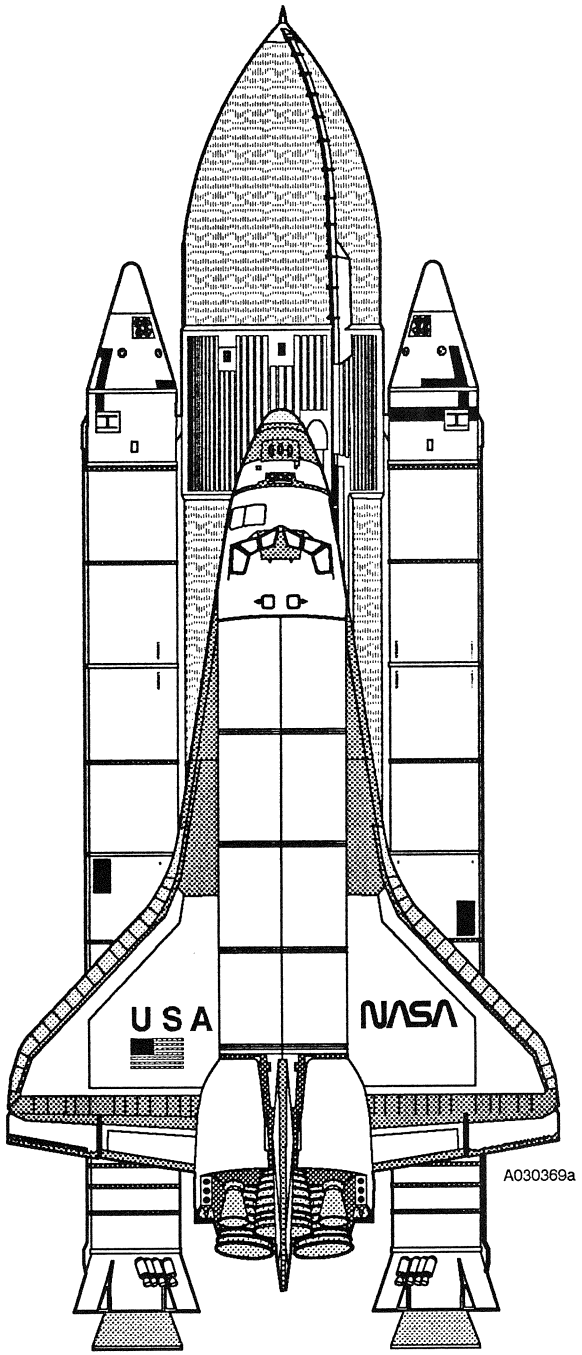
Flight Readiness Supervisor



Project Engineering



Program Management



TWR-63902
ECS No. 4731

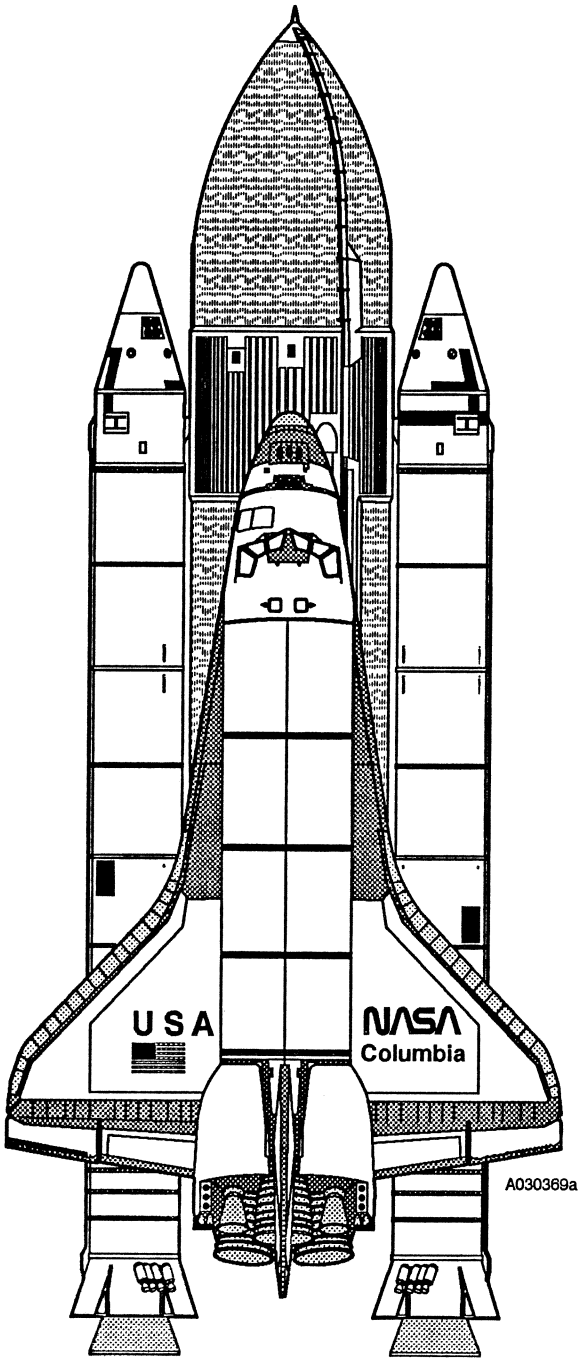
Countdown Data Book

Thiokol CORPORATION

SPACE OPERATIONS

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

TWR-63902 Rev. B
ECS SS4731



Countdown Data Book

November 1993

Thiokol CORPORATION
SPACE OPERATIONS

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

Reference

1.0 Overview / LCC

Launch Commit Criteria (LCC) Summary

LCC Title	Effectivity Period	MIN.	MAX.	Number of Sensors
S&A Device Safed	T-6 hrs to T-5 min	Safe on	Arm off	2 of 2 per booster
S&A Device Armed	T-5 min to T-0	Safe off	Arm on	2 of 2 per booster
OPT Ambient Pressure	T-1.5 hrs to T-31 sec	-7 psi	33 psi	3 of 3 per booster
Igniter Joint Temp.	T-6 hrs to T-9 min	74 °F	125 °F	1 of 2 per booster
Field Joint Temp.	T-6 hrs to T-5 min	80 °F	123 °F	2 of 4 per joint; 2 of 3 at 285 per SRM
Nozzle-to-Case Joint Temperature	T-6 hrs to T-5 min	75 °F	115 °F	2 of 3 per booster
Case Acreage Temperature	T-6 hrs to T-9 min	34 °F	N/A	3 of 5 per booster

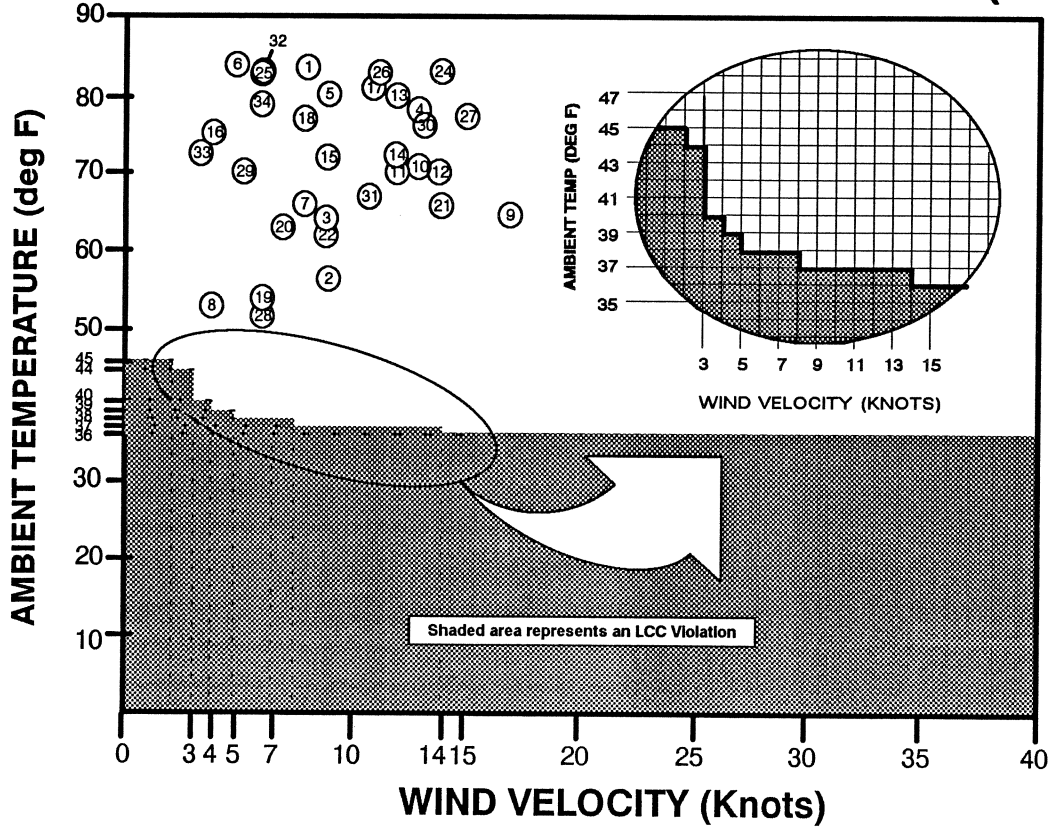
Operation/Maintenance Requirement Specifications (OMRSD) Summary

OMRSD Component/Action	Time Period	Requirements/Comments
Flex Bearing Mean Bulk Temperature	L-96 hrs	Extended conditioning required if less than 60°F; purge set point 115°F until first sensor reaches 95°F +/- 5°F.
Propellant Mean Bulk Temperature	L-24 hrs	Verify in range from 44° to 86°F
Igniter Joint Heater Activation	L-18 hrs	Set point 100 +/- 1°F
Field Joint Heater Activation	T-8 hrs	Set point 97.5 +/- 1°F (set point rounds up to 98°F)
Chamber Pressure (Ambient)	T-1 hr 30 min	Verify ambient readings within -7 to 33 psia
Chamber Pressure (75% CALIBRATION)	T-1 hr 30 min	Verify 75% calibration readings within 729 to 799 psia
Igniter Joint Heater Deactivation	T-9 min to T-5 min	Prior to S & A rotation to arm (Agreement to resume heating if an extended hold is encountered prior to T-5 min)
Field Joint Heater Deactivation	T- 1 min	

Ambient Environment Constraints

- Prior to ET cryogenic loading, the average ambient temperature for the preceding 24 hours shall be 41 °F or greater
- From start of ET cryogenic loading to exiting the last hold prior to APU start:
  - The countdown shall not be continued or the Shuttle launched if the ambient temperature during this time period exceeds 99 Deg F for more than 30 consecutive minutes, based on 5 minute averages.
  - The Shuttle shall not be launched if the ambient temperature is lower than the minimum temperature limit, Tmin (table on 1.0-4), for more than 30 consecutive minutes unless the preplanned contingency indicates recovery from the low temperature excursions which caused the LCC violation.

Ambient Constraints at Time of Launch (Rel. Humidity = 80-89%)



RSRM	MISS	DATE/ TIME (Eastern)	AMB TEMP	WIND VEL
1	STS-26R	29 SEP 88 /11:37	84	8
2	STS-27R	02 DEC 88 /09:30	56	9
3	STS-29R	13 MAR 89 /09:57	64	9
4	STS-30R	04 MAY 89 /14:46	78	13
5	STS-28R	08 AUG 89 /08:37	80	9
6	STS-34	18 OCT 89 /12:53	84	5
7	STS-33R	23 NOV 89 /19:23	66	8
8	STS-32R	09 JAN 90 /07:35	53	4
9	STS-36	28 FEB 90 /02:50	64	17
10	STS-31R	24 APR 90 /08:33	71	13
11	STS-35	02 DEC 90 /01:49	71	12
12	STS-38	15 NOV 90 /18:48	70	14
13	STS-41	06 OCT 90 /07:47	80	12
14	STS-37	05 APR 91 /09:22	72	12
15	STS-39	28 APR 91 /07:33	72	9
16	STS-40	05 JUN 91 /09:25	75	4
17	STS-43	02 AUG 91 /11:02	82	11
18	STS-48	12 SEP 91 /19:11	77	8
19	STS-44	24 NOV 91 /18:44	54	6
20	STS-42	22 JAN 92 /09:52	63	7
21	STS-45	24 MAR 92 /08:13	66	14
22	STS-49	07 MAY 92 /19:40	62	9
24	STS-50	25 JUN 92 /12:12	83	14
25	STS-46	31 JUL 92 /09:56	83	6
26	STS-47	12 SEP 92 /10:23	82	11
27	STS-52	22 OCT 92 /13:09	77	15
28	STS-53	02 DEC 92 /08:23	52	6
29	STS-54	13 JAN 93 /08:43	69	6
30	STS-55	26 APR 93 /10:50	77	13
31	STS-56	08 APR 93 /01:29	66	11
32	STS-57	21 JUN 93 /09:07	83	6
33	STS-51	12 SEP 93 /07:45	73	3
34	STS-58	18 OCT 93 /10:53	78	6

Ambient Environment Constraints

Wind Speed (Knots)	Minimum Ambient Temperature (Deg F), T_{min}				
	Relative Humidity				
	0–64%	65–74%	75–79%	80–89%	90–100%
0–1	48	47	46	45	44
2	47	46	45	44	43
3	41	41	41	40	39
4	39	39	39	39	38
5–7	38	38	38	38	38
8–14	37	37	37	37	37
>14	36	36	36	36	36

Ambient temperature, wind speed, and relative humidity are based on 5 minute averages

System Recovery Temperature Algorithm (RTA):

$$Esum = 0.5 \Sigma ((T_{amb}-T_{min})(\Delta t)(X)) + 0.2 \Sigma ((Q_{sol})(\Delta t)(X)) - \Sigma H_c ((T_{min}-T_{amb})(\Delta t)(1-X))$$

Δt = Time interval for summing (units of 5 minutes)

X = Switch for summing energy terms (X=1 for $T_{amb} \geq T_{min}$ X=0 for $T_{amb} < T_{min}$)

T_{amb} = Average measured ambient air temperature in the time interval (units of °F)

T_{min} = Minimum ambient air temperature from above table at the average measured wind speed in the time interval (units of °F)

Q_{sol} = Diffuse solar flux (units of Btu/hr–ft^2)

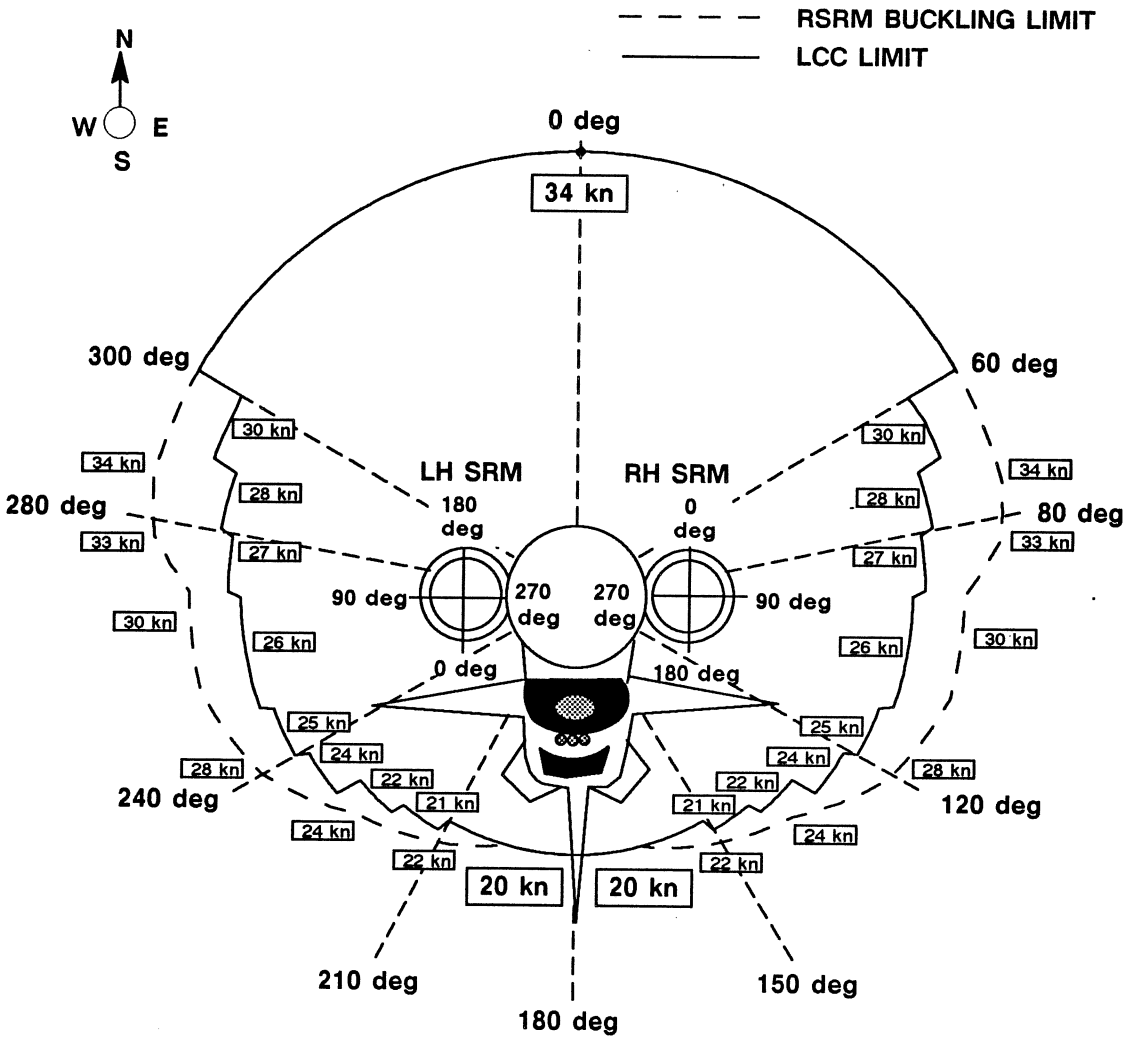
Esum = Running energy sum of convective cooling, convective heating and solar energy (units of Btu–minutes/ft^2–hr)

V = 5 minute averaged wind speed in knots

H_c = the maximum of: $4.0(V/5.0)^{0.5}$ or 1.0

The lower limit of 1.0 is a natural convection value and for winds greater than zero a forced value is calculated as a function of wind speed (units of Btu/ft^2–hr–°F)

Wind Limits



Forward Looking Aft
Surface Peak Wind Speed and Direction

SURFACE WIND LIMITS *		
WIND DIRECTION	BUCKLING LIMITS (Kn)	LCC LIMITS (Kn)
0	34	34
60	34	30
70	34	28
75	34	28
80	33.33	27
82.5	33	27
90	30	26
105	30	26
110	29.33	25
120	28	24
130	25.33	22
135	24	22
140	23.33	21
150	22	20
165	20	20
180	20	20
195	20	20
210	22	21
220	23.33	22
225	24	22
230	25.33	24
240	28	25
250	29.33	26
255	30	26
270	30	27
277.5	33	27
280	33.33	28
285	34	28
290	34	30
300	34	34
360	34	34

* WIND LIMITS IN EFFECT UNTIL APU START

Precipitation Constraints/ET Ice Accumulation

- No precipitation (visible rain, virga, or minimum discernable weather radar echo) shall exist in the flight path of the vehicle
- No formation of ice in areas on the ET that could impact orbiter surfaces. Final decision to launch will be made by mission management team based on observations by the ice inspection team

Natural and Triggered Lightning Constraints

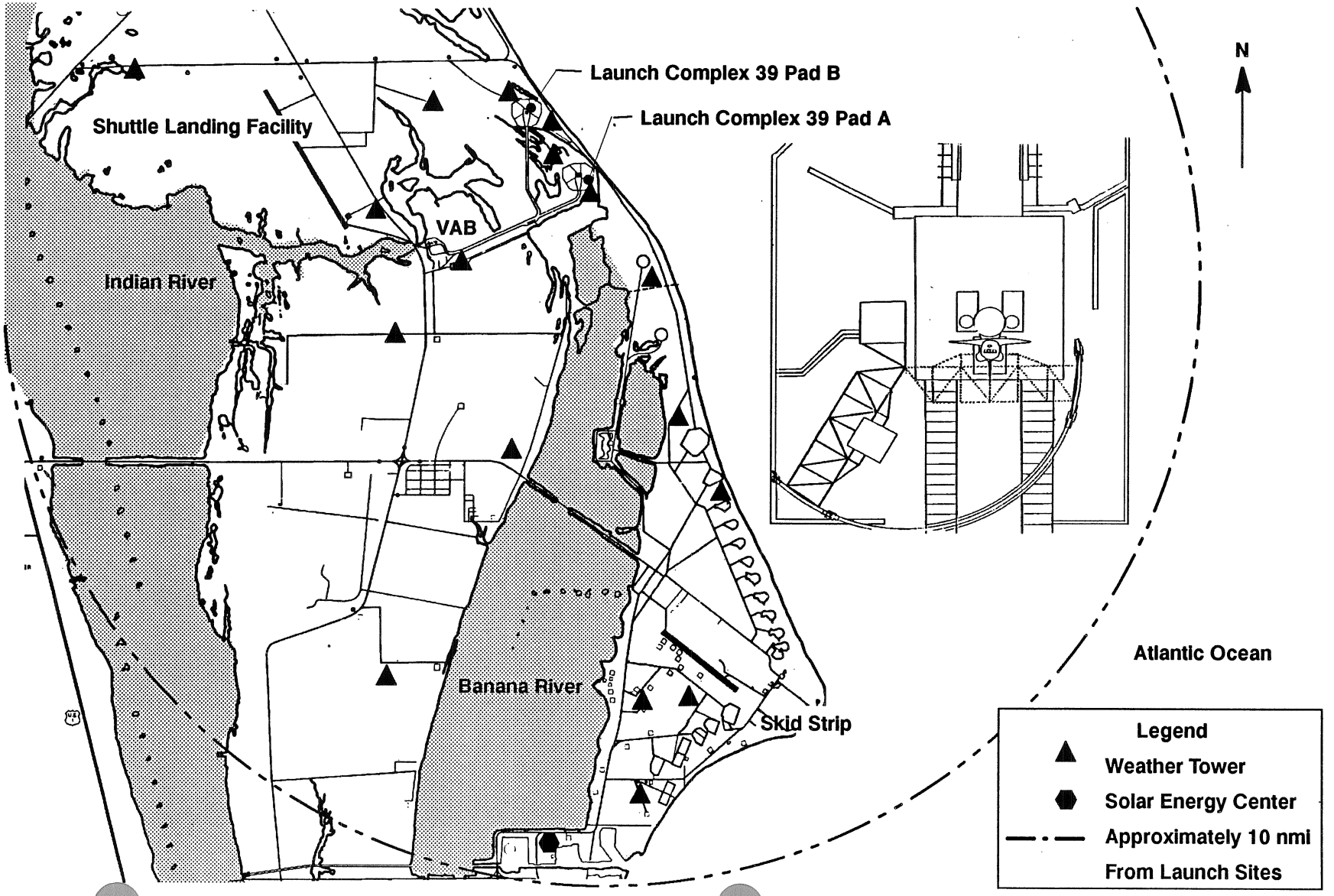
- The flight path must not carry the vehicle:
  - Through cumulus clouds with tops higher than the 5 °C level
  - Through or within 5 nmi of cumulus clouds with tops higher than the –10 °C level
  - Through or within 10 nmi of cumulus clouds with tops higher than the –20 °C level
  - Through or within 10 nmi of the nearest edge of any cumulonimbus or thunderstorm cloud including its associated anvil
  - Through a vertically continuous layer of clouds with an overall depth of 4500 feet or greater where any part of the clouds are located between the 0 and –20 °C levels
  - Through any cloud types that extend to altitudes at or above the 0 °C level and that are associated with disturbed weather within 5 nmi of the flight path
  - Through or within 5 nmi of thunderstorm debris clouds not monitored by a field mill network or producing radar returns greater or equal to 10 dBs
- Electric field intensity at ground level must not exceed 1 kV/M (average for 1 minute) within 5 nmi of launch site for 15 minutes prior to launch; unless, there are no clouds within 10 nmi of the launch site and smoke or ground fog is clearly causing abnormal readings
- No lightning within 10 nmi of launch site or flight path within 30 minutes prior to launch

Landing Sites

- Surface winds during daylight hours at all sites (surface winds represent peak winds, gust must be $\leq$ 10 kn above average wind)
  - Headwind $\leq$ 25 kn
  - Tailwind $\leq$ 10 kn
  - Crosswind $\leq$ 15 kn
- Sun angle limit on final shall not be within 10 deg of azimuth and 0-to-20 deg of elevation
- No precipitation at the surface or aloft along the flight path
- No thunderstorm, lightning, or precipitation within 30 nmi of landing site. Vertical clearance from these phenomena, at the 30-nmi range, shall be greater than 2 nmi (predeorbit or prelaunch AOA)
- No detached thunderstorm anvils less than 3 hours old shall be within 20 nmi of landing site or within 10 nmi of the approach path out to 30 nmi (predeorbit or prelaunch AOA)
- No thunderstorm, lightning, or precipitation within 20 nmi of landing site, or within 10 nmi laterally and 2 nmi vertically of the approach path out to 30 nmi (prelaunch RTLS and TAL)
- No detached thunderstorm anvils less than 3 hours old shall be within 10 nmi of the landing or within 5 nmi of the approach path out to 30 nmi (prelaunch RTLS and TAL)
- Turbulence not greater than moderate
- Night landing limits
  - When available, reconnaissance aircraft will provide go/no-go recommendation for light attenuation
  - Crosswind limit is $\leq$ 10 kn
  - Wind and atmospheric condition must not require use of close-in aimpoint, unless PAPIs are available
  - For lakebed landings with zero fault tolerant MLS, minimum ceiling heights are 15 kft

1.0 Overview / LCC (Cont)

KSC Weather Stations Map



Ice Launch Commit Criteria

This appendix contains data to be utilized for the prediction of ice accumulation on the External Tank, and thereby, implementing the below stated criteria.

Established criteria included in NSTS 08303, NSTS Program Ice Debris Inspection Criteria shall constitute a GO or NO-GO for launch.

Formation of any ice in an area which would impact the Orbiter windows dictates a NO-GO for launch. Refer to Figure 1 for definition of these areas.

Formation of acreage ice greater than 1/16 inch thickness and located in areas that would impact Orbiter surfaces other than windows dictates a NO-GO for launch. Formation of frost in these same areas is acceptable. Refer to Figure 2 for definition of these areas. Localized ice formation as defined in NSTS 08303 or as defined in "Allowable Ice Formation Areas" below is acceptable.

Ice predictions shall be made using KSC meteorological data and either of the methodologies for analysis outlined herein. These ice prediction methodologies reflect GO/NO-GO criteria and may be overruled by the Ice Inspection Team only:

For NO-GO when the model predicts no ice accumulation, but the Ice Inspection Team observes ice which violates the above criteria.

For GO when the model predicts ice accumulation without condensation and the Ice Inspection Team observes no ice which violates the above criteria.

Formation of ice is not precluded by the design in all areas. Exceptions are as follows:

Allowable Ice Formation Areas

Item	Description	XT	YT	ZT	Area
17 in LO2 Feedline	Bellows Shields	1106	70	564	3 in. sq
		1978.8	70	564	3 in. sq
		2026.4	70	564	3 in. sq
	Supports	1129	70	564	258 in. sq
		1377	70	564	286 in. sq
		1623	70	564	280 in. sq
		1871	70	564	175 in. sq
		1973	70	564	150 in. sq
17 in LO2 Feedline	Flange at I/T Splice	1115	70	564	27 in. sq

1.0 Overview / LCC (Cont)

Ice Launch Commit Criteria (Cont)

Item	Description	XT	YT	ZT	Area
	ECO Sensor Cond	1623	70	564	13 in. sq
LH2 Recirc Line	Bellows Shields	2095	-66	587	6 in. sq
		2108	-53	551	6 in. sq
Exposed Instr & Purge Vents		2093	80	590	1 in. sq
		2093	-80	590	1 in. sq
Thrust Struts	Left at Tank	1927	-112	523	12 in. sq
	Right at Tank	1927	112	523	12 in. sq
ET/SRB Aft Attach	Cable Tray	2058	-157	471.94	40 in. sq
		2058	157	471.94	40 in. sq
	Diagonal Strut	2058	-165.87	443.22	134 in. sq
		2058	165.87	443.22	134 in. sq
	Upper Strut	2058	-173.29	457	506 in. sq
		2058	173.29	457	506 in. sq
TSE (shipping footing)	Diagonal Strut	2058	-26.44	558.33	20 in. sq
Bipod Spindle	Left Hand	1129.9	-42.7	564	6 in. sq
	Right Hand	1129.9	42.7	564	6 in. sq
LH2 Aft Manhole Cover	Upper Lk Ck Ports	2171	-4.8	412.6	9.6 in. sq
	Lower Lk Ck Ports	2165	-4.8	340.1	9.6 in. sq
LO2 Cable Tray at Torque Multi-plier		2058	96.5	564.3	15.5 in. sq

For STS-31, Ice Formation in the area of the LO2 Feed Line bracket is acceptable as specified below:

XT	YT	ZT	Area
2051	80	583	22 in. sq

Authority: PRCBDS S21300A, S52877H, S52877R1, S77340B, S70957G, S87040 and S90812

Ice/frost formation will normally occur for the following Orbiter items and locations:

- External Tank Tie Bolt Cannister 3 places on the LH2 side
- External Tank Tie Bolt Cannister 3 places on the LO2 side
- External Tank/Orbiter Umbilical Baggie on the LH2 side and the LO2 side
- External Tank/Orbiter Umbilical Interface Cavity Purge Vent on the LH2 side (2 places)

Ice/frost significantly exceeding the amount normally observed in these areas as referenced in the ICE/DEBRIS INSPECTION CRITERIA DOCUMENT, NSTS 08303 will be evaluated by the Ice Team

Ice Launch Commit Criteria (Cont)

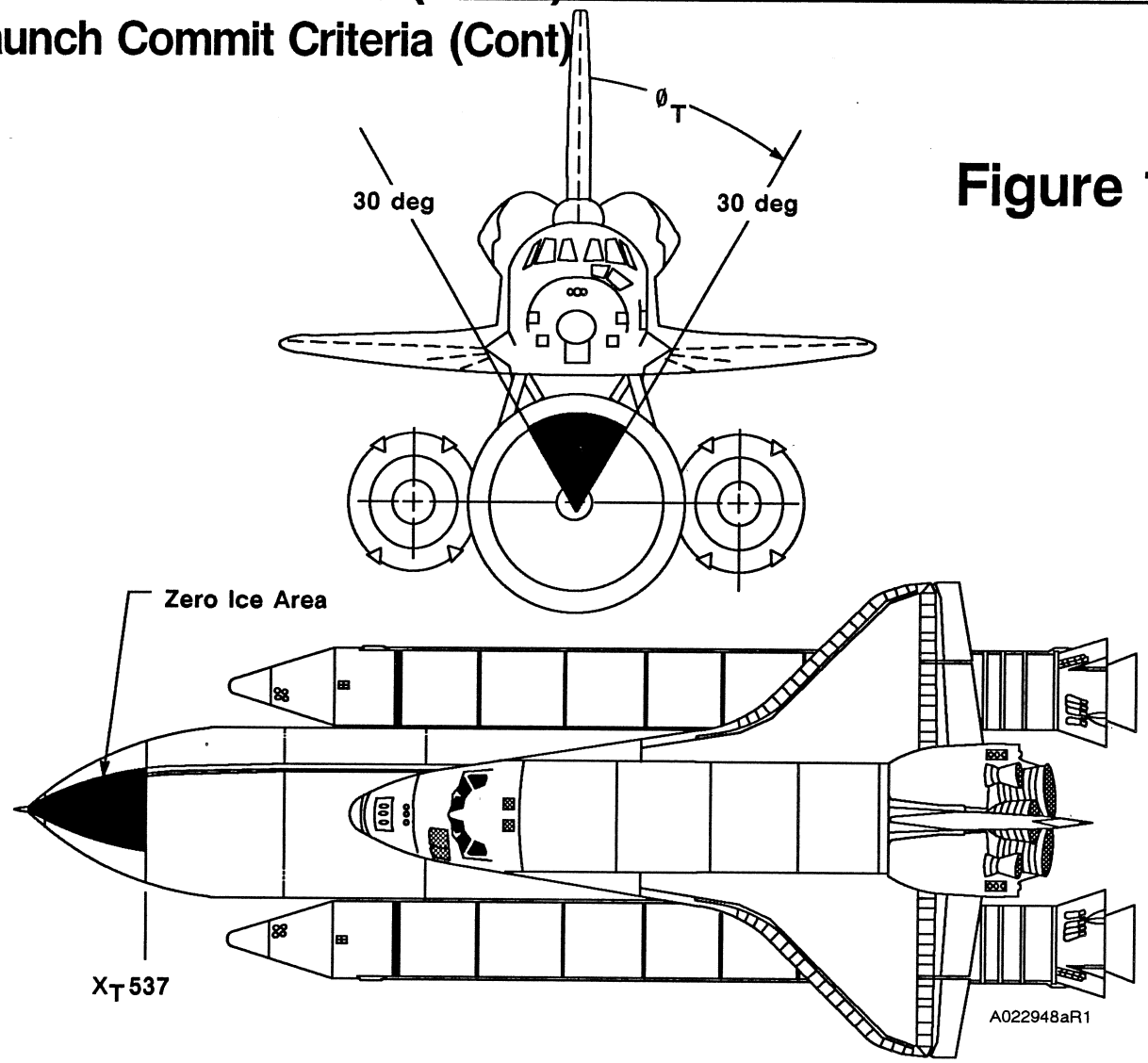


Figure 1

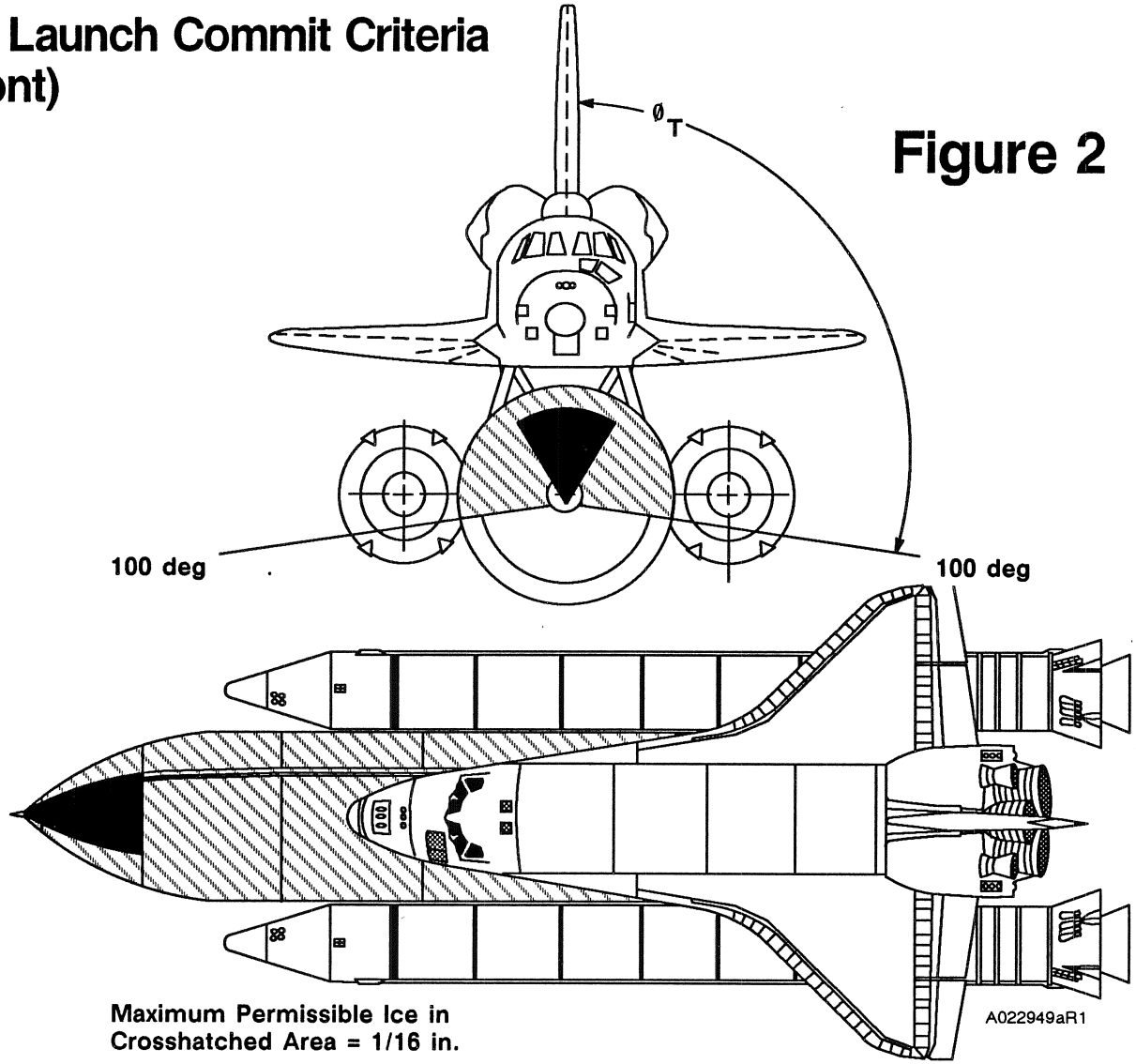
NSTS 16007 AUTH: PRCBD S81304N

REV D AMEND 10

Definition of Zero Ice Area on External Tank

Ice Launch Commit Criteria (Cont)

Figure 2



NSTS 16007 AUTH: PRCBD S81304N REV D AMEND 10

Definition of Area of 1/16 in. Maximum Ice Thickness

Historical KSC Ambient Temperatures (Information only)

Station No. 747945 Station Name: NASA Shuttle Landing Facility FL Years: Nov 78 — Oct 88

Hr (E.S.T.)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
00-02	Mean	53.7	57.0	60.8	63.9	69.2	74.1	75.7	75.7	74.7	70.3	65.4	59.7	66.7
	S.D.	9.714	8.578	7.741	6.344	4.413	2.908	2.708	2.304	2.829	4.724	7.899	9.528	
	Total OBS	930	849	930	900	930	900	930	930	900	930	900	930	10,959
03-05	Mean	52.3	55.8	59.4	62.2	67.7	72.8	74.5	74.6	73.8	69.7	64.5	58.5	65.5
	S.D.	10.250	8.830	8.091	6.562	4.677	3.052	2.682	2.042	2.892	4.953	8.089	9.783	
	Total OBS	930	849	930	900	930	900	930	930	900	930	900	930	10,959
06-08	Mean	51.8	55.6	60.2	64.7	71.3	76.3	77.6	77.5	75.9	71.1	64.8	58.4	67.1
	S.D.	10.560	8.989	8.263	6.651	5.205	3.824	3.834	3.600	3.866	5.330	8.206	9.938	
	Total OBS	930	849	930	900	930	900	930	930	900	930	900	930	10,959
09-11	Mean	60.0	63.8	68.6	74.1	79.2	83.5	85.5	85.4	83.3	79.3	73.0	66.0	75.2
	S.D.	9.393	8.385	7.182	5.501	3.842	3.418	3.087	3.096	3.665	4.410	6.611	9.353	
	Total OBS	930	849	930	900	930	900	930	930	900	930	900	930	10,959
12-14	Mean	65.1	68.0	72.1	77.0	81.3	85.5	87.5	87.0	84.9	81.1	75.7	70.3	78.0
	S.D.	8.658	8.515	7.316	5.805	4.582	4.116	4.086	4.114	3.975	4.191	5.989	8.431	
	Total OBS	930	849	930	900	930	900	930	930	900	930	900	930	10,959
15-17	Mean	64.2	66.9	71.2	75.9	79.4	83.3	85.1	84.6	82.7	79.0	73.6	68.8	76.3
	S.D.	8.083	8.155	6.925	5.513	4.539	4.353	5.000	4.497	3.915	4.221	5.726	7.955	
	Total OBS	930	849	930	900	930	900	930	930	900	930	900	930	10,959
18-20	Mean	57.9	61.3	65.6	70.3	74.6	78.9	80.4	80.0	78.2	73.9	68.0	63.0	71.0
	S.D.	8.082	7.752	6.692	5.325	3.942	3.259	3.985	3.244	2.997	3.886	6.785	5.405	
	Total OBS	930	849	930	900	930	900	930	930	900	928	900	930	10,957
21-23	Mean	55.0	58.4	62.4	66.3	71.2	75.7	77.0	77.0	76.0	72.0	66.1	61.0	68.2
	S.D.	8.923	8.110	7.303	5.614	4.041	2.675	2.922	2.217	2.688	4.455	7.723	8.157	
	Total OBS	930	849	930	900	930	900	930	930	900	927	900	930	10,956
All Hours	Mean	57.5	60.8	65.1	69.3	74.2	78.7	80.4	80.2	78.7	74.6	68.9	63.2	71.0
	S.D.	10.416	9.632	8.811	8.081	6.492	5.727	5.892	5.600	5.249	6.235	8.304	10.114	
	Total OBS	7,440	6,792	7,440	7,200	7,440	7,200	7,440	7,440	7,200	7,435	7,200	7,440	87,667

Historical KSC Ambient Temperatures (Cont)

Years: 57-89

Month	Day	Julian Day	Mean	Standard Deviation	30-day Mean	30-day Standard Deviation
January	01	01	62.3	6.6	61.9	3.2
	02	02	60.6	8.2	61.8	3.2
	03	03	60.8	9.1	61.7	3.3
	04	04	60.5	7.2	61.6	3.3
	05	05	60.1	6.7	61.5	3.3
	06	06	61.3	6.1	61.4	3.3
	07	07	61.2	5.5	61.4	3.2
	08	08	60.4	8.0	61.3	3.3
	09	09	59.2	9.5	61.1	3.4
	10	10	59.9	9.6	61.0	3.5
	11	11	58.7	8.9	60.9	3.6
	12	12	58.5	8.8	60.8	3.6
	13	13	59.2	8.3	60.7	3.6
	14	14	58.5	9 2	60.5	3.6
	15	15	58.2	8.1	60.3	3.6
	16	16	58.3	6.0	60.3	3.6
	17	17	57.7	8.6	60.2	3.7
	18	18	57.8	9.6	60.2	3.7
	19	19	59.4	8.4	60.1	3.7
	20	20	59.7	8.6	60.1	3.8
	21	21	58.0	9.2	60.0	3.9
	22	22	57.6	9.3	59.9	3.9
	23	23	58.9	8.6	59.8	3.9
	24	24	59.9	7.7	59.7	3.8
	25	25	61.1	7.2	59.8	3.8
	26	26	60.5	7.7	59.8	3 8
	27	27	59.7	9.2	59.7	3.8
	28	28	57.7	9.0	59.6	3.8
	29	29	57.8	7.6	59.4	3.9
	30	30	58.4	8.7	59.4	4.0
	31	31	59.8	8.1	59.3	4.0
	01	32	60.8	7.8	59.3	4.0
	02	33	62.3	7.2	59.4	4.0
February	03	34	61.1	7.8	59.4	4.1
	04	35	58.8	9.3	59.3	4.1
	05	36	59.6	8.1	59.3	4.1
	06	37	61.3	7.6	59.3	4.2
	07	38	60.8	7.8	59.3	4.2
	08	39	59.0	6.9	59.3	4.2
	09	40	57.7	7.4	59.2	4.1
	10	41	57.3	8.6	59.2	4.0
	11	42	58.4	7.5	59.2	3.9
	12	43	59.2	6.8	59.2	3.9
	13	44	58.9	7.7	59.2	3.9
	14	45	58.5	7.0	59.2	4.0
	15	46	60.8	6.5	59.3	4.0
	16	47	61.9	7.6	59.4	4.1
	17	48	60.8	8.3	59.5	4.2
	18	49	62.2	7.6	59.6	4.2
	19	50	62.0	8.1	59.7	4.2
	20	51	60.8	8.1	59.8	4.2
	21	52	61.4	7.6	59.9	4.1
	22	53	62.6	8.0	60.0	4.1
	23	54	61.0	7.4	60.1	4.0
	24	55	61.7	7.6	60.1	4.0
	25	56	60.4	7.7	60.1	3.9
	26	57	58.2	8.1	60.0	3.8
	27	58	61.2		60.1	3.8
	28	59	62.8		60.3	3.8

Note: The mean is the average of the daily temperatures for any given day over a 33-year span. The 30-day mean is the mean of the daily temperatures for 30 days prior to any given day over a 33-year span (i.e., the daily average temperature for the first Julian day corresponds to the mean of the 30-day average temperature on the fifteenth Julian day)

Historical KSC Ambient Temperatures (Cont)

Years: 57-89

Month	Day	Julian Day	Mean	Standard Deviation	30-day Mean	30-day S.D.
March	01	60	62.3	6.7	60.4	3.7
	02	61	62.1	7.0	60.5	3.6
	03	62	63.5	7.2	60.6	3.6
	04	63	63.8	7.5	60.7	3.5
	05	64	64.5	7.8	60.8	3.5
	06	65	63.9	7.7	60.9	3.5
	07	66	62.5	6.8	61.0	3.3
	08	67	62.7	7.0	61.1	3.1
	09	68	63.3	6.2	61.2	3.0
	10	69	63.1	5.6	61.3	2.9
	11	70	63.8	6.4	61.5	2.8
	12	71	65.8	7.2	61.8	2.8
	13	72	65.6	7.2	62.0	2.8
	14	73	65.6	6.5	62.3	2.9
	15	74	65.6	6.0	62.5	2.9
	16	75	66.7	6.2	62.7	2.9
	17	76	65.0	5.1	62.9	2.8
	18	77	65.5	5.6	63.0	2.8
	19	78	66.1	5.7	63.2	2.8
	20	79	66.2	6.0	63.3	2.8
	21	80	65.6	7.0	63.4	2.7
	22	81	64.2	7.0	63.5	2.7
	23	82	64.5	5.3	63.6	2.7
	24	83	66.5	5.7	64.8	2.7
	25	84	66.3	5.7	64.9	2.7
	26	85	66.5	4.4	64.1	2.6
	27	86	65.7	5.3	64.3	2.6
	28	87	68.0	4.8	64.6	2.6
	29	88	68.1	4.1	64.8	2.6
	30	89	69.2	5.1	65.1	2.7
	31	90	68.9	5.5	65.3	2.7
	01	91	67.4	5.6	65.5	2.8
	02	92	67.6	4.9	65.6	2.8
April	03	93	68.7	4.7	65.8	2.7
	04	94	69.0	5.3	65.9	2.5
	05	95	68.7	4.9	66.1	2.4
	06	96	67.4	5.2	66.2	2.3
	07	97	67.6	5.1	66.4	2.2
	08	98	69.2	4.8	66.6	2.3
	09	99	69.3	4.1	66.8	2.3
	10	100	69.0	4.3	67.0	2.3
	11	101	68.9	4.4	67.1	2.2
	12	102	69.5	4.5	67.2	2.2
	13	103	69.4	4.4	67.4	2.2
	14	104	69.4	4.7	67.5	2.2
	15	105	69.4	3.8	67.6	2.1
	16	106	68.8	4.2	67.7	2.0
	17	107	68.6	4.4	67.8	2.0
	18	108	70.0	4.0	67.9	2.0
	19	109	70.7	3.9	68.1	1.9
	20	110	71.5	3.3	68.3	1.9
	21	111	71.7	3.1	68.5	1.7
	22	112	72.5	2.8	68.8	1.7
	23	113	72.5	3.2	69.0	1.6
	24	114	73.0	3.4	69.2	1.6
	25	115	72.0	3.5	69.4	1.7
	26	116	72.3	3.5	69.6	1.7
	27	117	72.8	3.8	69.8	1.7
	28	118	72.1	3.9	69.9	1.6
	29	119	71.8	3.7	70.0	1.6
	30	120	72.1	3.5	70.1	1.5

Note: The mean is the average of the daily temperatures for any given day over a 33-year span. The 30-day mean is the mean of the daily temperatures for 30 days prior to any given day over a 33-year span (i.e., the daily average temperature for the first Julian day corresponds to the mean of the 30-day average temperature on the fifteenth Julian day)

Historical KSC Ambient Temperatures (Cont)

Years: 57-89

Month	Day	Julian Day	Mean	Standard Deviation	30-day Mean	30-day S.D.
May	01	121	72.3	2.8	70.3	1.5
	02	122	72.7	2.3	70.4	1.4
	03	123	73.3	2.8	70.6	1.4
	04	124	72.9	3.3	70.7	1.3
	05	125	72.4	3.1	70.8	1.3
	06	126	73.4	2.5	71.0	1.3
	07	127	73.5	2.9	71.2	1.4
	08	128	73.5	3.4	71.4	1.4
	09	129	73.4	2.9	71.5	1.4
	10	130	73.6	2.4	71.7	1.3
	11	131	73.8	2.8	71.8	1.3
	12	132	73.8	2.9	72.0	1.3
	13	133	74.2	3.0	72.1	1.4
	14	134	74.2	3.0	72.3	1.3
	15	135	74.4	2.2	72.5	1.3
	16	136	74.6	2.2	72.7	1.3
	17	137	75.3	2.5	72.9	1.2
	18	138	75.0	3.0	73.0	1.1
	19	139	75.0	2.6	73.2	1.1
	20	140	75.6	2.2	73.3	1.0
	21	141	76.0	2.4	73.5	1.0
	22	142	76.4	2.3	73.6	1.0
	23	143	76.3	2.0	73.7	1.0
	24	144	76.2	2.4	73.8	1.0
	25	145	76.1	2.4	74.0	1.0
	26	146	75.8	2.8	74.1	1.0
	27	147	76.4	3.1	74.2	1.0
	28	148	76.9	2.3	74.4	1.0
	29	149	76.6	2.1	74.5	1.0
	30	150	76.4	2.2	74.7	1.0
	31	151	77.1	2.7	74.8	1.0
June	01	152	77.4	2.5	75.0	1.0
	02	153	77.0	2.5	75.1	1.0
	03	154	77.3	2.4	75.3	1.0
	04	155	77.6	2.2	75.4	1.0
	05	156	77.4	2.2	75.6	1.1
	06	157	77.5	2.1	75.7	1.1
	07	158	77.9	2.3	75.8	1.1
	08	159	78.0	2.3	76.0	1.1
	09	160	78.5	2.1	76.2	1.1
	10	161	78.4	2.1	76.3	1.1
	11	162	78.3	2.0	76.5	1.2
	12	163	78.0	2.2	76.6	1.2
	13	164	78.2	2.3	76.7	1.2
	14	165	78.4	2.3	76.9	1.2
	15	166	78.7	2.4	77.0	1.2
	16	167	78.8	2.1	77.1	1.2
	17	168	79.1	2.5	77.2	1.2
	18	169	78.4	2.4	77.4	1.2
	19	170	78.7	2.2	77.5	1.2
	20	171	78.5	2.2	77.5	1.2
	21	172	78.9	1.9	77.6	1.2
	22	173	78.8	1.6	77.7	1.2
	23	174	78.8	1.9	77.8	1.2
	24	175	78.7	1.7	77.9	1.2
	25	176	78.9	1.9	78.0	1.2
	26	177	79.3	2.3	78.1	1.2
	27	178	79.2	2.1	78.2	1.2
	28	179	79.0	2.0	78.2	1.2
	29	180	79.1	2.[illegible]	78.3	1.2
	30	181	79.7	[illegible]	78.4	1.1

Note: The mean is the average of the daily temperatures for any given day over a 33-year span. The 30-day mean is the mean of the daily temperatures for 30 days prior to any given day over a 33-year span (i.e., the daily average temperature for the first Julian day corresponds to the mean of the 30-day average temperature on the fifteenth Julian day)

Historical KSC Ambient Temperatures (Cont)

Years: 57-89

Month	Day	Julian Day	Mean	Standard Deviation	30-day Mean	30-day S.D.
July	01	182	79.7	2.5	78.5	1.1
	02	183	79.7	2.1	78.6	1.1
	03	184	79.7	2.0	78.7	1.1
	04	185	79.5	2.0	78.7	1.1
	05	186	80.0	2.0	78.8	1.1
	06	187	79.8	2.1	78.9	1.1
	07	188	80.2	1.7	79.0	1.1
	08	189	80.0	1.9	79.0	1.1
	09	190	79.9	1.8	79.1	1.1
	10	191	80.2	2.0	79.1	1.1
	11	192	80.4	1.9	79.2	1.1
	12	193	80.1	2.3	79.3	1.1
	13	194	80.1	2.1	79.3	1.1
	14	195	80.3	2.1	79.4	1.1
	15	196	80.6	2.1	79.5	1.1
	16	197	80.1	1.8	79.5	1.1
	17	198	79.8	1.9	79.5	1.1
	18	199	79.7	1.9	79.6	1.1
	19	200	79.4	1.9	79.6	1.0
	20	201	79.9	2.2	79.6	1.0
	21	202	80.2	2.3	79.7	1.1
	22	203	79.2	2.4	79.7	1.1
	23	204	79.3	2.3	79.7	1.1
	24	205	79.7	2.5	79.8	1.1
	25	206	79.9	2.1	79.8	1.1
	26	207	80.0	1.9	79.8	1.1
	27	208	80.1	1.6	79.8	1.1
	28	209	80.6	1.6	79.9	1.1
	29	210	80.1	1.8	79.9	1.1
	30	211	80.3	1.4	79.9	1.1
	31	212	80.0	1.9	79.9	1.1
August	01	213	79.9	2.0	80.0	1.1
	02	214	79.8	1.6	80.0	1.1
	03	215	79.9	1.8	80.0	1.1
	04	216	80.1	1.6	80.0	1.1
	05	217	80.1	1.7	80.0	1.0
	06	218	80.0	1.9	80.0	1.0
	07	219	79.9	2.2	80.0	1.0
	08	220	80.2	1.9	80.0	1.0
	09	221	80.0	1.7	80.0	1.0
	10	222	80.0	2.0	80.0	1.0
	11	223	79.9	1.6	80.0	1 0
	12	224	79.3	1.8	79.9	1.0
	13	225	79.1	1.6	79.9	1.0
	14	226	79.1	2.1	79.8	1.0
	15	227	79.6	1.7	79.8	1.0
	16	228	80.2	1.6	79.8	1.0
	17	229	80.4	1.8	79.9	1.0
	18	230	79.8	1.8	79.9	1.0
	19	231	79.8	1.8	79.9	1.0
	20	232	79.5	1.9	79.9	1.0
	21	233	79.5	2.1	79.9	0.9
	22	234	79.4	2.1	79.9	0.9
	23	235	79.6	1.9	79.9	0.9
	24	236	79.8	2.2	79.9	0.9
	25	237	80.1	1.8	79.9	0.9
	26	238	80.0	1.8	79.9	0.8
	27	239	79.7	1.5	79.8	0.8
	28	240	79.8	1.9	79.8	0.8
	29	241	80.1	1.8	79.8	0.8
	30	242	80.3	1.6	79.8	0.8
	31	243	79.9	1.6	79.8	0.8

Note: The mean is the average of the daily temperatures for any given day over a 33-year span. The 30-day mean is the mean of the daily temperatures for 30 days prior to any given day over a 33-year span (I.e., the daily average temperature for the first Julian day corresponds to the mean of the 30-day average temperature on the fifteenth Julian day)

Historical KSC Ambient Temperatures (Cont)

Years: 57-89

Month	Day	Julian Day	Mean	Standard Deviation	30-day Mean	30-day S.D.
September	01	244	79.9	1.6	79.8	0.8
	02	245	79.1	1.9	79.8	0.8
	03	246	78.9	1.8	79.8	0.8
	04	247	79.5	1.9	79.8	0.8
	05	248	79.5	1.9	79.7	0.8
	06	249	79.4	1.8	79.7	0.8
	07	250	79.5	1.5	79.7	0.8
	08	251	79.7	1.9	79.7	0.8
	09	252	78.8	2.5	79.6	0.8
	10	253	79.1	1.9	79.6	0.9
	11	254	79.5	1.8	79.6	0.9
	12	255	79.4	1.9	79.6	0.9
	13	256	79.3	1.7	79.6	0.9
	14	257	78.8	1.8	79.6	0.9
	15	258	78.9	2.0	79.6	0.9
	16	259	79.4	2.4	79.5	1.0
	17	260	79.0	2.0	79.5	1.0
	18	261	79.0	2.0	79.5	1.0
	19	262	78.6	2.8	79.5	1.0
	20	263	79.0	2.2	79.4	1.0
	21	264	79.3	1.8	79.4	1.0
	22	265	78.7	1.8	79.4	1.0
	23	266	77.8	2.1	79.3	1.0
	24	267	78.0	2.2	79.3	1.0
	25	268	78.3	1.8	79.2	1.0
	26	269	78.6	1.8	79.2	1.0
	27	270	78.7	1.9	79.1	1.0
	28	271	78.7	1.8	79.1	1.0
	29	272	78.4	2.5	79.0	1.0
	30	273	78.0	2.3	79.0	1.0
	01	274	78.1	2.4	78.9	1.0
	02	275	77.4	3.0	78.8	1 0
	03	276	77.2	3.4	78.8	1.0
October	04	277	77.1	2.9	78.7	1.1
	05	278	77.2	2.5	78.6	1.1
	06	279	76.8	3.0	78.5	1.1
	07	280	76.3	2.8	78.4	1.1
	08	281	76.2	3.1	78.3	1.1
	09	282	76.5	2.6	78.2	1.1
	10	283	76.6	2.2	78.2	1.1
	11	284	76.3	2.7	78.1	1.1
	12	285	76.0	2.8	77.9	1.1
	13	286	75.4	3.5	77.8	1.1
	14	287	74.8	4.6	77.7	1.2
	15	288	74.6	4.0	77.5	1.2
	16	289	74.7	4.0	77.4	1.3
	17	290	74.7	4.0	77.2	1.3
	18	291	74.1	4.2	77.1	1.4
	19	292	73.8	4.0	76.9	1.4
	20	293	72.7	5.3	76.7	1.4
	21	294	72.3	5.5	76.5	1.4
	22	295	72.9	4.7	76.3	1.4
	23	296	73.0	3.3	76.1	1.4
	24	297	72.8	3.3	75.9	1.4
	25	298	72.0	4.0	75.7	1.4
	26	299	70.4	5.0	75.5	1.4
	27	300	70.7	4.5	75.2	1.4
	28	301	71.9	4.4	75.0	1.4
	29	302	71.7	4.2	74.7	1.5
	30	303	72.2	4.7	74.5	1.5
	31	304	72.3		74.4	1.6

Note: The mean is the average of the daily temperatures for any given day over a 33-year span. The 30-day mean is the mean of the daily temperatures for 30 days prior to any given day over a 33-year span (i.e., the daily average temperature for the first Julian day corresponds to the mean of the 30-day average temperature on the fifteenth Julian day)

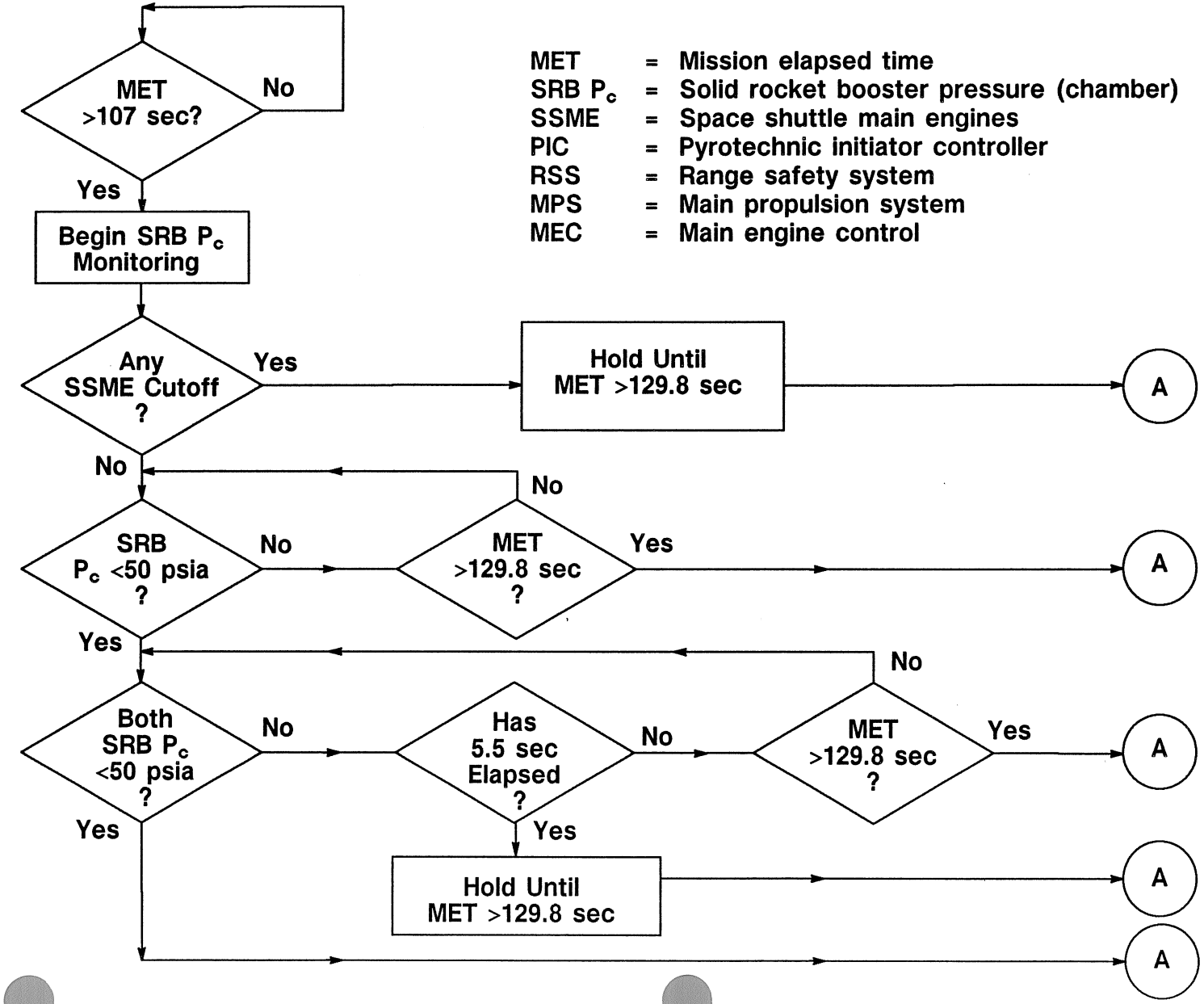
Historical KSC Ambient Temperatures (Cont)

Years: 57-89

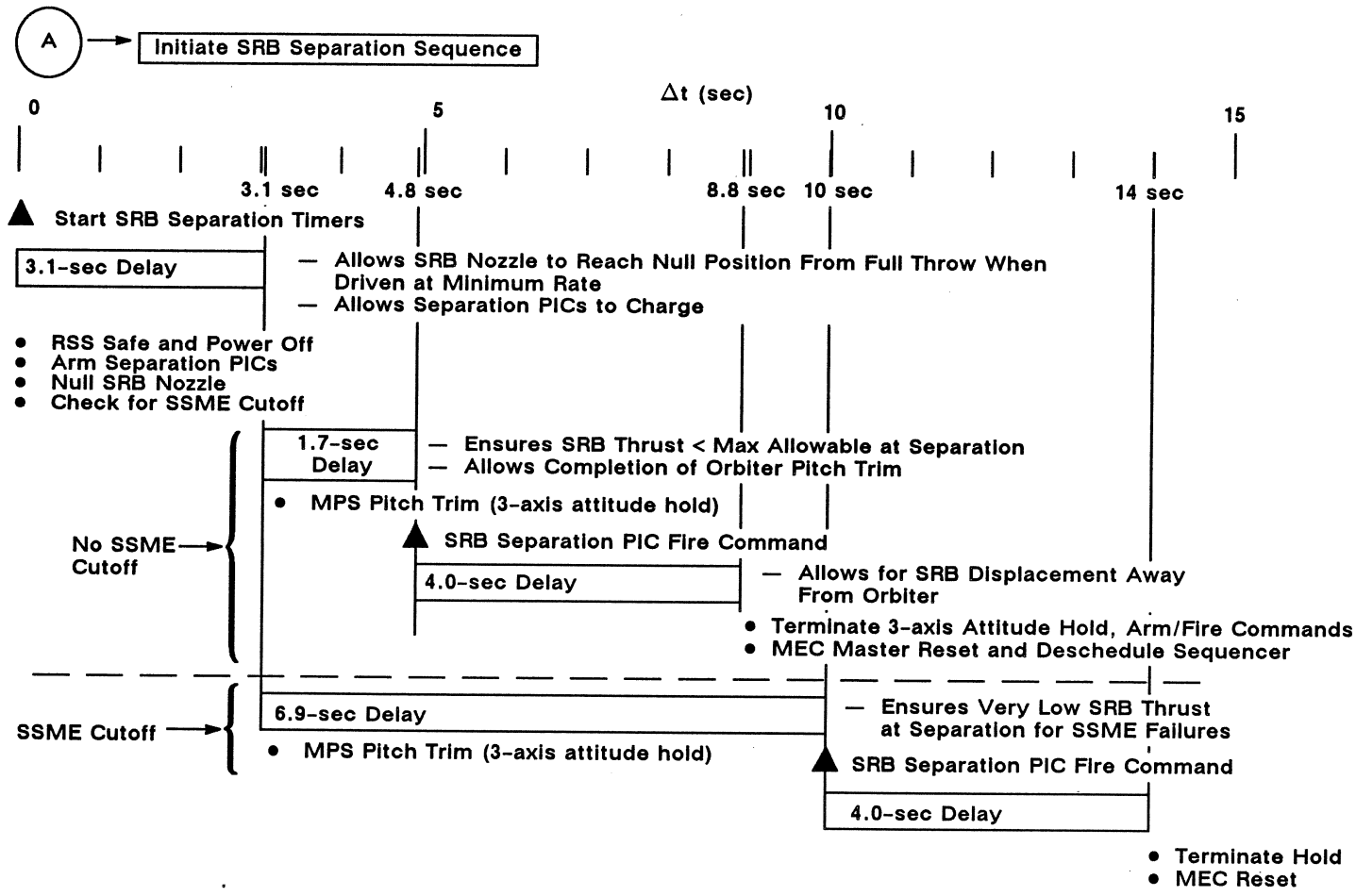
Month	Day	Julian Day	Mean	Standard Deviation	30-day Mean	30-day S.D.
November	01	305	71.8	3.6	74.2	1.6
	02	306	70.7	4.4	73.9	1.7
	03	307	69.8	5.6	73.7	1.7
	04	308	70.2	5.1	73.5	1.7
	05	309	69.1	6.6	73.2	1.7
	06	310	68.3	5.8	72.9	1.7
	07	311	68.1	5.6	72.7	1.7
	08	312	69.0	4.7	72.4	1.7
	09	313	68.9	4.5	72.2	1.7
	10	314	69.1	4.9	71.9	1.7
	11	315	67.9	5.6	71.7	1.8
	12	316	67.2	7.0	71.4	1.8
	13	317	66.8	7.1	71.1	1.9
	14	318	67.1	7.1	70.9	1.9
	15	319	67.6	7.0	70.6	1.9
	16	320	68.2	6.1	70.4	1.9
	17	321	68.4	6.7	70.2	1.9
	18	322	68.7	6.5	70.1	2.0
	19	323	68.3	5.8	69.9	2.0
	20	324	68.6	5.4	69.8	2.1
	21	325	66.5	6.9	69.6	2.1
	22	326	66.1	7.2	69.3	2.2
	23	327	67.3	6.6	69.2	2.3
	24	328	67.4	7.4	69.0	2.5
	25	329	66.7	6.6	68.9	2.6
	26	330	66.8	5.1	68.8	2.6
	27	331	68.1	5.3	68.6	2.6
	28	332	68.7	5.5	68.5	2.6
	29	333	65.8	7.5	68.3	2.7
	30	334	63.9	8.1	68.0	2.7
December	01	335	62.9	7.6	67.7	2.8
	02	336	63.7	6.9	67.5	2.8
	03	337	63.6	6.8	67.3	2.9
	04	338	62.9	7.0	67.1	2.9
	05	339	63.6	7.9	66.9	3.0
	06	340	63.8	7.0	66.7	3.1
	07	341	63.1	7.9	66.6	3.1
	08	342	63.5	7.0	66.4	3.2
	09	343	63.5	7.2	66.2	3.2
	10	344	62.2	9.3	66.0	3.3
	11	345	63.2	8.6	65.8	3.4
	12	346	62.2	9.4	65.6	3.4
	13	347	61.4	9.1	65.5	3.3
	14	348	62.9	8.7	65.3	3.3
	15	349	63.6	7.9	65.2	3.4
	16	350	62.0	7.7	65.0	3.4
	17	351	59.5	8.6	64.7	3.4
	18	352	59.8	7.7	64.4	3.5
	19	353	59.4	7.8	64.1	3.5
	20	354	61.2	6.5	63.8	3.5
	21	355	60.4	6.5	63.6	3.5
	22	356	59.9	8.9	63.4	3.5
	23	357	60.8	8.1	63.2	3.5
	24	358	61.0	9.3	63.0	3.5
	25	359	60.6	10.5	62.8	3.5
	26	360	58.7	10.1	62.5	3.5
	27	361	59.4	9.1	62.2	3.5
	28	362	61.1	8.5	62.0	3.5
	29	363	61.2	7.1	61.8	3.4
	30	364	61.6	6.8	61.8	3.4
	31	365	63.8	5.9	61.8	3.3

Note: The mean is the average of the daily temperatures for any given day over a 33-year span. The 30-day mean is the mean of the daily temperatures for 30 days prior to any given day over a 33-year span (i.e., the daily average temperature for the first Julian day corresponds to the mean of the 30-day average temperature on the fifteenth Julian day)

SRB Separation Sequence



SRB Separation Sequence (Cont)



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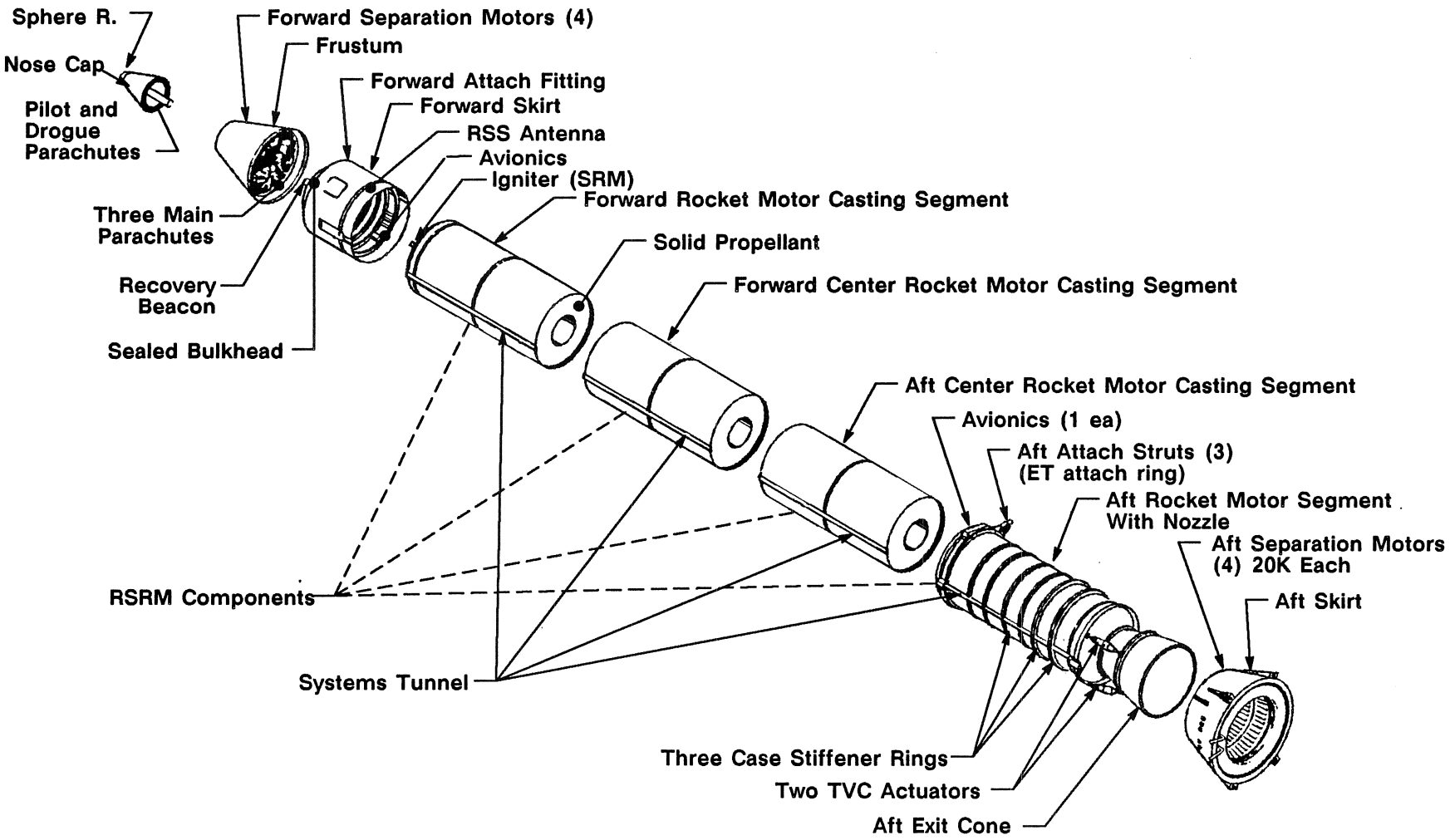
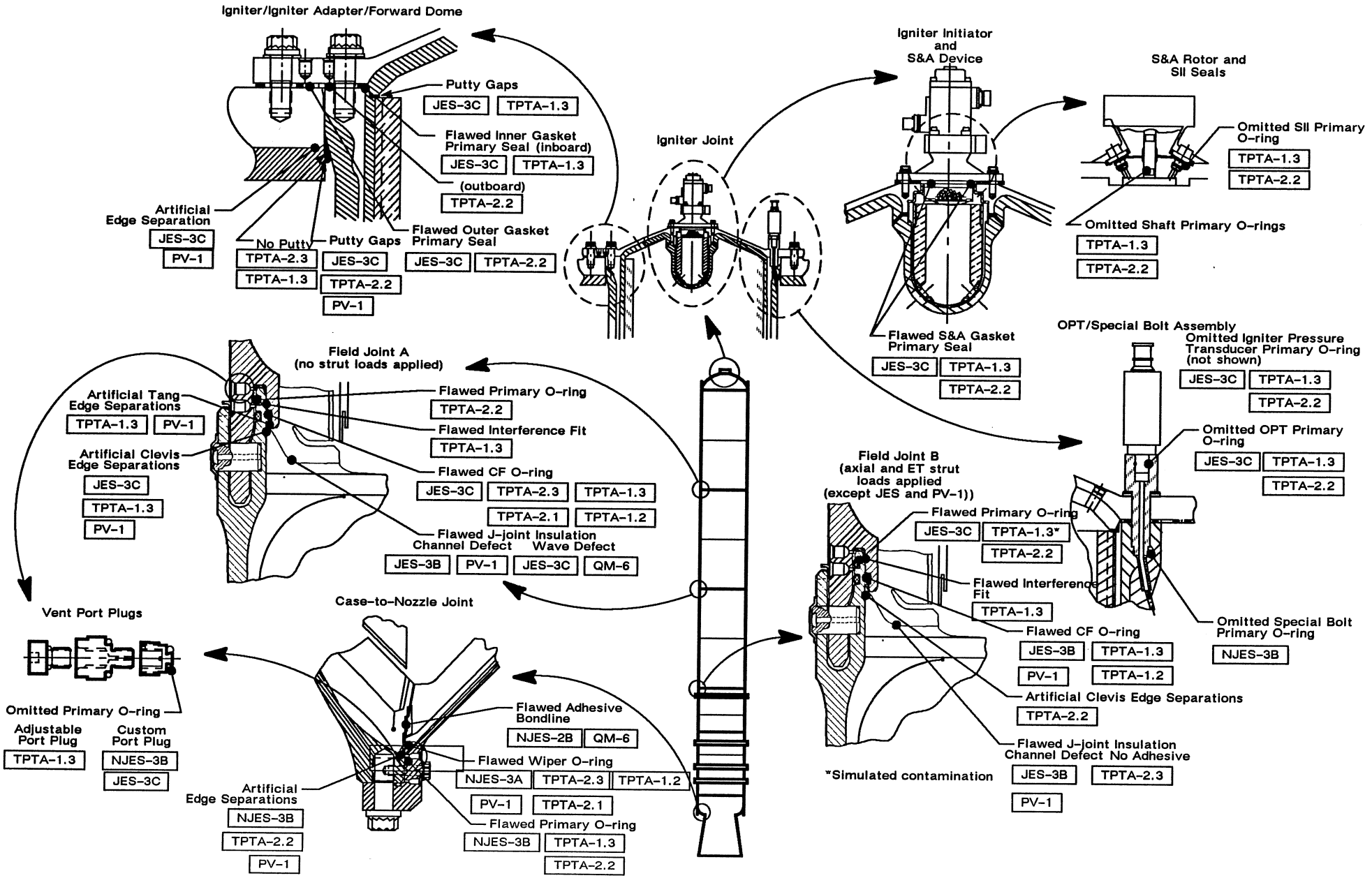
Solid Rocket Booster Configuration



Subscale and PVM–1 RSRM Seal Tests



Subscale and PVM-1 RSRM Seal Tests (Cont)

	PVM-1	JES-3B	JES-3C	NJES-2B	NJES-3A	NJES-3B	TPTA-1.1	TPTA-1.2	TPTA-2.1	TPTA-2.2
S&A Seals										
SII PRIM	O		F		V	V			O	F
SII SEC			O							O
ROTOR PRIM	O		F		V	V			O	F
ROTOR SEC			O							O
LEAK CHECK PORT SEC			O**							O**
S&A / IGNITION JOINT										
GASK-O-SEAL® PRIM			F		V	V		O	O	F
GASK-O-SEAL® SEC			O							O
LEAK CHECK PORT SEC			O**							O**
IGNITER ADAPTER INNER GASKET										
GASK-O-SEAL INBOARD PRIM			F		V			O	O	
GASK-O-SEAL OUTBOARD PRIM					V			O	O	F
STAT-O-SEAL (36) SEC			O			O				O
SPECIAL BOLT TIP PRIM	O				V	F			O	
OPT ADAPTER PRIM	O		F		O	O			O	F
OPT ADAPTER SEC			O							O
LEAK CHECK PORT SEC			O**							O**
OUTER GASKET										
GASK-O-SEAL® PRIM			F		V	V		O	O	F
GASK-O-SEAL® SEC			O							O
LEAK CHECK PORT SEC			O**							O**

F = SEAL FLAWED TO TEST DOWNSTREAM SEAL
O = PRESSURIZATION EFFECTS OBSERVED BY POST-TEST INSPECTION
V = PRESSURIZATION VERIFIED BY TEST INSTRUMENTATION—NO. OF TESTS

* TEST CONDUCTED WITH A NON-1ST FLT 2-PIECE VENT PORT
** OBSERVED SIMILARITY WITH PRESSURE TRANSDUCER

Subscale and PVM-1 RSRM Seal Tests (Cont)

	PVM-1	JES-3B	JES-3C	NJES-2B	NJES-3A	NJES-3B	TPTA-1.1	TPTA-1.2	TPTA-2.1	TPTA-2.2
FIELD JOINTS FWD CTR AFT										
CAPTURE FEATURE O-RING	/V/ F	V / F	F / F	N/A	N/A	N/A	/	F / F	F /	F / F
CLEVIS O-RING PRIM	/·/ V	/ V	V / F	N/A	N/A	N/A	/	V / V	V /	F / F
VENT PORT PRIM	/ /	/	/ V	N/A	N/A	N/A	/	V-2/V-2	V-2/	V*/ V*
VENT PORT SHOULDER SEC	/ / C	/	V / V	N/A	N/A	N/A	/	/	/	V-2/V-2
VENT PORT CLOSURE SEC	/ /	/	/	N/A	N/A	N/A	/	/	/	/
CLEVIS O-RING SEC	/ /	/	/ O	N/A	N/A	N/A	/	/	/	O / O
LEAK CHECK PORT SEC	/ /	/	/ O**	N/A	N/A	N/A	/	/	/	O**/O**
CASE/NOZZLE JOINT										
WIPER O-RING	F	N/A	N/A	V	F	F	O	F	F	F
O-RING PRIM	V	N/A	N/A		V	F		V	V	F
VENT PORT PRIM		N/A	N/A			V				V*
VENT PORT SHOULDER SEC	O**	N/A	N/A		O**			O	O	O
VENT PORT CLOSURE SEC		N/A	N/A					O	O	O
O-RING SEC		N/A	N/A			O				O
STAT-O-SEAL (100) SEC		N/A	N/A			O				O
LEAK CHECK PORT SEC		N/A	N/A			O**				O**
NOZZLE/INT JOINTS										
JOINT NO. 5										
O-RING PRIM	O	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
O-RING SEC		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LEAK CHECK PORT SEC		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: PVM-1 Joints 1 through 4 showed no pressurization effects.

F = SEAL FLAWED TO TEST DOWNSTREAM SEAL
O = PRESSURIZATION EFFECTS OBSERVED BY POST-TEST INSPECTION
V = PRESSURIZATION VERIFIED BY TEST INSTRUMENTATION—NO. OF TESTS

* TEST CONDUCTED WITH A NON-1ST FLT 2-PIECE VENT PORT
** OBSERVED SIMILARITY WITH PRESSURE TRANSDUCER

Subscale and PVM-1 RSRM Seal Tests (Cont)

Test Name	Final Report TWR	Test Date
JES-1A	15756	14 Aug 86
JES-1B	16109	03 Oct 86
JES-2A	16533	09 Dec 86
JES-2B	16573	23 Feb 87
JES-3A	16501	04 Aug 87
JES-3B	16534	09 Nov 87
JES-3C	18000	28 Jul 88
NJES-1A	16807	23 May 87
NJES-2A	16755	17 Aug 87
NJES-2B	17011	08 Oct 87
NJES-3A	17463	24 Feb 88
NJES-3B	17453	03 May 88
TPTA-1.1, 1.1A	17927	19 Nov 87
TPTA-1.2	18075	11 Feb 88
TPTA-1.3	18624	01 Sep 88
TPTA-2.1	17563	21 Mar 88
TPTA-2.2	18428	17 May 88
PVM-1	17592	18 Aug 88

Reference Documents

Component	Document No.	Title
Seals/Thermal	TWR–17033	Flow/Thermal Analysis of the On–Pad SRB Aft Skirt Conditioning System
	TWR–50168	Gasket Dynamic Testing Final Test Report
	TWR–50217	Environmental Seal Squeeze A&M
	TWR–15771	O–ring Squeeze and Gland Fill Calculation Method
	TWR–17991	RSRM Seal Design Summary Report
	TWR–17992	RSRM Seal Leak Test Design Summary Report
	TWR–18070	Thermal Design Data Book Submittal to USBI
	TWR–16801	RSRM Design Loads Data Book,Vol.1:Prelaunch & Ascent
	TWR–17416	Thermal Anal. of GN2 Purge Effect on Noz. Components
Heaters/LCC	TWR–19731	Contingent LCC Redline Derivation for the Field Joint
	TWR–16404	Igniter Heater Certification Analysis
	TWR–63712	Launch Commit Criterion (LCC) Derivation for the Interim Redesigned Igniter (Valid for Baseline Redisigned Igniter)
	TWR–50018	Thermal Analysis Verification of RSRM JPS Redesign Concepts
Case	TWR–17118	RSRM Case Structural Analysis
	TWR–19706	RSRM Prelaunch Buckling Analysis
	TWR–18893	Case GEI LCC Justification
Nozzle	TWR–16975	RSRM Nozzle Stress Report
Instrumentation	TWR–63731	RSRM Instrument List—Flight 23 and Subsequent

RDW Number	Description
0601R3	Some nozzle components do not meet general and bond SFs using worst–case dimensions
0641R1	Manufacturing tools for KSC not built to 8U drawings

2.0 Ignition System

2.0 Ignition System (Cont)

S&A Device LCC

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-01

LCC VIOLATION CALL: SRB IGNITION SAFE AND ARM SAFED ANOMALY | EMERG COND YELLOW (1)

MEAS NO.	MEASUREMENT DESCRIPTION	CAT.	MIN	MAX	UNITS	CODE
B55X1842X	LH Event Ign S&A Device Armed		Off	NA	Event	CI
B55X2842X	RH Event Ign S&A Device Armed		Off	NA	Event	CI
B55X1843X	LH Event Ign S&A Device Safed		On	NA	Event	CI
B55X2843X	RH Event Ign S&A Device Safed		On	NA	Event	CI

TIME PERIOD: From Start of ET Cryo Tanking (T-6 hr) to Ign S&A Device Arm Command ON (T-5 min)

REQUIREMENTS: DRAWING:

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

(1) Any unresolved problem with position indication of S&A device is considered to be a high-risk condition and will be cause for terminating the countdown

REDLINE DERIVATION: CRITICALITY:

(2) To ensure that the S&A device is not ARMED. If the S&A device is not ARMED, the output from the Shuttle Ignition Initiator (SII) is physically blocked from the Solid Rocket Motor (SRM) igniter

CONSEQUENCES OF EXCEEDING REDLINE:

(3) Possible prematrue ignition of SRM (multiple failures required)

CAUSES OF EXCEEDING REDLINE:

(4) S&A device accidentally commanded to ARMED position
(5) S&A device failure
(6) Instrumentation failure

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO. JSC 11174 SHEET 10.2 ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO. VS72-948099 SHEET 24 ZONE B4

NASA: MSFC, S. Thornton CONTRACTOR: TC, R. Rasmussen

ELEMENT: SRB SUBSYSTEM: SRM MISSION: STS-35, 37-999

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-02

LCC VIOLATION CALL: SRB IGNITION SAFE AND ARM ARMED ANOMALY | EMERG COND YEL NO TAG

MEAS NO.	MEASUREMENT DESCRIPTION	CAT.	MIN	MAX	UNITS	CODE
B55X1842X	LH Event Ign S&A Device Armed		On	NA	Event	CI
B55X2842X	RH Event Ign S&A Device Armed		On	NA	Event	CI
B55X1843X	LH Event Ign S&A Device Safed		Off	NA	Event	CI
B55X2843X	RH Event Ign S&A Device Safed		Off	NA	Event	CI

TIME PERIOD: From 10 sec After Initiation of S&A Device Arm Command (~ T-5 min) to SRM Ignition (T-0)

REQUIREMENTS: DRAWING:

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

(1) Any redline violation is considered to be a high-risk condition and the countdown will be terminated

REDLINE DERIVATION: CRITICALITY:

(2) To ensure that the S&A device is in the ARMED position which allows the output from the Shuttle Ignition Initiator (SII) to pass into the Solid Rocket Motor (SRM) igniter for igniter activation
(3) The following is the expected S&A device arming sequence (for info only)
A. S&A device arm command given for 4.5 sec
B. S&A device armed/unsafed within 2.0 sec from initiation of ARM command
C. Verify S&A device armed at 10 sec after initiation of ARM command

CONSEQUENCES OF EXCEEDING REDLINE:

(4) No ignition of given SRM

CAUSES OF EXCEEDING REDLINE:

(5) Insufficient power reaching S&A device
(6) S&A device failure
(7) Instrumentation failure

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO. JSC 11174 SHEET 10.2 ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO. VS72-948099 SHEET 24 ZONE B4

NASA: MSFC, S. Thornton CONTRACTOR: TC, R. Rasmussen

ELEMENT: SRB SUBSYSTEM: SRM MISSION: STS-35, 37-999

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FM0.210	1	ARM SRB AND ET S&A DEVICES		HAZ	A:SAF1-90
	0-000				B:
	0-001	ARM IGN AND RSS S&A DEVICES ON			C: C-1. THE ARM CMD SHALL BE ISSUED
	0-002	EACH SRB AND THE ET AND VERIFY			"ON" FOR A MINIMUM OF 2 SECONDS.
	0-003	THE RESPONSES:			
	0-004				
	0-005	COMMANDS:			
	0-006	LH IGN S/A DEVICE SAFE 1 CMD	B55K3001X	OFF	R-1. LH, RH AND ET A RANGE
	0-007	LH IGN S/A DEVICE SAFE 2 CMD	B55K3002X	OFF	SAFETY BATTERY CURRENT WILL
	0-008	RH IGN S/A DEVICE SAFE 1 CMD	B55K4001X	OFF	VIOLATE LIMITS DURING S&A
	0-009	RH IGN S/A DEVICE SAFE 2 CMD	B55K4002X	OFF	ROTOR MOVEMENT.
	0-010	ET RSS S/A DEVICE SAFE 1 CMD	T55K3111X	OFF	
	0-011	ET RSS S/A DEVICE SAFE 2 CMD	T55K3112X	OFF	
	0-012	LH RSS S/A DEVICE ARM CMD	B55K3044X	ON/OFF	CAUTION
	0-013	RH RSS S/A DEVICE ARM CMD	B55K4044X	ON/OFF	SIMULTANEOUS APPLICATION OF
	0-014	LH IGN S/A DEVICE ARM CMD	B55K3000X	ON/OFF	IGNITION SAFE AND ARM COMMANDS
	0-015	RH IGN S/A DEVICE ARM CMD	B55K4000X	ON/OFF	CAN CAUSE IRREPARABLE DAMAGE
	0-016	ET RSS S/A DEVICE ARM CMD	T55K3110X	ON/OFF	TO THE S&A DEVICE.
	0-017				
	0-018				
	0-019	RESPONSES:			
	0-020	LH EVENT RSS S/A DEVICE ARMED	B55X1870X	ON	C-2. MONITOR FROM RSS S&A DEVICE
	0-021	RH EVENT RSS S/A DEVICE ARMED	B55X2870X	ON	ARM PLUS 2 SECONDS UNTIL LCC
	0-022	ET EVENT RSS S/A DEVICE ARMED	T55X1870X	ON	MONITORING BEGINS.
	0-023	LH EVENT IGN S&A DEVICE ARMED	B55X1842X	ON	
	0-024	RH EVENT IGN S&A DEVICE ARMED	B55X2842X	ON	
	0-025				
	0-026	LH EVENT RSS S/A DEVICE SAFED	B55X1869X	OFF	C-3. ALLOW 2 SECONDS FOR RSS S&A
	0-027	RH EVENT RSS S/A DEVICE SAFED	B55X2869X	OFF	DEVICE TO ARM.
	0-028	ET EVENT RSS S/A DEVICE SAFED	T55X1869X	OFF	
	0-029				C-4. THE SRB IGNITION S&A DEVICE
	0-030	LH EVENT IGN S&A DEVICE SAFED	B55X1843X	OFF	SHALL ARM ON THE FIRST COMMAND.
	0-031	RH EVENT IGN S&A DEVICE SAFED	B55X2843X	OFF	NO REPEATED ARM COMMANDS ARE
	0-032				ALLOWED.
	0-033				
	0-034				
	0-035				
	0-036				
	0-037				
	0-038				D: ICD'S 2-14001, 2-24001
	0-039				HAZ #: SRB HA B-70-16, C-70-07,
	0-040				X-00-19, A-70-15

2.0 Ignition System (Cont)

S&A Arm Cycle Times (sec)

Flight	S&A S/N		At Bench Checkout		At Forward Skirt Closeout						At Launch			
			First Cycle		Days After Bench Checkout		First Cycle		Tenth Cycle		Days After Fwd Skirt Closeout	Date of Launch	Arm Cycle	
	LH (A)	RH (B)	LH (A)	RH (B)	LH (A)	RH (B)	LH (A)	RH (B)	LH (A)	RH (B)			LH (A)	RH (B)
STS-29 (3)	005	006	0.86	0.91	47	47	1.8	1.5	1.4	1.1	5	03/13/89		
STS-30 (4)*	004	001	0.73	0.91	68	54	0.75	0.99	0.79	0.87	5 11	04/27/89 05/04/89	0.76 0.76	1.04 1.24
STS-28 (5)	002	012	1.38	0.88	68	75	1.11	0.99	0.83	0.99	6	08/08/89	1.04	1.12
STS-34 (6)	015	014	0.85	0.84	85	85	0.99	0.87	0.74	0.82	13	10/18/89	0.89	0.97
STS-33 (7)	019	018	1.38	0.87	58	58	2.63	0.91	0.87	0.71	4	11/22/89	1.08	0.96
STS-32 (8)**	021	022	0.72	0.87	44 59	44 59	0.87 0.79	0.95 0.87	0.71 0.87	0.79 0.95	7	01/09/90	0.84	0.88
STS-36 (9)*	017	020	0.78	1.56	65	65	1.03	1.71	0.99	0.87	7 11	02/25/90 02/28/90	0.97 1.05	1.21 1.33
STS-31R (10)*	025	024	1.12	1.13	63 72	63 72	0.78 0.91	0.86 0.99	0.82 0.75	0.90 0.83	-- 5	04/10/90 04/24/90	0.84 0.88	1.12 0.92
STS-41 (13)	025	024	0.72	0.80	62	62	0.87	0.91	0.79	0.87	8	10/06/90	0.72	0.80
STS-38 (12)	023	022	0.70	0.77	170	170	0.79	0.87	0.67	0.75	3	11/15/90	0.80	0.89
STS-35 (11)*	015	018	0.71	0.63	158 174 248	158 174 248	0.79 0.71 0.80	0.67 0.67 0.68	0.79 0.79 0.72	0.67 0.67 0.80	7	12/02/90	0.85	0.87
STS-37 (14)	027	028	0.70	0.77	46	46	0.83	0.83	0.83	0.91	7	04/05/91	0.93	1.01
STS-39 (15)	035	034	0.73	0.75	89	89	0.87	0.75	0.79	0.83	11	04/28/91	0.88	0.77
STS-40 (16)*	029	031	0.69	0.73	74 84	74 84	1.22 0.83	0.91 0.87	0.67 0.79	0.75 0.83	10	06/05/91	0.85	0.92
STS-43 (17)	033	032	0.77	0.72	57	57	0.78	0.86	0.86	0.74	16	08/02/91	0.97	0.85
STS-48 (18)	037	038	0.70	0.71	65	65	0.79	0.87	0.83	0.71	7	09/12/91	0.97	0.80
STS-44 (19)	039	040	0.70	0.74	52	52	0.83	0.71	0.79	0.67	10	11/24/91	0.85	0.73
STS-42 (20)	043	042	0.75	0.73	60 64	60 64	0.87 0.74	0.75 0.83	0.70 0.79	0.75 0.67	-- 2	11/22/92	0.84	0.92
STS-45 (21)	049	046	0.70	0.71	69	69	0.79	0.87	0.75	0.83	7	03/24/92	0.77	0.85
STS-49 (22)	045	054	0.64	0.69	79	79	0.71	0.79	0.79	0.67	6	05/07/92	0.85	0.73

*Additional cycle times due to launch scrub/delay

**Second Closeout due to instrumentation repair

Note: Flight Set 360W011 and subsequent use Dupont Krytox grease

S&A Arm Cycle Times (sec)

Flight	S&A S/N		At Bench Checkout		At Forward Skirt Closeout						At Launch			
			First Cycle		Days After Bench Checkout		First Cycle		Tenth Cycle		Days After Fwd Skirt Closeout	Date of Launch	Arm Cycle	
	LH (A)	RH (B)	LH (A)	RH (B)	LH (A)	RH (B)	LH (A)	RH (B)	LH (A)	RH (B)			LH (A)	RH (B)
STS-50 (24)	055	050	0.72	0.69	68	68	0.87	0.75	0.75	0.83	4	06/25/92	0.88	0.77
STS-46 (25)	001	002	0.68	0.70	65	65	0.87	0.75	0.67	0.75	7	07/31/92	0.80	0.89
STS-47 (26)**	003	004	0.72	0.84	64 69	64 69	0.91 0.87	0.79 0.95	0.75 --	0.83 --	-- 2	09/12/92	0.77	1.05
STS-52 (27)**	006	008	0.68	0.78	53 56	53 56	0.83 0.71	0.91 0.99	0.83 --	0.71 --	5	10/22/92	0.81	1.09
STS-53 (28)	009	010	0.70	0.69	67	67	0.83	0.71	0.79	0.67	10	12/02/92	0.88	0.73
STS-54 (29)	007	011	0.70	0.69	65	65	0.83	0.71	0.75	0.79	6	1/13/93	0.89	0.77
STS-56 (31) *	001	002	0.68	0.65	70	70	0.81	0.69	0.77	0.65	6 8	4/6/93 4/8/93	0.77 0.85	0.85 0.73
STS-55 (30) *	013	012	0.74	0.72	91 124	91 124	0.75 0.89	0.83 0.77	0.83 0.85	0.71 0.69	6 42	3/22/93 4/26/93	0.92 † 0.81	0.80 † 0.88
STS-57 (32)	005	003	0.68	0.74	98	98	0.75	0.83	0.87	0.75	5	6/21/93	0.85	0.93
STS-51 (33) *	004	006	0.77	0.68	88 98 107 140	88 98 107 140	0.86 0.91 0.82 0.91	0.70 0.79 0.71 0.79	0.82 0.82 0.87 0.79	0.86 0.86 0.75 0.87	6 3 13 11	7/17/93 7/24/93 8/12/93 9/12/93	†† 0.89 0.85 † 0.97	†† 0.93 0.93 † 0.85
STS-58 (34)	007	008	0.70	0.71	147	147	0.75	0.83	0.75	0.87		10/11/93 10/14/93 10/18/93	0.75 0.84 0.88	0.83 0.93 0.96

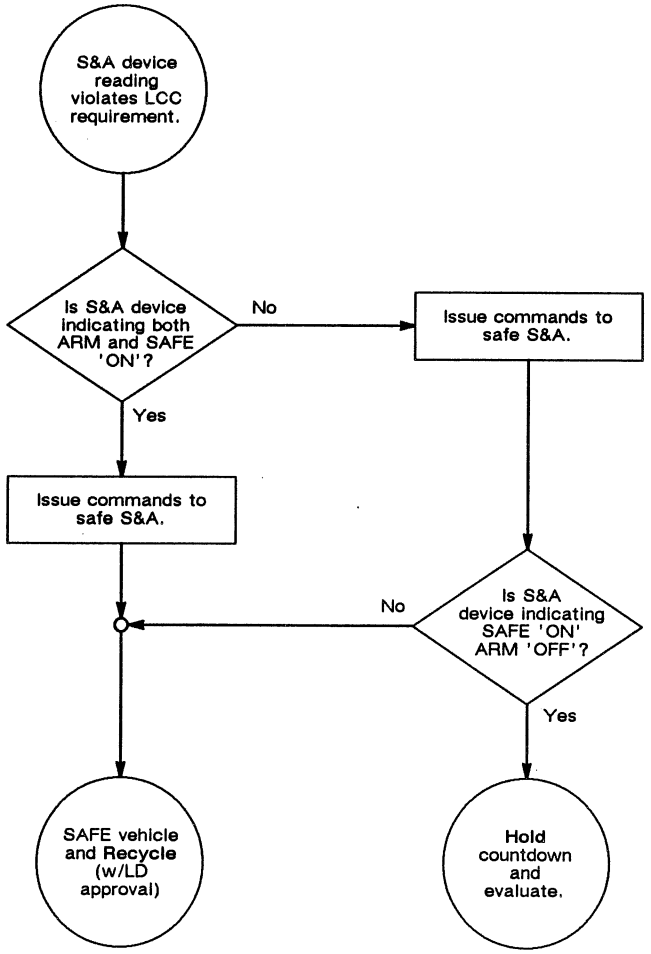
*Additional cycle times due to launch scrub/delay
**Second Closeout due to electrical repair/troubleshooting
† Launch Abort
†† Launch scrub prior to S&A Rotation

Note: Flight Set 360W011 and subsequent use Dupont Krytox grease

S&A Device Safed (Decision Tree)

Sensor	Indication
LH S&A	SAFE
LH S&A	SAFE
RH S&A	SAFE
RH S&A	SAFE

No. of Sensors: 2 of 2 sensors per motor functional
LCC Time Period: From T-6 hr until T-5 min

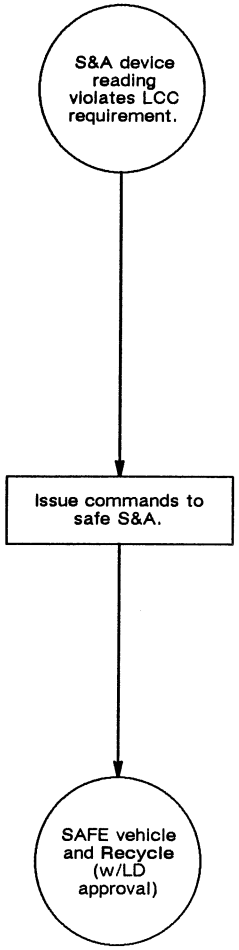


S&A Device Armed (Decision Tree)

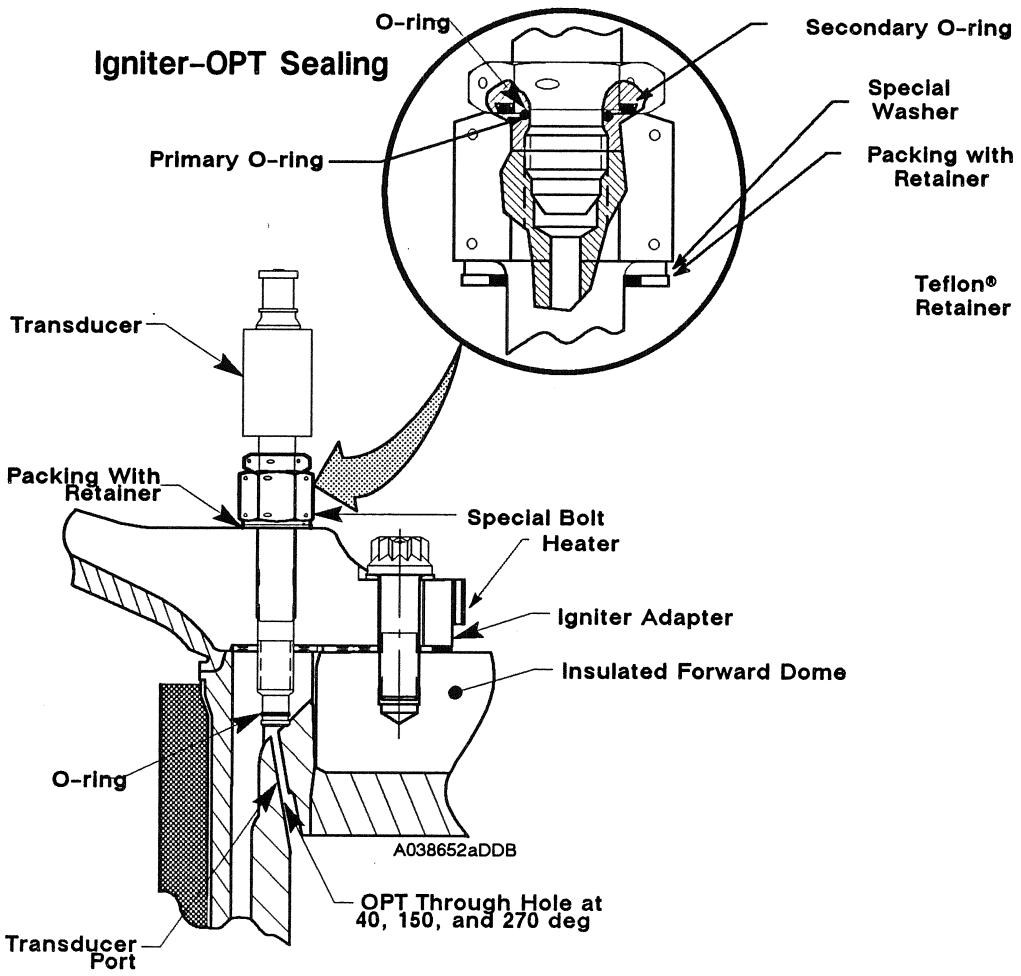
Sensor	Indication
LH S&A	ARM
LH S&A	ARM
RH S&A	ARM
RH S&A	ARM

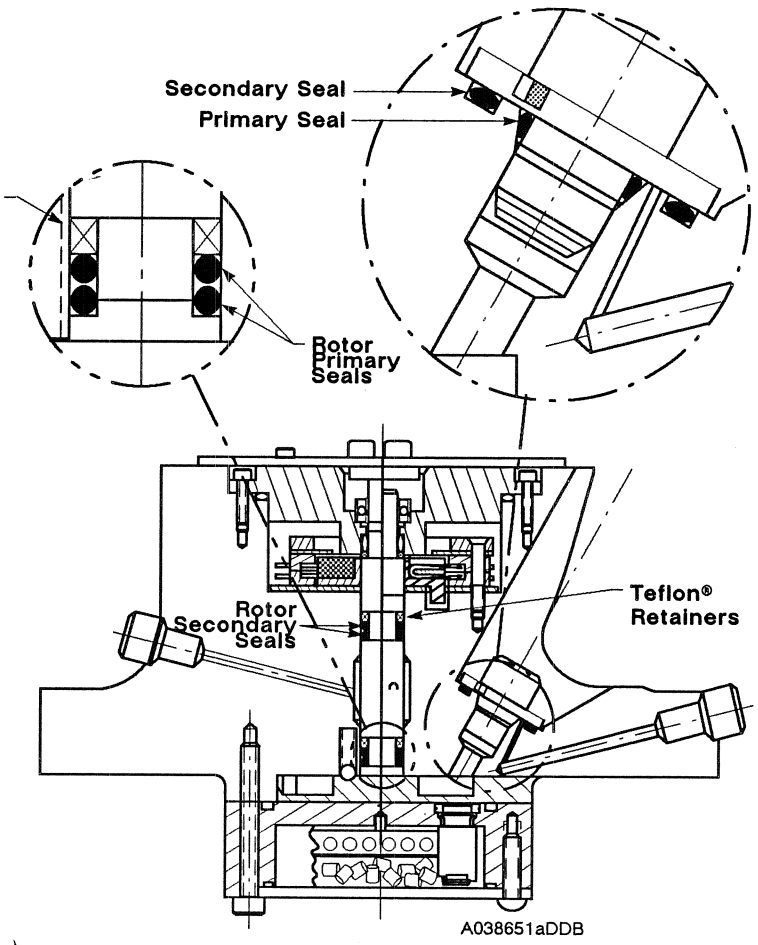
No. of Sensors: 2 of 2 sensors per motor functional

LCC Time Period: From 10 seconds after S&A Arm command (T-5 min) until launch



S&A and OPT–Igniter Sealing

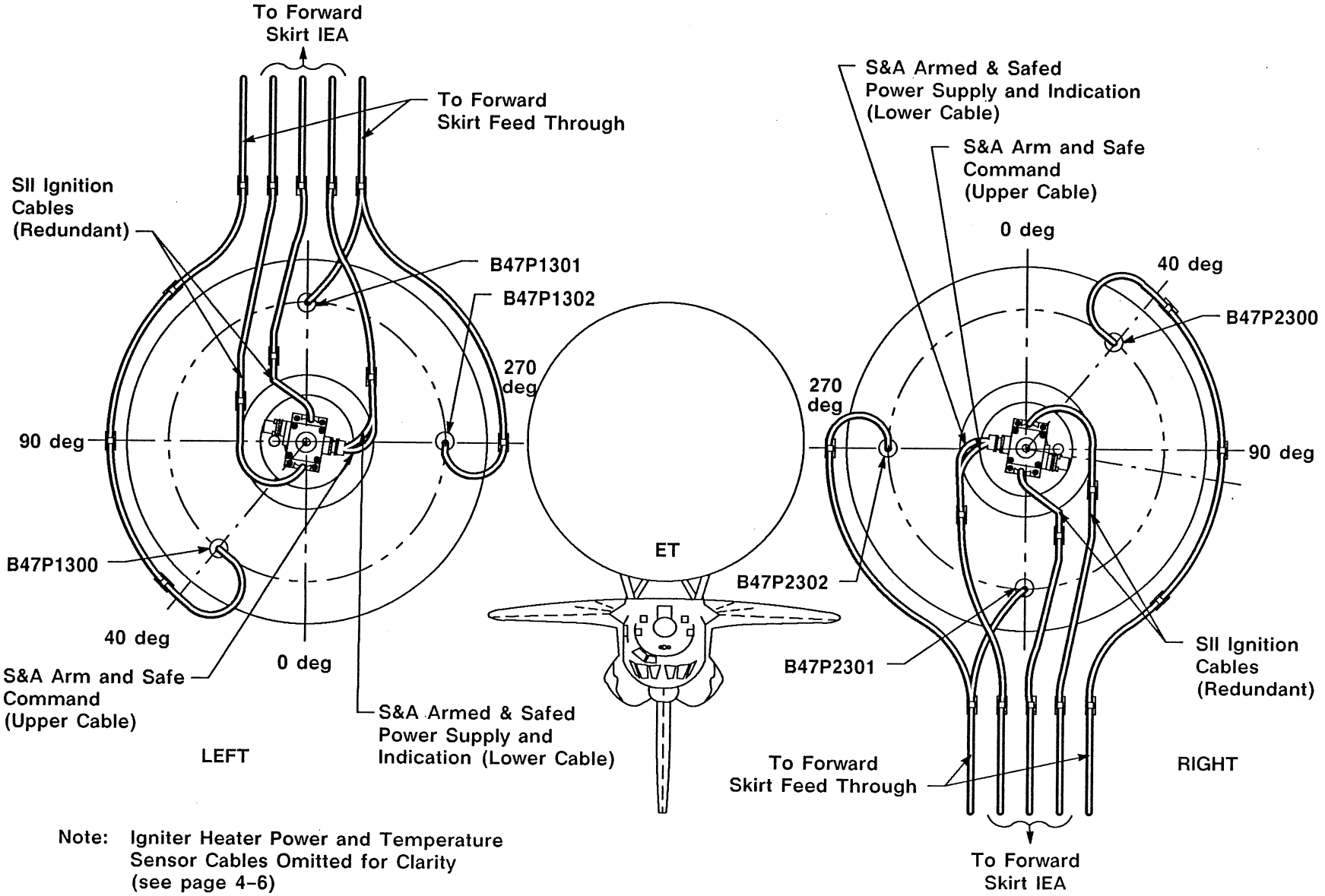




S&A Device Rotor and SII Port Sealing System

2.0 Ignition System (Cont)

OPT and S&A Location and Cable Routing



Note: Igniter Heater Power and Temperature Sensor Cables Omitted for Clarity (see page 4-6)

2.0 Ignition System (Cont)

Igniter Joint Temperature

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-10

LCC VIOLATION CALL: SRM IGNITER JOINT TEMPERATURE ANOMALY | EMERG COND NONE

MEAS NO.	MEASUREMENT DESCRIPTION	CAT.	MIN	MAX	UNITS	CODE
B06T7085A	PRI LH SRB Ign 486.4/185 Temp		74(2)	125	deg F	CI
B06T7086A	PRI LH SRB Ign 486.4/356 Temp		74(2)	125	deg F	CI
B06T8085A	PRI RH SRB Ign 486.4/356 Temp		74(2)	125	deg F	CI
B06T8086A	PRI RH SRB Ign 486.4/185 Temp		74(2)	125	deg F	CI
	Backup Measurements					
B06T7185A	SEC LH SRB Ign 486.4/185 Temp		74(2)	125	deg F	CI
B06T7186A	SEC LH SRB Ign 486.4/356 Temp		74(2)	125	deg F	CI
B06T8185A	SEC RH SRB Ign 486.4/356 Temp		74(2)	125	deg F	CI
B06T8186A	SEC RH SRB Ign 486.4/185 Temp		74(2)	125	deg F	CI

TIME PERIOD: From Start of ET Cryo Tanking (T-6 hr) to Heater Deactivation (3)

REQUIREMENTS: DRAWING:

(1) One of two sensors per motor required functional (one of four measurements per SRM acceptable for confirmed instrumentation loss). All functional sensors must be within the redlines
(2) If an igniter temperature is decreasing and nearing 74 deg F, switch to alternate heater if functional (Ref. OMRS S00FA0.620)
(3) Deactivation will be initiated as late as possible during the T-9 min hold and will be completed before RSRM ignition S&A rotation (T-5 min)

CAUTION: Do not cycle heaters when the RSRM ignition S&A is in the ARMED position

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

(4) There are two temperature sensors per igniter joint. Output of each sensor is split for two MSID readings per sensor
(5) If a launch hold occurs after T-9 min, but prior to T-5 min, the heaters may be reactivated. If reactivated, heaters must be turned OFF prior to resuming countdown at T-5 min

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-10

REDLINE DERIVATION: CRITICALITY:

		Min		Max	
(6)	Redline development:				
	Basic redline	70.0 deg F		130.0 deg F	
	Seal/RTD differential & joint cooldown (8)	+3.1	deg F	-4.5	deg F
	Circumferential joint temperature	+0.2	deg F	NA	deg F
	Heater gap depression	0.0	deg F	NA	deg F
	Instrumentation error (7)	+1.9	deg F	-1.9	deg F
	RSS total errors	+3.6	deg F	-4.9	deg F
	Redline (rounded)	74.0	deg F	125.0	deg F

(7) Instrumentation error development

Sensor error	+/- 1.6
KSC signal conditioner	+/- 0.8
KSC LPS	+/- 0.7
RSS instrumentation error	+/- 1.9

(8) RTD = Resistance Temperature Detector
(9) The minimum redline ensures the igniter inner joint seals are at least 70 deg F and the maximum redline ensures all ignition system seals are below 130 deg F at launch for proper seal capabilities
(10) Manual hold — do not automate

CONSEQUENCES OF EXCEEDING REDLINE:

(11) The S&A and igniter joint seals will not meet the required seal tracking factor of safety at temperatures outside this range

CAUSES OF EXCEEDING REDLINE:

(12) Cold ambient air temperature
(13) Instrumentation failure
(14) Heater failure

BIT VALUE	PCM RANGE LOW	PCM RANGE HIGH	METER RANGE LOW	METER RANGE HIGH	C AND W MIN	C AND W MAX	SM MIN	SM MAX
0.65	-4	158						

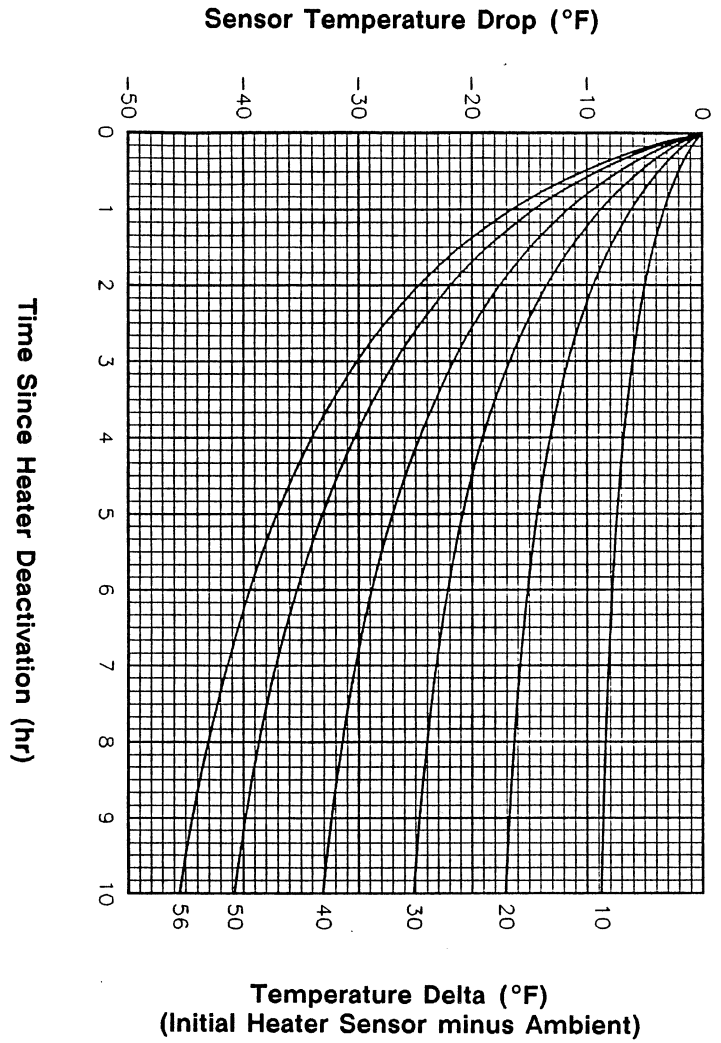
SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO. SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO. SHEET ZONE

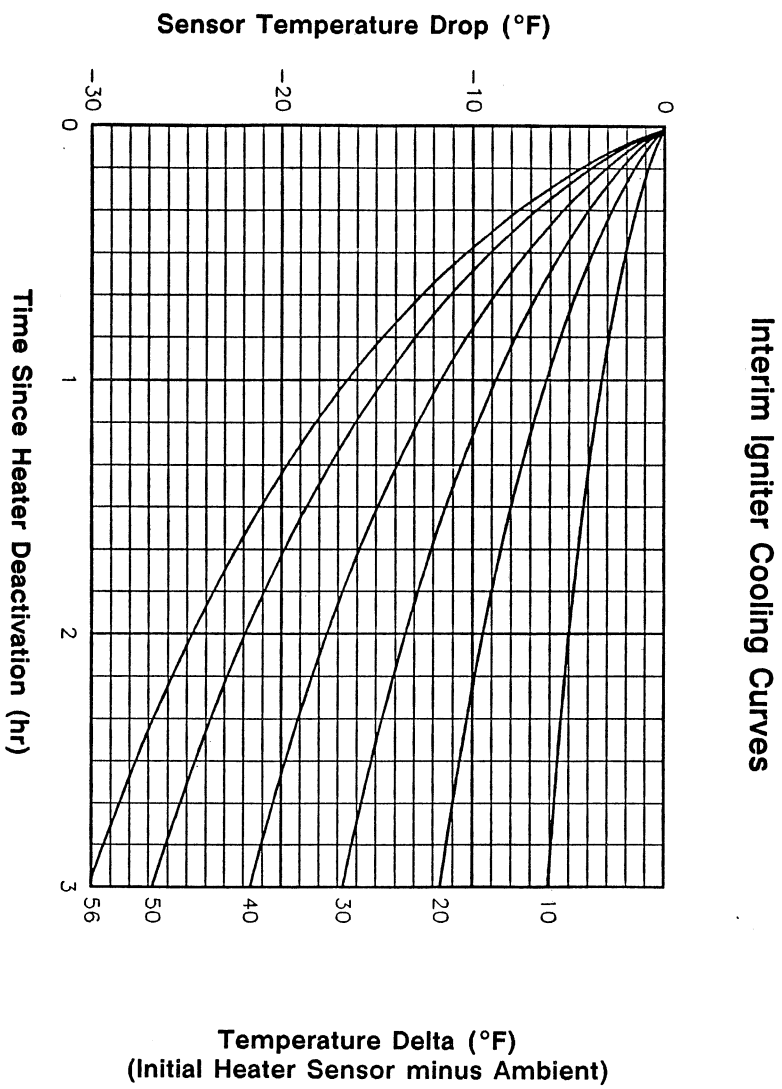
NASA: MSFC, S. Thornton CONTRACTOR: TC, D. Nisonger

ELEMENT: SRM SUBSYSTEM: SRM MISSION: STS-59-999

2.0 Ignition System (Cont)

Projected Igniter Joint Cooldown Curves





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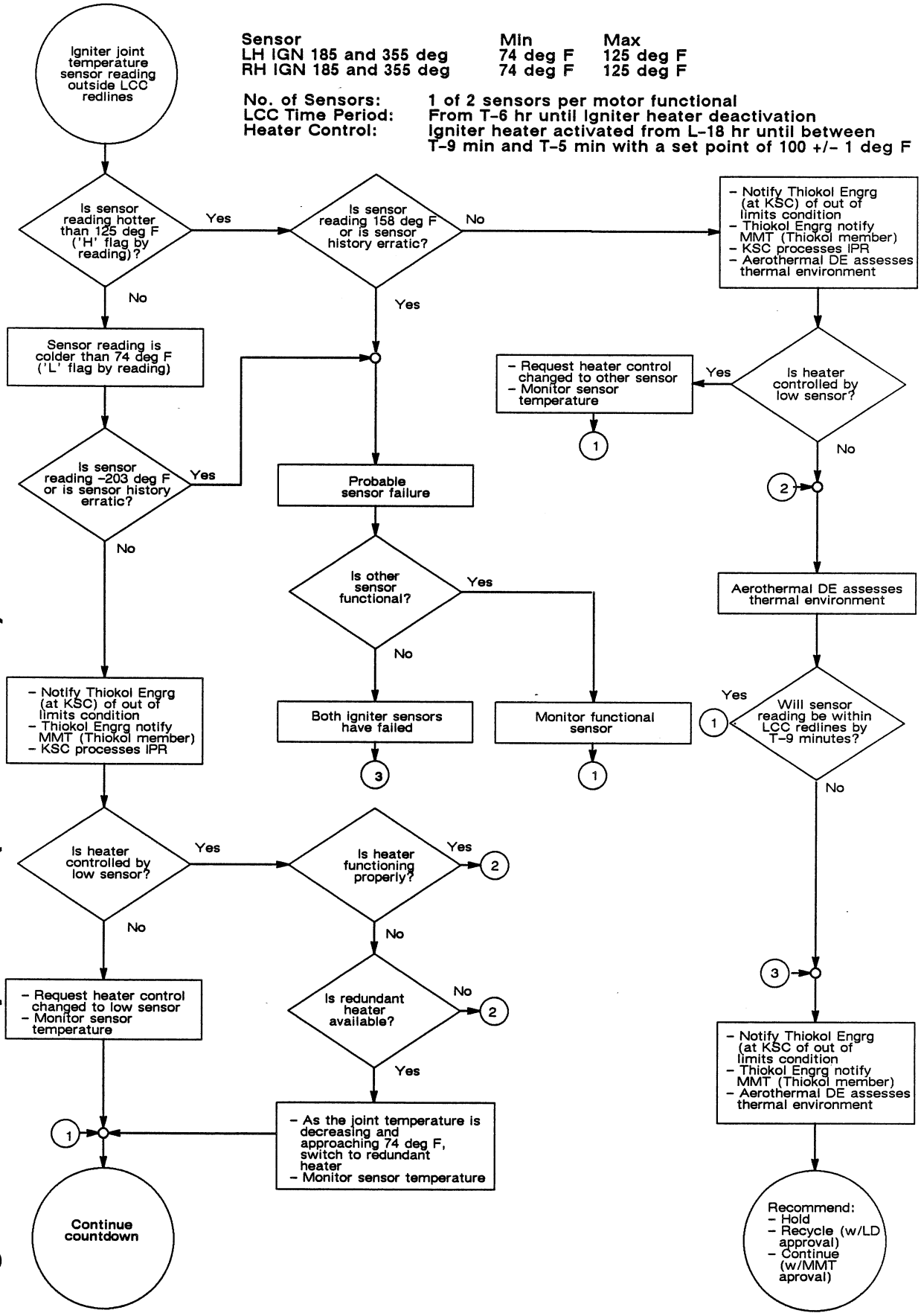
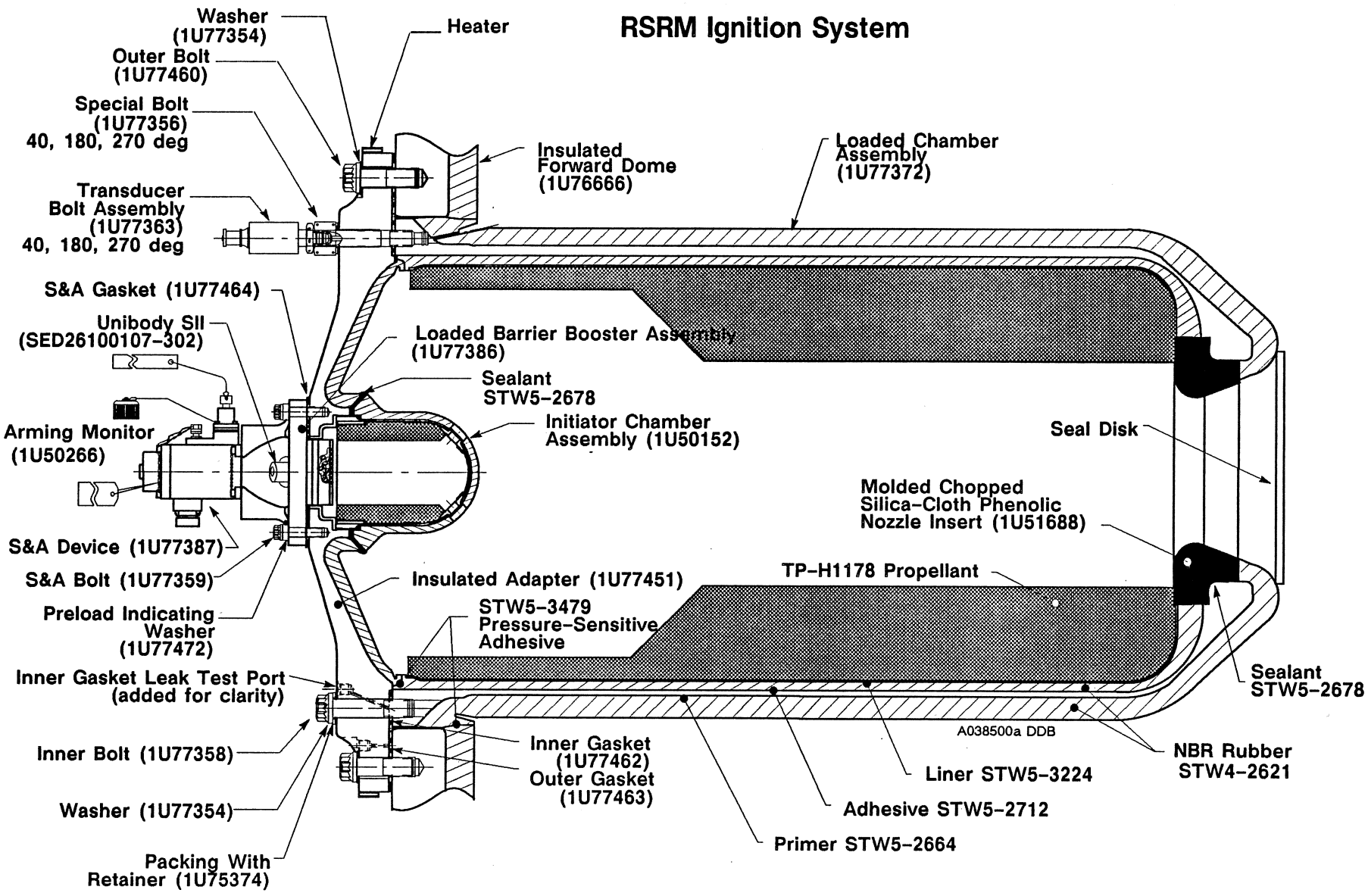
2.0 Ignition System (Cont)

Igniter Joint Temperature (Decision Tree)

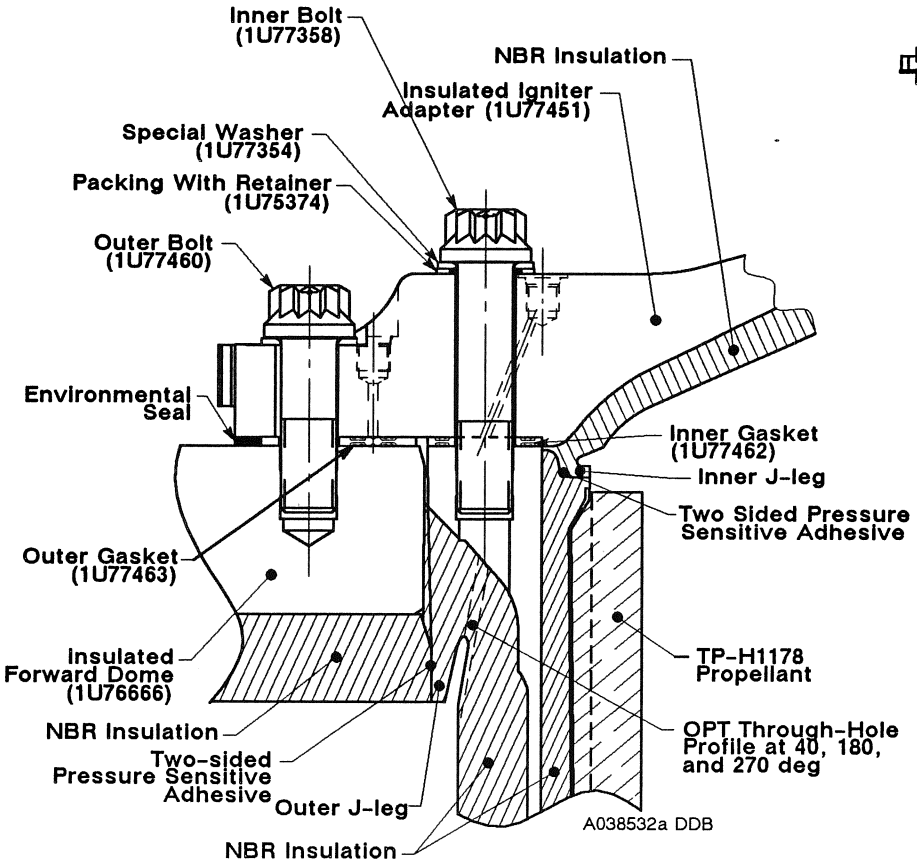


Igniter Description



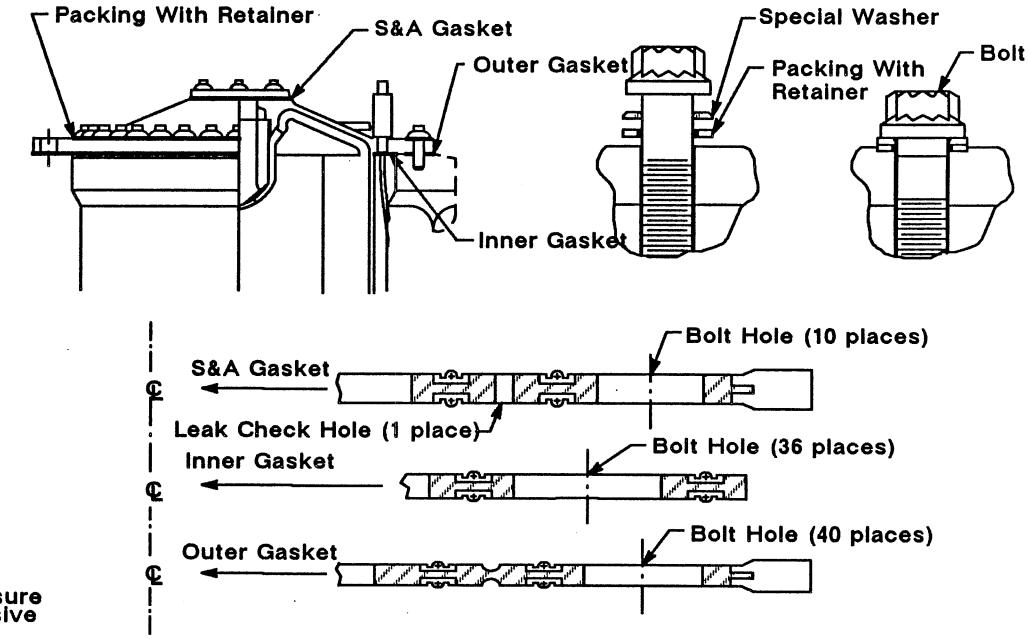
Igniter Description (Cont)

Igniter-to-Igniter Adapter Joint and
Igniter Adapter-to-Forward Segment Joint Seals

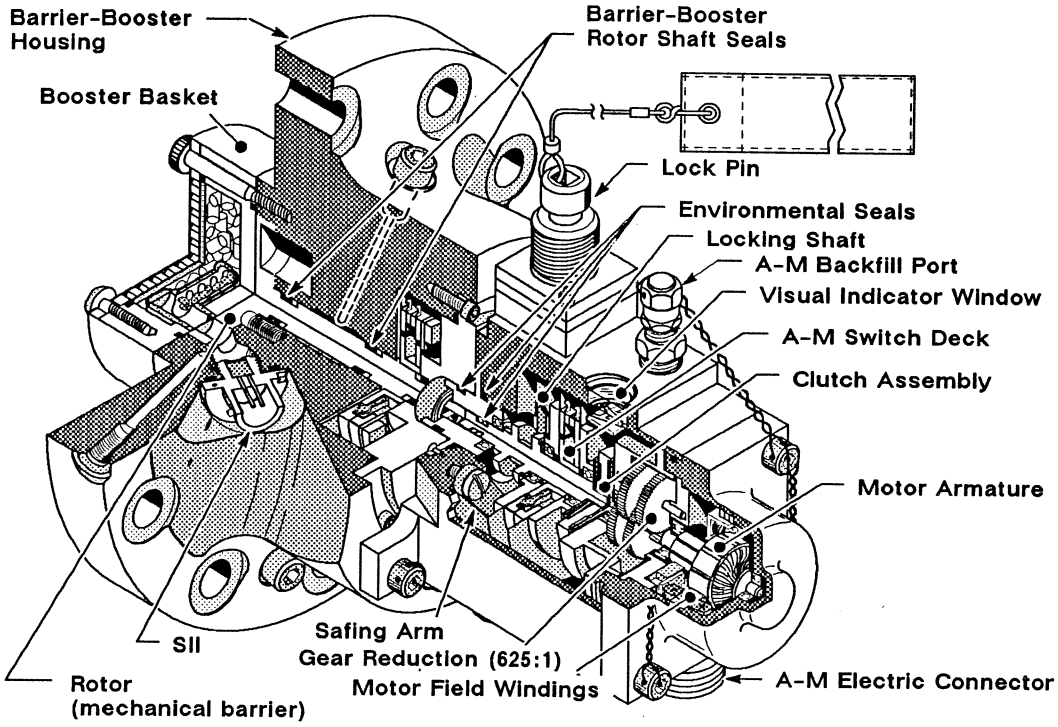


RSRM Igniter Inner and Outer Joints

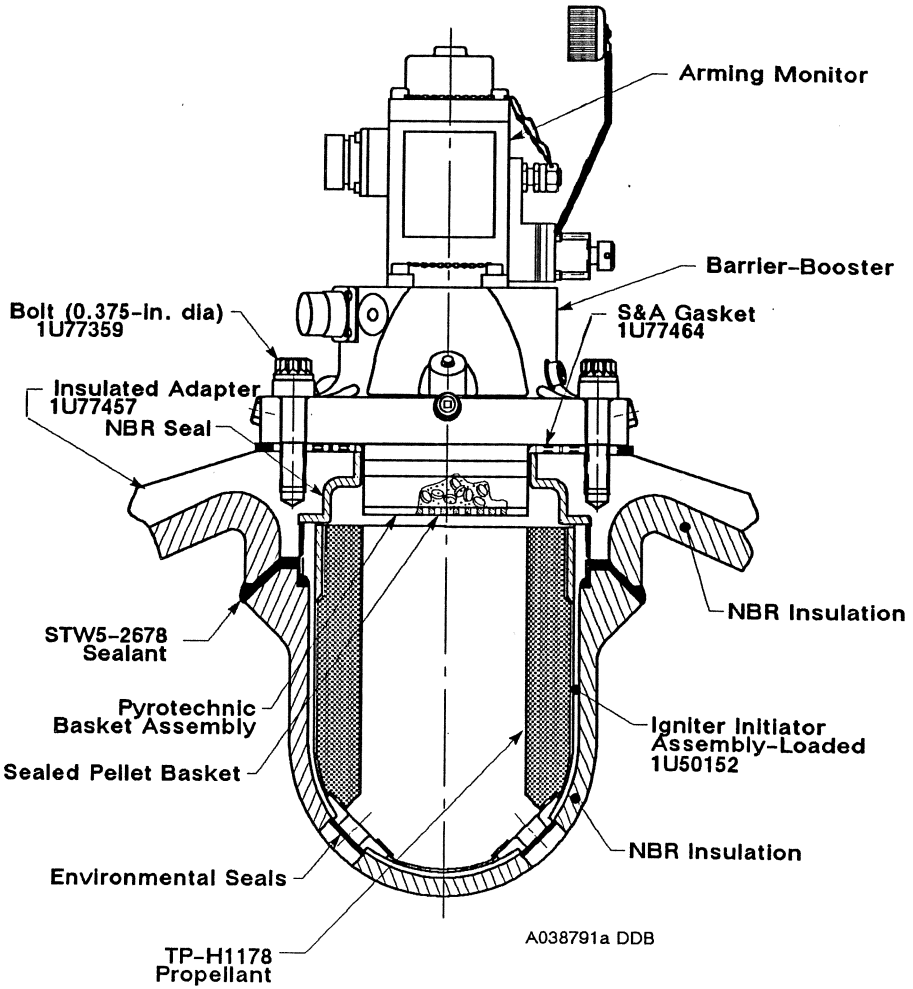
Seal Configuration



Igniter Description (Cont)

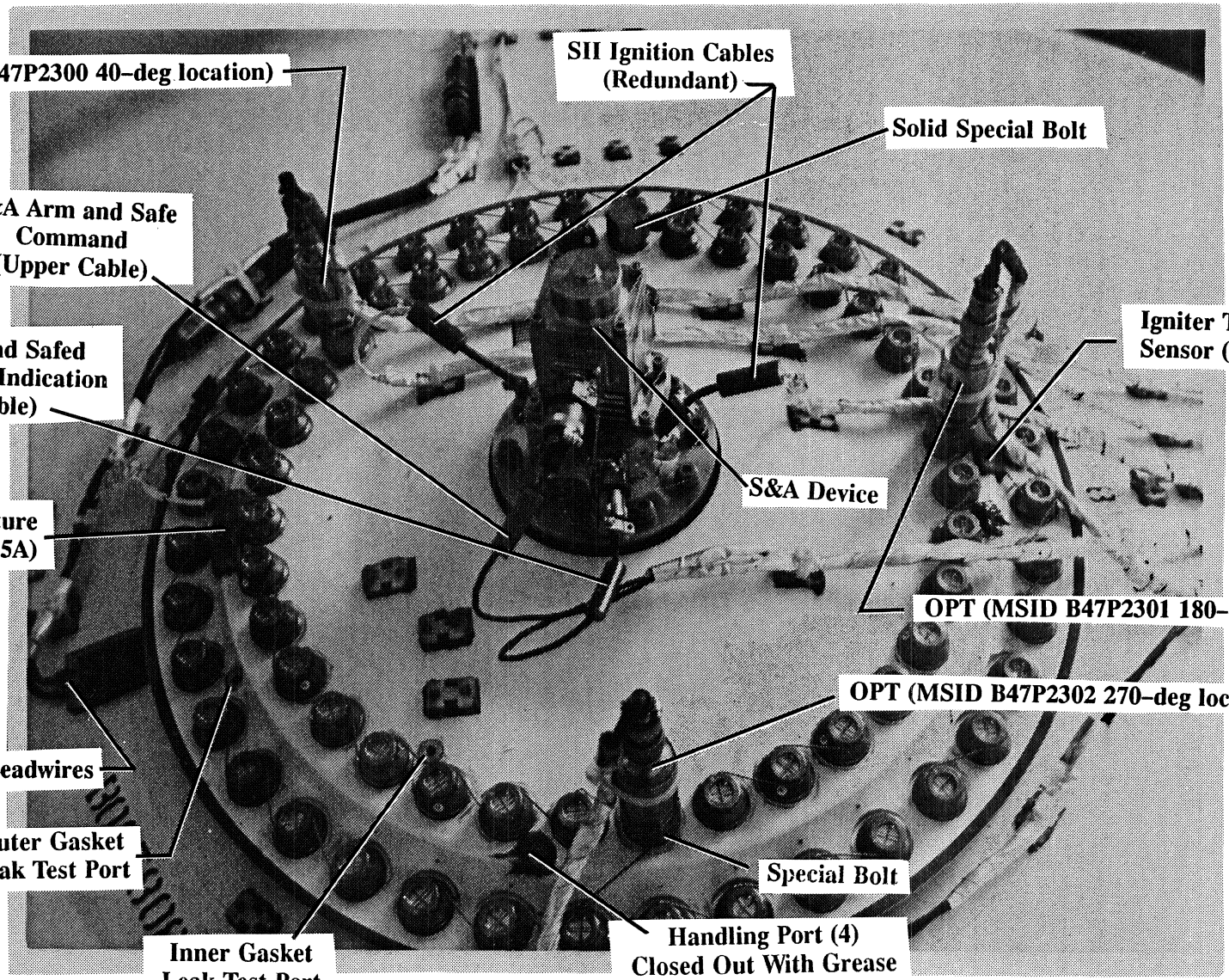


Safe & Arm Device Configuration



Igniter Initiator

Igniter Description (Cont)
RSRM Igniter and Instrumentation



3.0 Field Joints

3.0 Field Joints (Cont)

Field Joint Temperature LCC

LCC VIOLATION CALL: SRM FIELD JOINT TEMPERATURE ANOMALY | EMERG COND NONE

Meas No.	Measurement Description	Cat.	Min	Max	Units	Code
	LH FWD JOINT TEMPS					
B06T7060A	PRI LH SRB STA 851.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T7061A	PRI LH SRB STA 851.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T7062A	PRI LH SRB STA 851.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T7063A	PRI LH SRB STA 851.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI
	LH CENTER JOINT TEMPS					
B06T7064A	PRI LH SRB STA 1171.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T7065A	PRI LH SRB STA 1171.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T7066A	PRI LH SRB STA 1171.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T7067A	PRI LH SRB STA 1171.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI
	LH AFT JOINT TEMPS					
B06T7068A	PRI LH SRB STA 1491.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T7069A	PRI LH SRB STA 1491.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T7070A	PRI LH SRB STA 1491.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T7071A	PRI LH SRB STA 1491.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI
	RH FWD JOINT TEMPS					
B06T8060A	PRI RH SRB STA 851.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T8061A	PRI RH SRB STA 851.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T8062A	PRI RH SRB STA 851.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T8063A	PRI RH SRB STA 851.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI
	RH CENTER JOINT TEMPS					
B06T8064A	PRI RH SRB STA 1171.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T8065A	PRI RH SRB STA 1171.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T8066A	PRI RH SRB STA 1171.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T8067A	PRI RH SRB STA 1171.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI
	RH AFT JOINT TEMPS					
B06T8068A	PRI RH SRB STA 1491.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T8069A	PRI RH SRB STA 1491.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T8070A	PRI RH SRB STA 1491.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T8071A	PRI RH SRB STA 1491.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-06

LCC VIOLATION CALL: SRM FIELD JOINT TEMPERATURE ANOMALY | EMERG COND NONE

Meas No.	Measurement Description	Cat.	Min	Max	Units	Code
	(Backup Measurements)					
	LH FWD JOINT TEMPS					
B06T7160A	SEC LH SRB STA 851.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T7161A	SEC LH SRB STA 851.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T7162A	SEC LH SRB STA 851.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T7163A	SEC LH SRB STA 851.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI
	LH CENTER JOINT TEMPS					
B06T7164A	SEC LH SRB STA 1171.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T7165A	SEC LH SRB STA 1171.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T7166A	SEC LH SRB STA 1171.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T7167A	SEC LH SRB STA 1171.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI
	LH AFT JOINT TEMPS					
B06T7168A	SEC LH SRB STA 1491.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T7169A	SEC LH SRB STA 1491.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T7170A	SEC LH SRB STA 1491.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T7171A	SEC LH SRB STA 1491.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI
	RH FWD JOINT TEMPS					
B06T8160A	SEC RH SRB STA 851.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T8161A	SEC RH SRB STA 851.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T8162A	SEC RH SRB STA 851.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T8163A	SEC RH SRB STA 851.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI
	RH CENTER JOINT TEMPS					
B06T8164A	SEC RH SRB STA1171.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T8165A	SEC RH SRB STA1171.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T8166A	SEC RH SRB STA1171.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T8167A	SEC RH SRB STA1171.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI
	RH AFT JOINT TEMPS					
B06T8168A	SEC RH SRB STA 1491.5/15 Temp	(1)	80(3,4)	123	deg F	CI
B06T8169A	SEC RH SRB STA1491.5/135 Temp	(1)	80(3,4)	123	deg F	CI
B06T8170A	SEC RH SRB STA1491.5/195 Temp	(1)	80(3,4)	123	deg F	CI
B06T8171A	SEC RH SRB STA1491.5/285 Temp	(1,2)	80(3,4)	123	deg F	CI

3.0 Field Joints (Cont)

Field Joint Temperature LCC (Cont)

TIME PERIOD: From Start of ET Cryo Tanking (T-6 hr) to Go for APU Start (T-5 min)

REQUIREMENTS: DRAWING:

(1) Two of four sensors per joint required functional. All functional sensors must be within the redlines. One measurement per functional sensor acceptable
(2) Two of three sensors per motor at 285-degree location required functional
(3) If a joint temperature is decreasing and nearing 80 °F, switch to alternate heater if functional (Ref. OMRS S00FA0.610)

PREPLANNED CONTINGENCY PROCEDURE:

(4) In the event of a heater failure, a change will be processed which would allow the countdown to continue for a companion heater failure. This change will specify the minimum redline for the affected field joint and will be consistent with the temperature data presented at Level I FRR (CoFR6)

NOTES:

(5) There are four temperature sensors per joint (fwd, ctr, and aft), 12 per RSRM. Output for each sensor is split for two MSID readings per sensor
(6) Heaters will be enabled at T-8 hrs and remain operational until T-1 min

REDLINE DERIVATION: CRITICALITY:

(7) Redline development:

	Min	Max
Basic Redline	75.0 deg F	130.0 deg F
O-ring/RTD Differential (9)	+3.0 deg F	-1.0 deg F
One-Minute Cooldown	+0.7 deg F	N/A
Circumferential Joint Temp	+2.8 deg F	-6.7 deg F
Heater Gap Depression	+2.7 deg F	N/A
Instrumentation error (8)	+1.9 deg F	-1.9 deg F
RSS total errors	+5.3 deg F	-7.0 deg F
Redline (Rounded)	80.0 deg F	123.0 deg F

(8) Instrumentation error development:

Sensor error	+/- 1.6
KSC signal condition	+/- 0.8
KSC LPS	+/- 0.7
RSS instrumentation error	+/- 1.9

(9) RTD = Resistance Temperature Detector
(10) This redline ensures the case field joint O-ring seals are between 75 and 130 deg F at launch to allow proper seal capabilities
(11) Manual hold — Do not automate

CONSEQUENCES OF EXCEEDING REDLINE:

(12) Field joint O-ring seals will not meet the required seal tracking safety factor at temperatures outside this range

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-06

CAUSES OF EXCEEDING REDLINE:

(13) Cold ambient air temperature
(14) Cryogenic leakage
(15) Instrumentation failure
(16) Heater failure

BIT VALUE	PCM RANGE LOW	PCM RANGE HIGH	METER RANGE LOW	METER RANGE HIGH	C AND W MIN	C AND W MAX	SM MIN	SM MAX
0.8	-4	158						

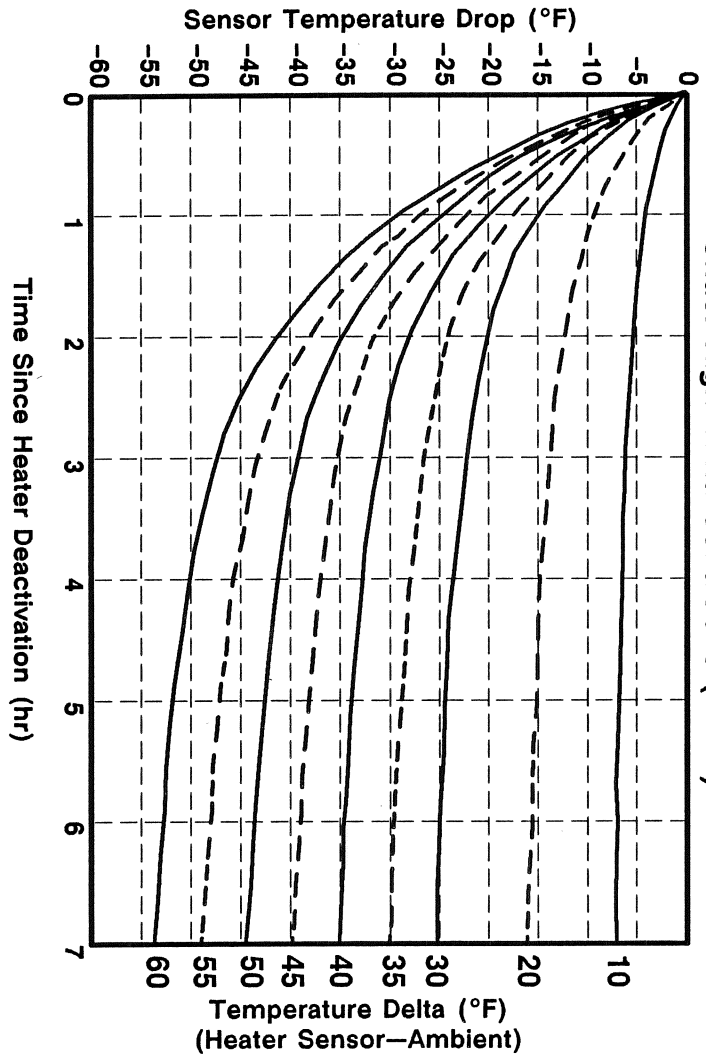
SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO. SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO. VS72-948099 SHEET 24 ZONE B4

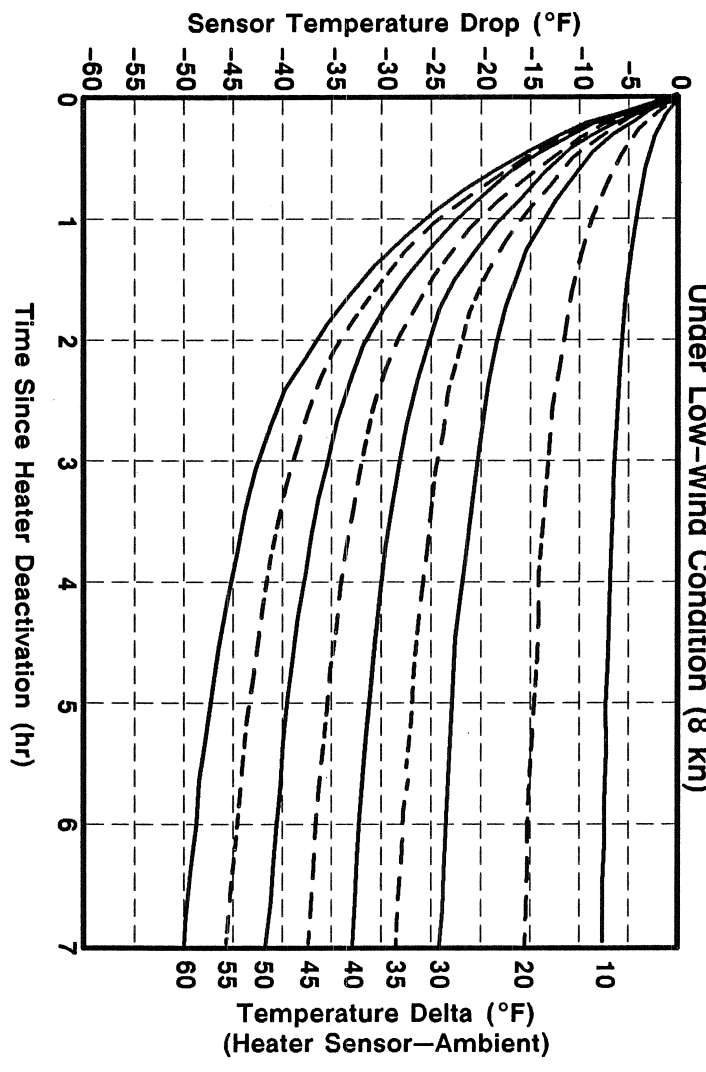
NASA: MSFC, S. Thornton CONTRACTOR: TC, R. Rasmussen

ELEMENT: SRB SUBSYSTEM: SRM MISSION: STS-42-999

3.0 Field Joints (Cont)

Projected Field Joint Cooldown Curves





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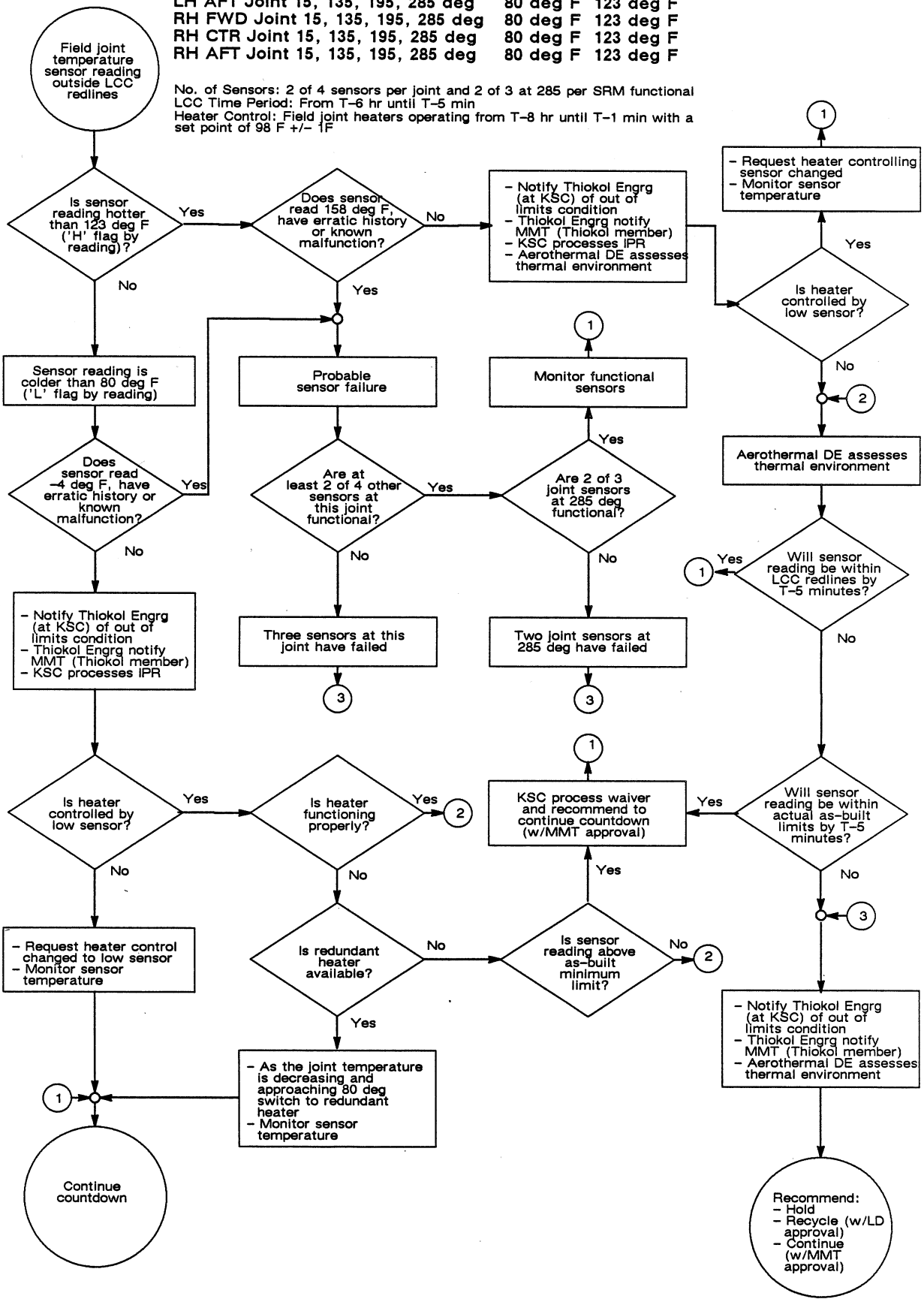
3.0 Field Joints (Cont)

Field Joint Temperature (Decision Tree)

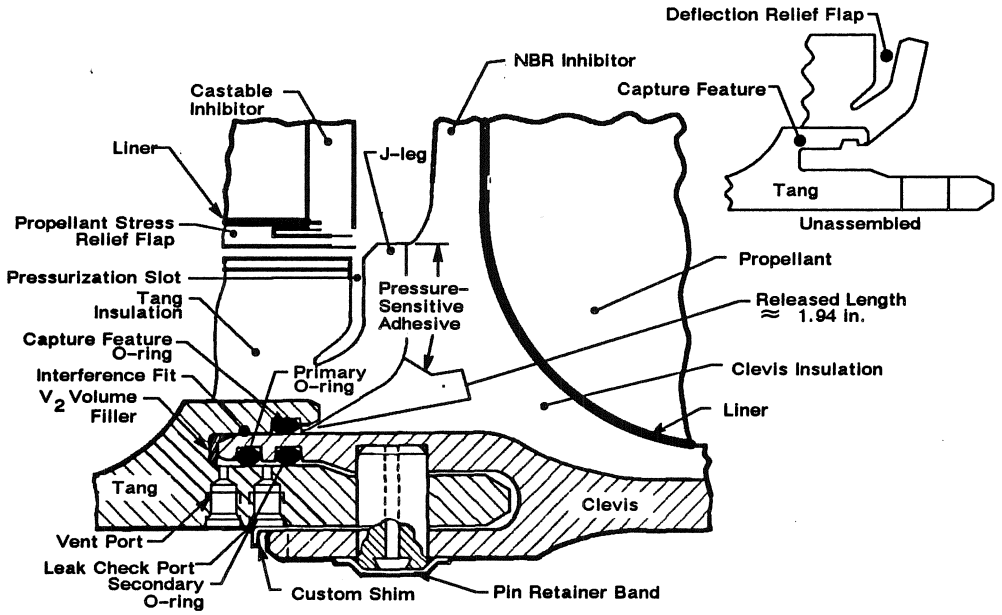
Sensor	Min	Max
LH FWD Joint 15, 135, 195, 285 deg	80 deg F	123 deg F
LH CTR Joint 15, 135, 195, 285 deg	80 deg F	123 deg F
LH AFT Joint 15, 135, 195, 285 deg	80 deg F	123 deg F
RH FWD Joint 15, 135, 195, 285 deg	80 deg F	123 deg F
RH CTR Joint 15, 135, 195, 285 deg	80 deg F	123 deg F
RH AFT Joint 15, 135, 195, 285 deg	80 deg F	123 deg F

No. of Sensors: 2 of 4 sensors per joint and 2 of 3 at 285 per SRM functional
LCC Time Period: From T-6 hr until T-5 min
Heater Control: Field joint heaters operating from T-8 hr until T-1 min with a set point of 98 F +/- 1F

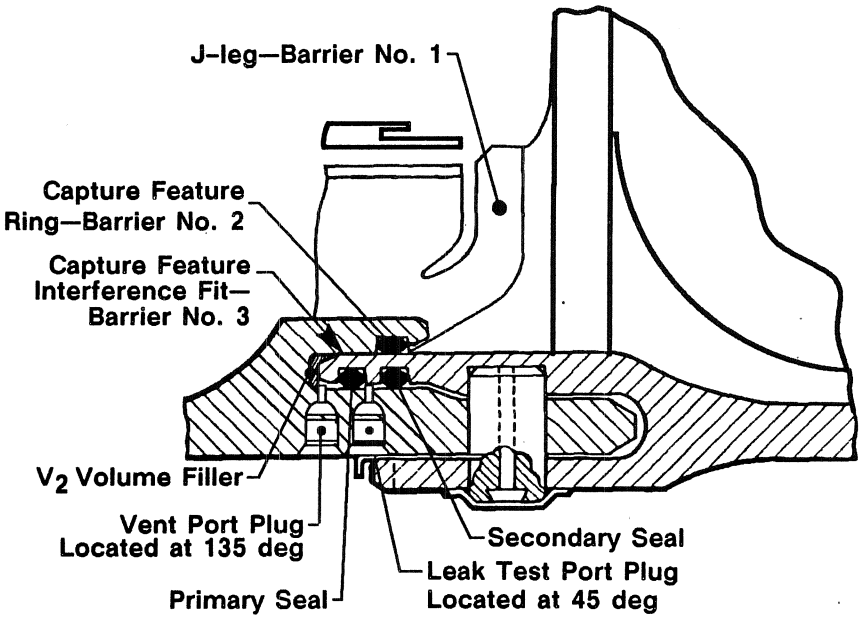


Field Joint Description

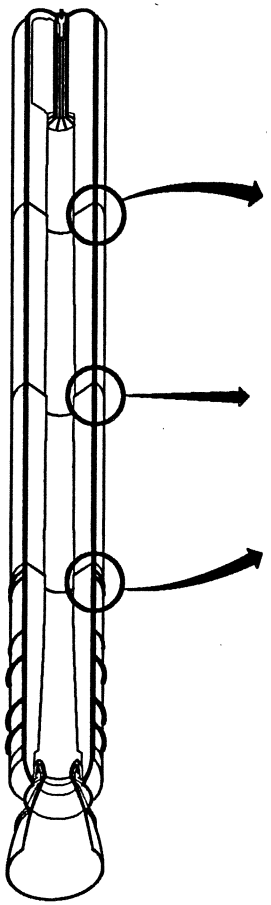
Assembled Field Joint

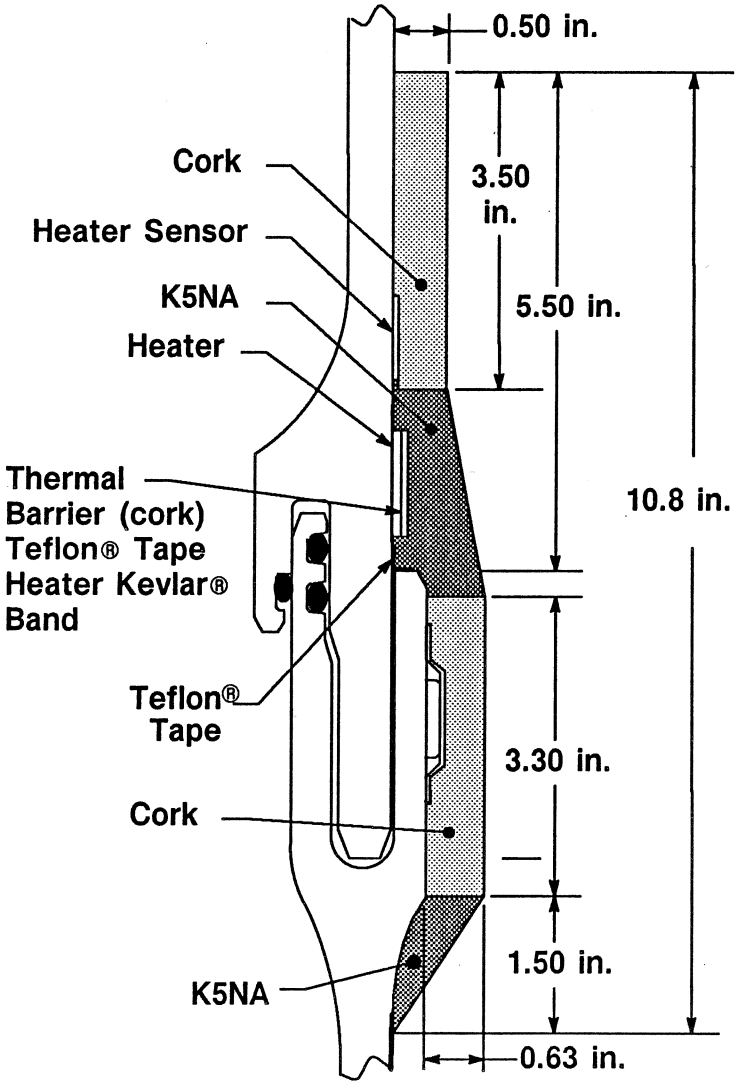


Heat and Flow Barriers



Joint Protection System Description





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PLACE TAB HERE

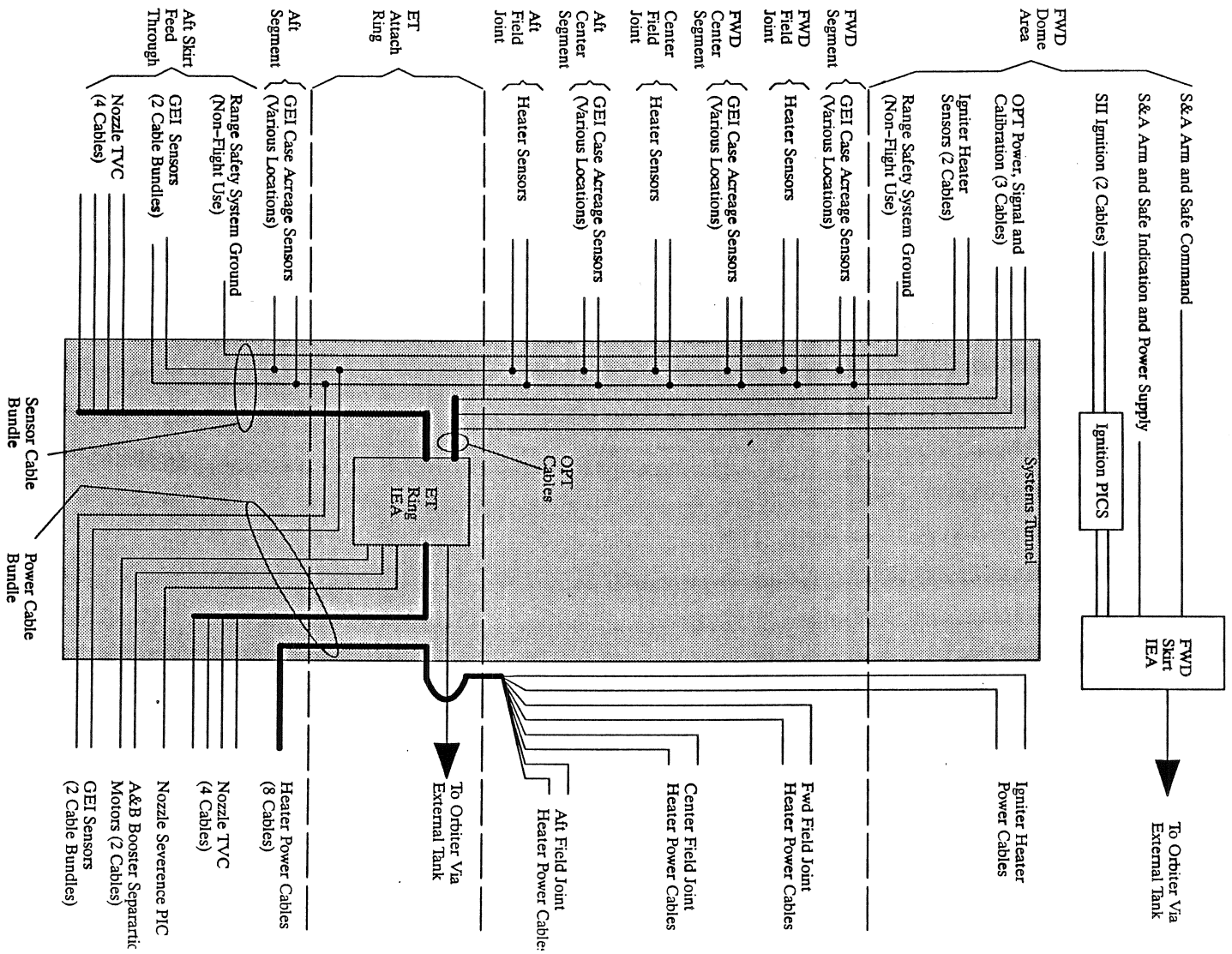
4.0 JOINT HEATERS/CABLING

Tab

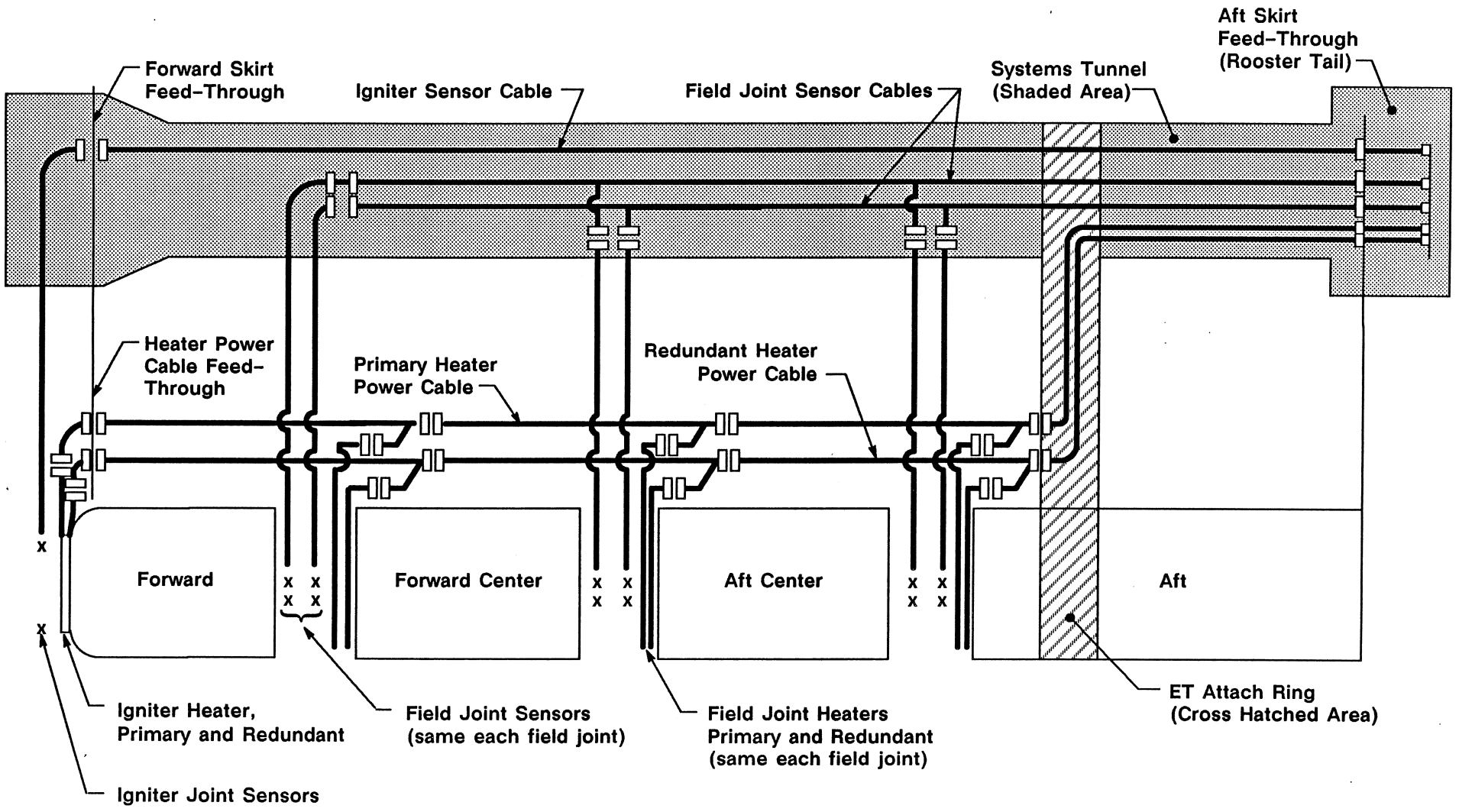
4.0 Joint Heaters/Cabling

4.0 Joint Heaters/Cabling (Cont)

Schematic of System Tunnel Cable Routing

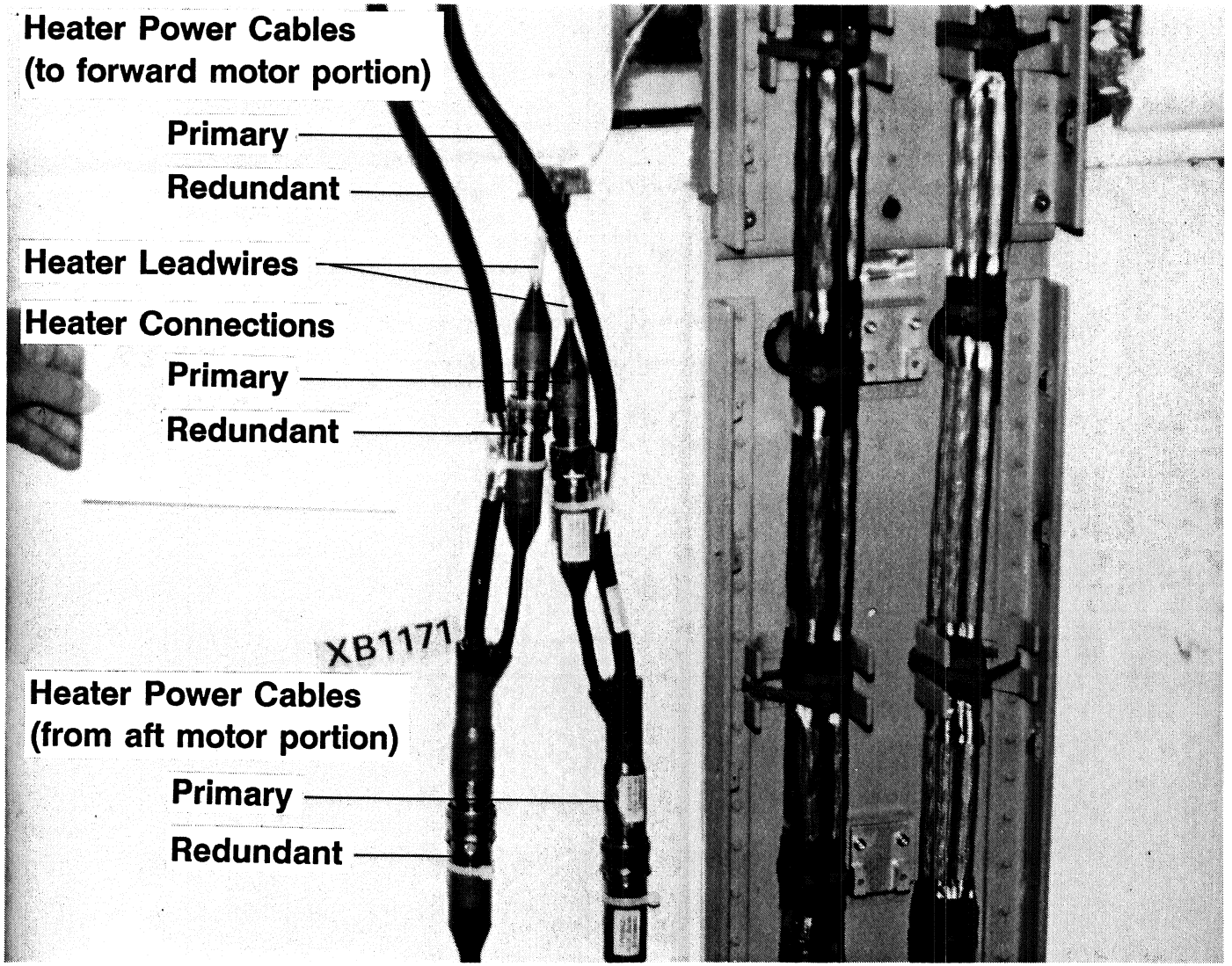


Heater Power Cable and Sensor Cable Routing

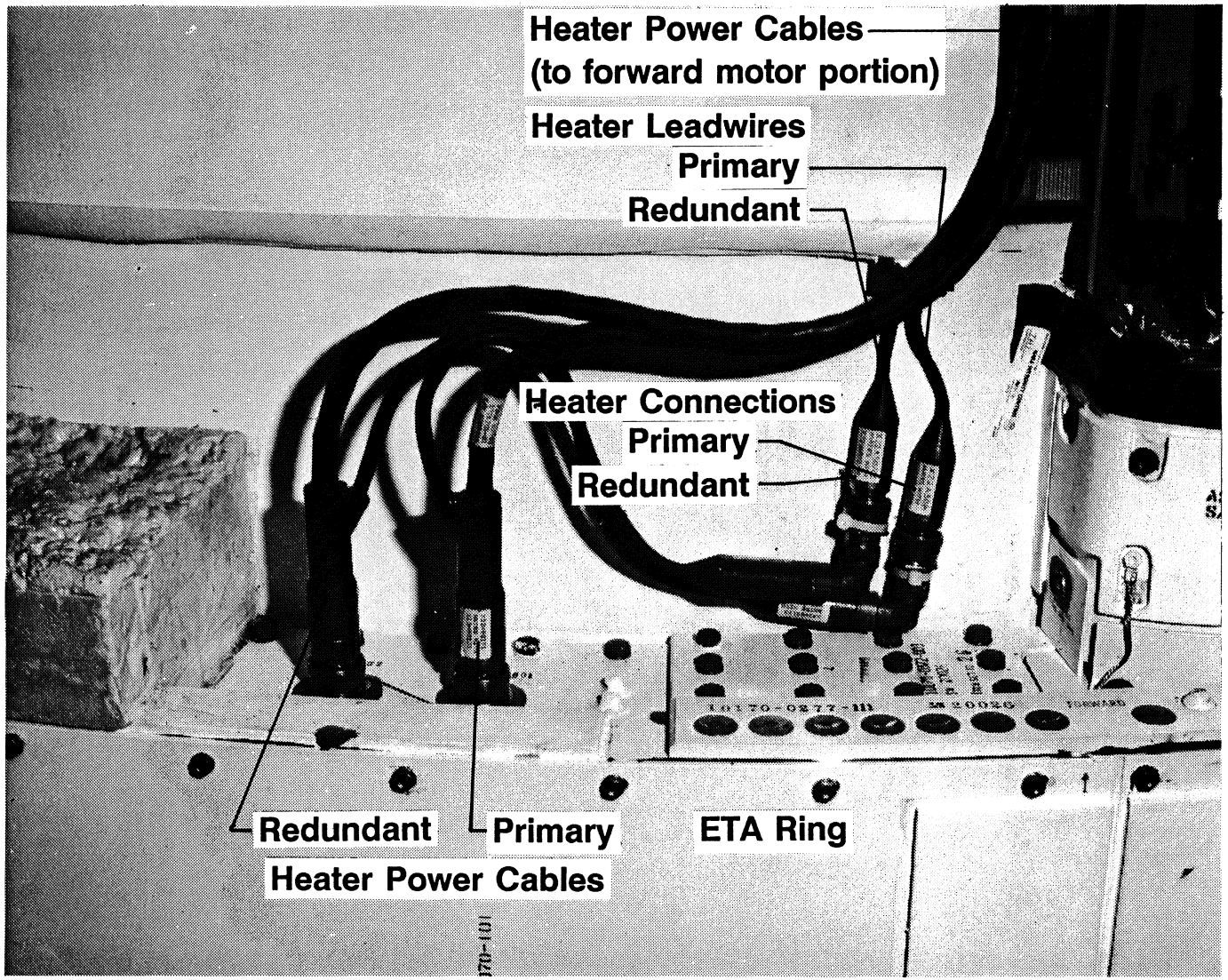


4.0 Joint Heaters/Cabling (Cont)

Heater Cable Connections—Center and Forward Joints

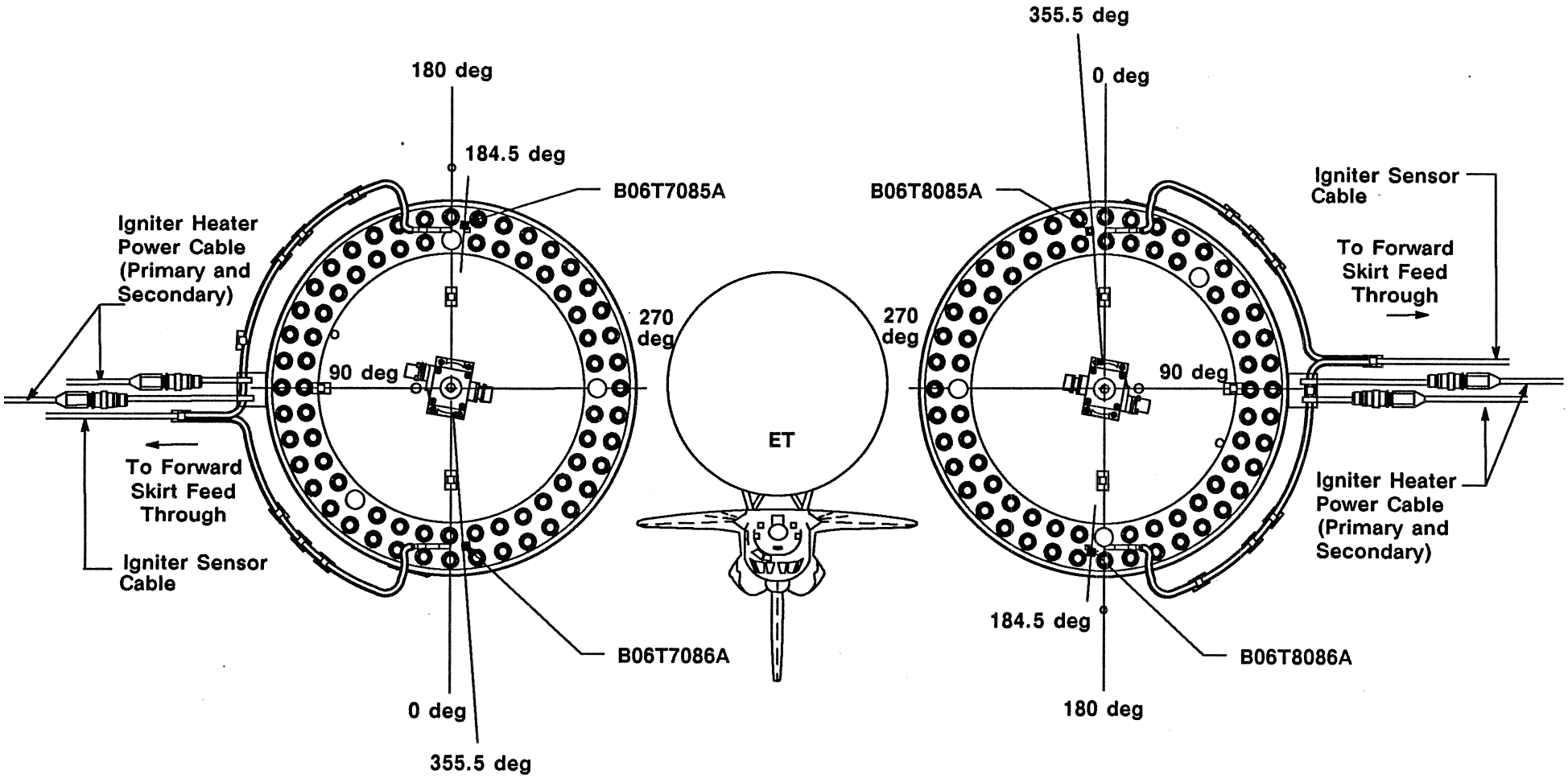


Heater Cable Connections—Aft Joint



4.0 Joint Heaters/Cabling (Cont)

Igniter Heater and Sensor Location and Cable Routing



OMRSD Reference

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FA0.610	0-000	RSRM SEGMENT JOINT HEATER SYSTEM	HAZ		A:B042-090 B:
	0-001 0-002	ACTIVATE RSRM SEGMENT JOINT HEATER SYSTEM	HEATER SYSTEM ACTIVATED		C: C-1. PERFORM AT T-8 HOURS. CAUTION RSRM JOINT TEMPERATURE SHALL NOT EXCEED 123 DEGREES F. C-2. ONLY ONE (1) (PRIMARY OR REDUNDANT) RSRM JOINT HEATER PER JOINT SHALL BE ACTIVE AT GIVEN TIME. C-3. ACTIVATION AND DEACTIVATION OF THE HEATER SYSTEM SHALL BE AT ZERO CROSSOVER. R-1. THE KSC RSRM SEGMENT FIELD JOINT HEATER CONTROL SETTING WILL BE AT 98 +/-1 DEGREES F. R-2. THE HEATER CONTROL SCANNING FOR THE LOWEST RSRM FIELD JOINT HEATER TEMPERATURE SENSOR READING WILL BE BETWEEN 10 MINUTES TO 15 MINUTES. R-3. THE FIELD JOINT SEAL TEMPERATURE WILL BE WITHIN THE LCC TEMPERATURE LIMITS PRIOR TO T-6 HOURS, WHEN THE LCC REQUIREMENT MUST BE MET. D: HAZ #: SRB HA B-50-27 ICD 2-0A001, ICD 2-0A002
	0-003 0-004 0-005 0-006 0-007 0-008 0-009 0-010 0-011 0-012 0-013 0-014 0-015 0-016 0-017 0-018 0-019 0-020 0-021 0-022 0-023 0-024 0-025 0-026 0-027 0-028 0-029 0-030 0-031 0-032				

OMRSD Reference

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FA0.620	0-000	RSRM IGNITER HEATER SYSTEM	HAZ		A:B042-090 B:
	0-001 0-002	ACTIVATE RSRM IGNITER HEATER SYSTEM	HEATER SYSTEM ACTIVATED		C: C-1. PERFORM AT L-18 HOURS. CAUTION RSRM GEI IGNITER HEATER TEMPERATURE SENSORS SHALL NOT EXCEED 125 DEGREES F. C-2. ONLY ONE (1) (PRIMARY OR REDUNDANT) RSRM IGNITER HEATER PER SEGMENT SHALL BE ACTIVE AT A GIVEN TIME. C-3. ACTIVATION AND DEACTIVATION OF HEATER SYSTEM SHALL BE AT ZERO CROSSOVER. R-1. THE KSC RSRM IGNITER HEATER CONTROL SETTING WILL BE AT 100+/-1 DEGREES F. R-2. THE IGNITER SEAL TEMPERATURE WILL BE WITHIN THE LCC TEMPERATURE LIMITS PRIOR TO T-6 HOURS, WHEN THE LCC REQUIREMENT MUST BE MET. R-3. THE HEATER CONTROL SCANNING INTERVAL FOR THE LOWEST RSRM IGNITER HEATER TEMPERATURE SENSOR READING WILL NOT EXCEED 15 MINUTES. D: HAZ #: SRB HA B-50-27 ICD 2-0A001, ICD 2-0A002
	0-003 0-004 0-005 0-006 0-007 0-008 0-009 0-010 0-011 0-012 0-013 0-014 0-015 0-016 0-017 0-018 0-019 0-020 0-021 0-022 0-023 0-024 0-025 0-026 0-027 0-028 0-029 0-030 0-031 0-032				

OMRSD Reference

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FA0.960	0-000	RSRM IGNITER HEATER SYS CURRENT VERIF	HAZ		A:B025,027,028,032-090 B:
	0-001	VERIFY IGNITER HEATER SYSTEM CURRENT	NOT GREATER THAN 4.9 AMPS (SEE C-2)		C: C-1. PERFORM FROM IGNITER HEATER SYSTEM ACTIVATION (L-18 HOURS) UNTIL IGNITER HEATER SYSTEM DEACTIVATION (AS LATE AS POSSIBLE DURING THE T-9 MINUTE HOLD AND COMPLETE BEFORE RSRM IGNITION S&A ROTATION (T-5 MIN) PRIOR TO LAUNCH). CAUTION EXCESSIVE CURRENT TO THE HEATER MAY INDICATE SHORTING IN THE HEATER SYSTEM WHICH, IF POWER REMAINS ON, POSSIBLY COULD CAUSE DAMAGE TO THE HARDWARE. C-2. IF THE CURRENT EXCEEDS 4.9 AMPS, THEN THE POWER TO THE HEATER SHALL BE DEACTIVATED. THE BACKUP HEATER SYSTEM, IF FULLY OPERATIONAL, SHALL BE USED TO MAINTAIN THE THE LCC JOINT TEMPERATURE LIMITS. D: ICD 2-0A002 HAZ #: RSRM FI-01, BC-09 HAZ #: SRB HA B-00-23, B-50-27, B-50-07
	0-002				
	0-003				
	0-004				
	0-005				
	0-006				
	0-007				
	0-008				
	0-009				
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	0-023				
	0-024				
	0-025				
	0-026				

OMRSD Reference

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FA0.970	0-000	RSRM FLD JNT HEATER SYS CURRENT VERIF	HAZ		A:B025,027,028,032-090 B:
	0-001 0-002	VERIFY FIELD JOINT HEATER SYSTEM CURRENT	NOT GREATER THAN 19.5 AMPS (SEE C-2)		C: C-1. PERFORM FROM FIELD JOINT HEATER SYSTEM ACTIVATION (T-8 HOURS) UNTIL FIELD JOINT HEATER SYSTEM DEACTIVATION (NO EARLIER THAN T-1 MINUTE). CAUTION EXCESSIVE CURRENT TO THE HEATER MAY INDICATE SHORTING IN THE HEATER SYSTEM WHICH, IF POWER REMAINS ON, POSSIBLY COULD CAUSE DAMAGE TO THE HARDWARE. C-2. IF THE CURRENT EXCEEDS 19.5 AMPS, THEN THE POWER TO THE HEATER SHALL BE DEACTIVATED. THE BACKUP HEATER SYSTEM, IF FULLY OPERATIONAL, SHALL BE USED TO MAINTAIN THE LCC JOINT TEMPERATURE LIMITS.
	0-003 0-004 0-005 0-006 0-007 0-008 0-009 0-010 0-011 0-012 0-013 0-014 0-015 0-016 0-017 0-018 0-019 0-020 0-021 0-022				D: ICD 2-0A002 HAZ #: RSRM FI-01, FC-01, BC-09 HAZ #: SRB HA B-00-23, B-50-27

OMRSD Reference

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FA0.980		DEACTIVATE RSRM IGNITER HEATER SYSTEM	HAZ		A:B025,027,028 B030-090
	0-000				B:
	0-001	DEACTIVATE RSRM IGNITER HEATER	HEATER SYSTEM		C: C-1. INITIATE AS LATE AS
	0-002	SYSTEM PRIOR TO LAUNCH	DEACTIVATED		POSSIBLE DURING THE T-9 MINUTE
	0-003				HOLD AND COMPLETE BEFORE
	0-004				RSRM IGNITION S&A ROTATION
	0-005				(T-5 MIN) PRIOR TO LAUNCH.
	0-006				
	0-007				C-2. ACTIVATION AND DEACTIVATION
	0-008				OF HEATER SYSTEM SHALL BE AT ZERO
	0-009				CROSSOVER.
	0-010				D: ICD-2-0A001, ICD-2-0A002
	0-011				HAZ #: RSRM FI-01
	0-012				HAZ #: SRB HA A-40-11, A-30-07,
	0-013				B-00-23, B-50-07, B-50-27,
	0-014				B-50-29, B-40-03
S00FN0.825		DEACTIVATE RSRM JOINT HEATER SYSTEM	HAZ		A:B025,027,028,031-090
	0-000				B:
	0-001	DEACTIVATE RSRM JOINT HEATER	HEATER SYSTEM		C: C-1. PERFORM NO EARLIER THAN
	0-002	SYSTEM PRIOR TO LAUNCH	DEACTIVATED		T-1 MINUTE.
	0-003				
	0-004				C-2. DEACTIVATION OF THE HEATER
	0-005				SYSTEM SHALL BE AT ZERO CROSSOVER.
	0-006				
	0-007				D: ICD-2-0A001, ICD-2-0A002
	0-008				HAZ #: SRB HA A-30-07, B-50-07,
	0-009				B-00-23, B-50-27, A-40-11,
	0-010				B-40-03

5.0 Case/PLI

5.0 Case/PLI (Cont)

Case Acreage Temperature LCC

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-11

LCC VIOLATION CALL: SRM CASE ACREAGE TEMPERATURE ANOMALY | EMERG COND NONE

MEAS NO.	MEASUREMENT DESCRIPTION	CAT.	MIN	MAX	UNITS	CODE
	LH Case Surface Temps					
B06T7007A	PRI LH SRB STA 694.54/270 Temp		34	NA	deg F	CI
B06T7013A	PRI LH SRB STA 931.5/270 Temp		34	NA	deg F	CI
B06T7018A	PRI LH SRB STA 1091.6/270 Temp		34	NA	deg F	CI
B06T7024A	PRI LH SRB STA 1411.5/270 Temp		34	NA	deg F	CI
B06T7038A	PRI LH SRB STA 1751.5/270 Temp		34	NA	deg F	CI
	RH Case Surface Temps					CI
B06T8007A	PRI RH SRB STA 694.54/270 Temp		34	NA	deg F	CI
B06T8013A	PRI RH SRB STA 931.5/270 Temp		34	NA	deg F	CI
B06T8018A	PRI RH SRB STA 1091.6/270 Temp		34	NA	deg F	CI
B06T8024A	PRI RH SRB STA 1411.5/270 Temp		34	NA	deg F	CI
B06T8038A	PRI RH SRB STA 1751.5/270 Temp		34	NA	deg F	

TIME PERIOD: From Start of ET Cryo Tanking (T-6 hrs) to Go for GLS Start (T-9 min)

REQUIREMENTS: DRAWING:

(1) Three of five sensors per motor required functional. (2, 3) All functional sensors must be within the redlines.

PREPLANNED CONTINGENCY PROCEDURE:

(2) Thermal community to confirm any problem.

(3) For loss of more than two measurements per motor, realtime thermal evaluation will be performed using all available data and a recommendation presented to the Mission Management Team

NOTES:

(4) Manual hold - Do not automate

REDLINE DERIVATION: CRITICALITY:

(5) Redline development: Min

Basic redline	30.0 deg F
Case/Remote RTD defferential (7)	+2.5 deg F
Cooldown	NA
Differential temperature (8)	+2.5
Instrumentation error (6)	+1.9 deg F
RSS total errors	+4.0 deg F
Redline (Rounded)	34.0 deg F

(6) Instrumentation error development:

Sensor error	+/- 1.6
KSC signal condition	+/- 0.8
KSC LPS	+/- 0.7
RSS instrumentation error	+/- 1.9

(7) RTD = Resistance temperature detector
(8) Temperature difference due to insulation covering RTD.
(9) This redline ensures the case acreage is at least 30 deg F to assure proper fracture toughness at launch.

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-11

CONSEQUENCES OF EXCEEDING REDLINE:

(10) The steel case may not meet the required fracture toughness outside this range

CAUSES OF EXCEEDING REDLINE:

(11) Extreme ambient air temperature
(12) Cryogenic leakage
(13) Instrumentation failure

BIT VALUE	PCM RANGE LOW	PCM RANGE HIGH	METER RANGE LOW	METER RANGE HIGH	C AND W MIN	C AND W MAX	SM MIN	SM MAX
1.6	-222.4	+188.8						

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO. SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO. VS72-948099 SHEET 24 ZONE B4

NASA: MSFC, S. Thornton CONTRACTOR: TC, D Nisonger

ELEMENT: SRM SUBSYSTEM: SRM MISSION: STS-59-999

Outboard Sensor Monitoring Procedure

The four outboard sensors on each motor will be monitored by Thiokol console personnel at KSC and HOSC. In the event that one or more of these sensors indicate case temperatures cooler than the case LCC limit of 34 deg. F, the console operators will notify all Thiokol and MSFC/RSRM support personnel.

Console and Aero/thermal engineers will evaluate the validity of the sensor data using adjacent sensor and thermal imager data.

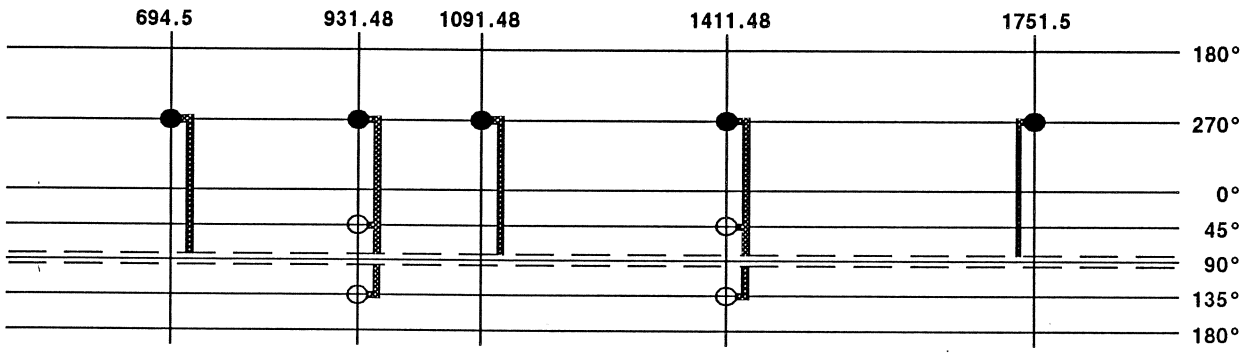
Validated cold case conditions will be reported as follows:

Mission Management Team (MMT) by Thiokol's MMT representative or by MSFC/RSRM Project Manager
Director STS Engineering by Thiokol's VP of Engineering or MSFC/RSRM Chief Engineer
HOSC Shuttle Manager by Thiokol's Chief Engineer or MSFC/RSRM representative at HOSC

If thermal analysis done by Thiokol Aero/Thermal analysts indicate that the case temperatures have not recovered from the low limit exceedance all Thiokol positions polled at T–20 minutes will identify the situation as a problem in work. The poll at T–9 minutes will be answered "NO GO" for start of terminal count.

USE DECISION TREE PAGE 5.0–5

Reduced GEI Configuration



○ - DENOTES OUTBOARD CASE GEI TEMPERATURE SENSORS (NON-LCC)
● - DENOTES INBOARD CASE GEI TEMPERATURE SENSORS (MONITORED FOR LCC VERIFICATION)
▩ - DENOTES GEI CABLE TPS RUN

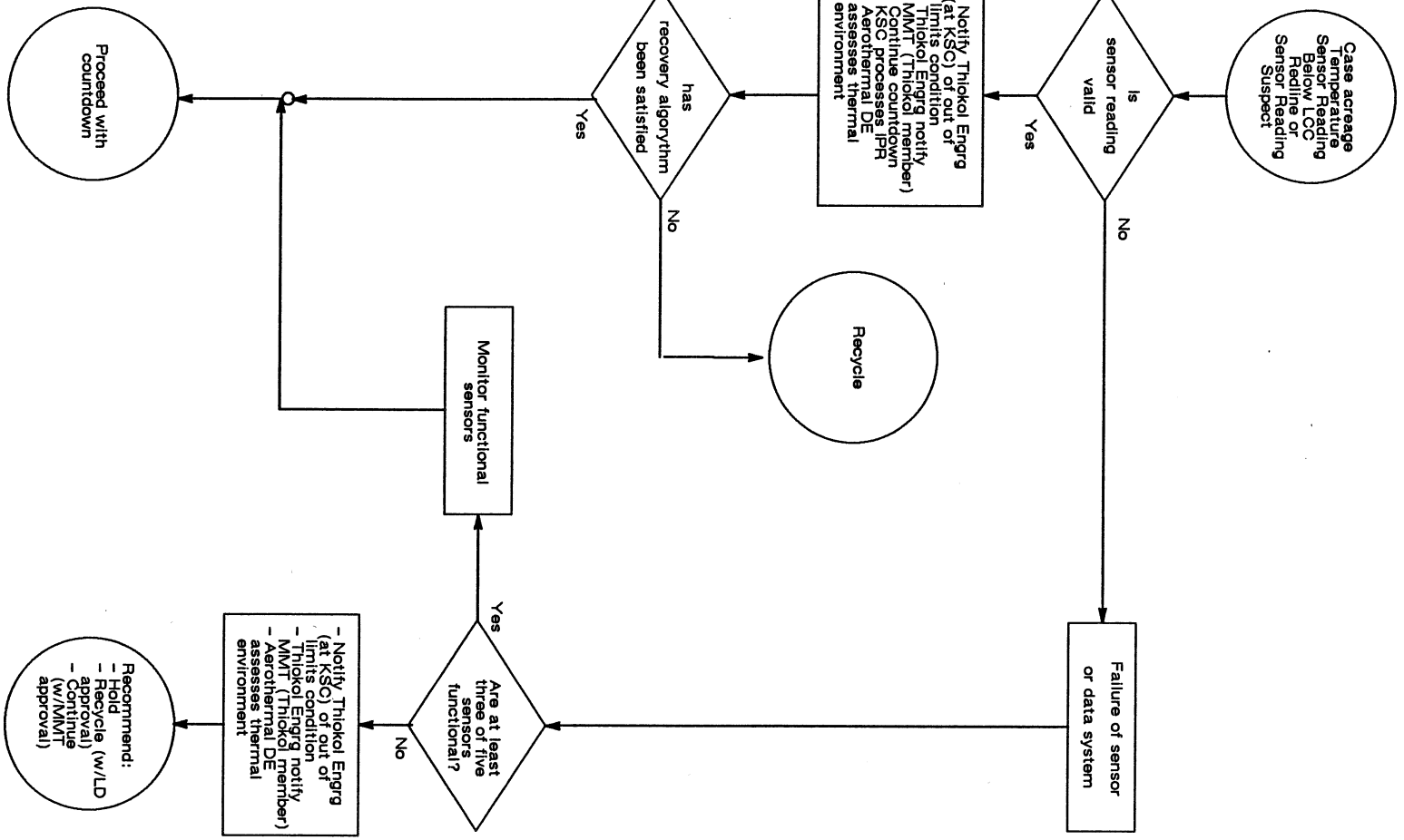
OMRSD Reference

REQUIREMENT NUMBER	REV	REQUIREMENT DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FA0.600	1	RSRM PMBT	HAZ		A:B025,027-090;C
	0-000				B: CONTINGENCY - IF LAUNCH IS DELAYED
	0-001				IN EXCESS OF 24 HOURS, THE PRE-
	0-002				DICTED PMBT SHALL BE REVERIFIED.
	0-003	VERIFY PREDICTED RSRM PMBT AT TIME	86 DEG F MAX		C: C-1. PERFORM PMBT ACCEPTABILITY
	0-004	OF LAUNCH (PROVIDED BY THE RSRM	44 DEG F MIN		VERIFICATION AT L-24 HOURS.
	0-005	CONTRACTOR) IS ACCEPTABLE			
	0-006				R-1. THE COLLECTION OF ENVIRON-
	0-007				MENTAL HISTORY TO SUPPORT THIS
	0-008				REQUIREMENT WILL BE THROUGH THE
	0-009				AUTHORITY OF THE PRD FROM ONE OF
	0-010				THE FOLLOWING SIX (6) SOURCES IN
	0-011				DESCENDING ORDER OF PREFERENCE:
	0-012				
	0-013				1. CAMERA SITE 3 AT 60 FT LEVEL.
	0-014				2. CAMERA SITE 6 AT 60 FT LEVEL.
	0-015				3. TOWER 112 AT 54 FT LEVEL.
	0-016				4. TOWER 311 AT 54 FT LEVEL.
	0-017				5. TOWER 313 AT 54, 204, AND
	0-018				492 FT LEVELS.
	0-019				6. SHUTTLE LANDING FACILITY
	0-020				HOURLY TEMPERATURE RECORD.
	0-021				D: CRIT 1
	0-022				HAZ #: RSRM BC-06

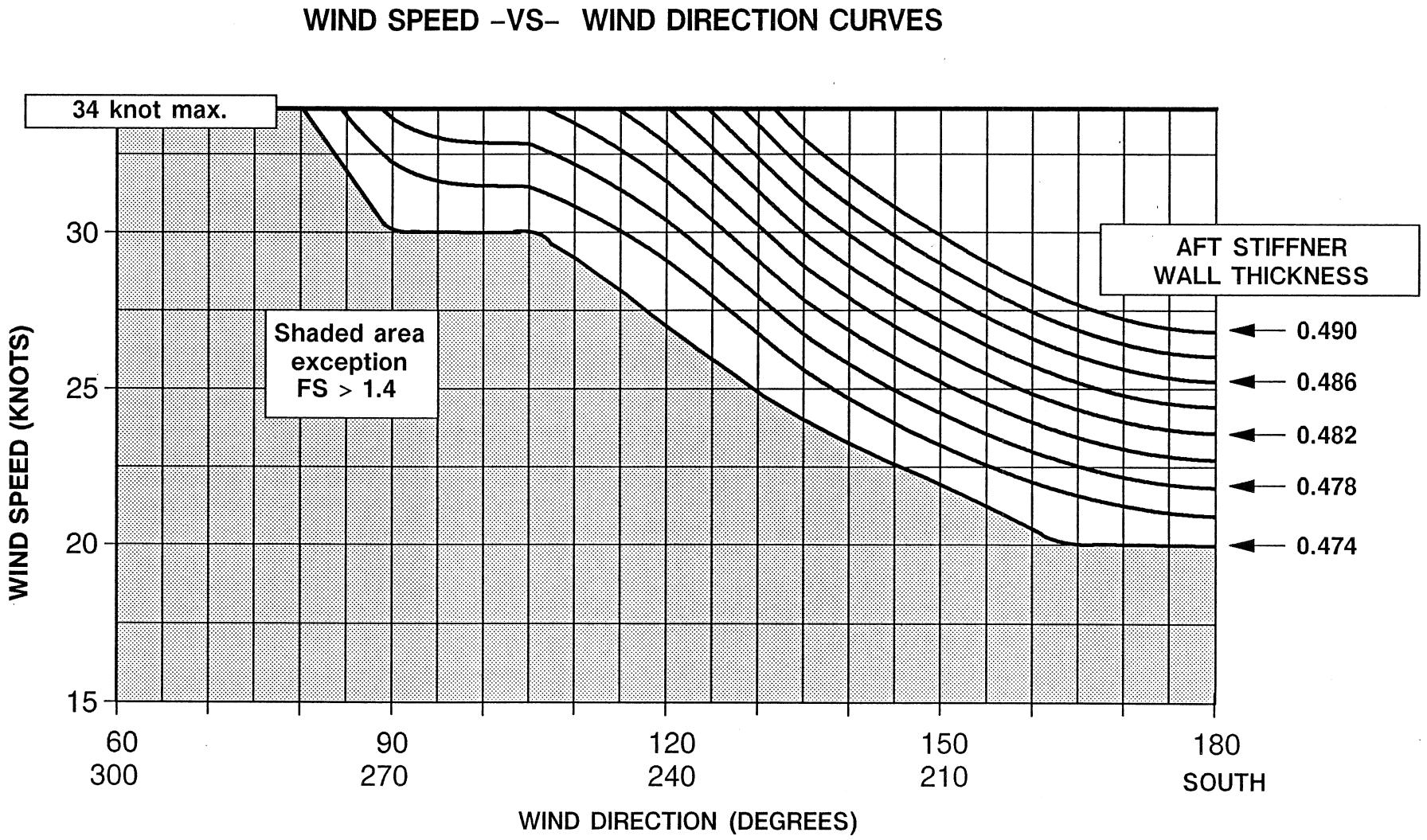
5.0 Case/PLI (Cont)

Case Acreage Temperature (Decision Tree)

Sensor	Min.
LH Case Acreage 270 deg (694, 931, 1091, 1411, 1751)	34 deg F
RH Case Acreage 270 deg (694, 931, 1091, 1411, 1751)	34 deg F
No. of Sensors: 3 of 5 sensors per motor functional	
LCC Time Period From T-6 hr until T-9 min	

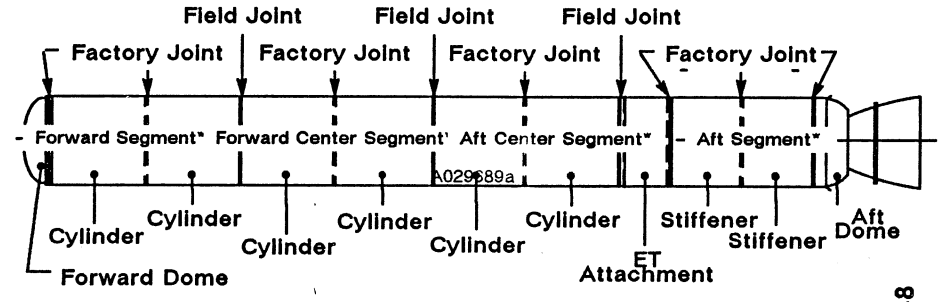


Case Buclking Safety Factors



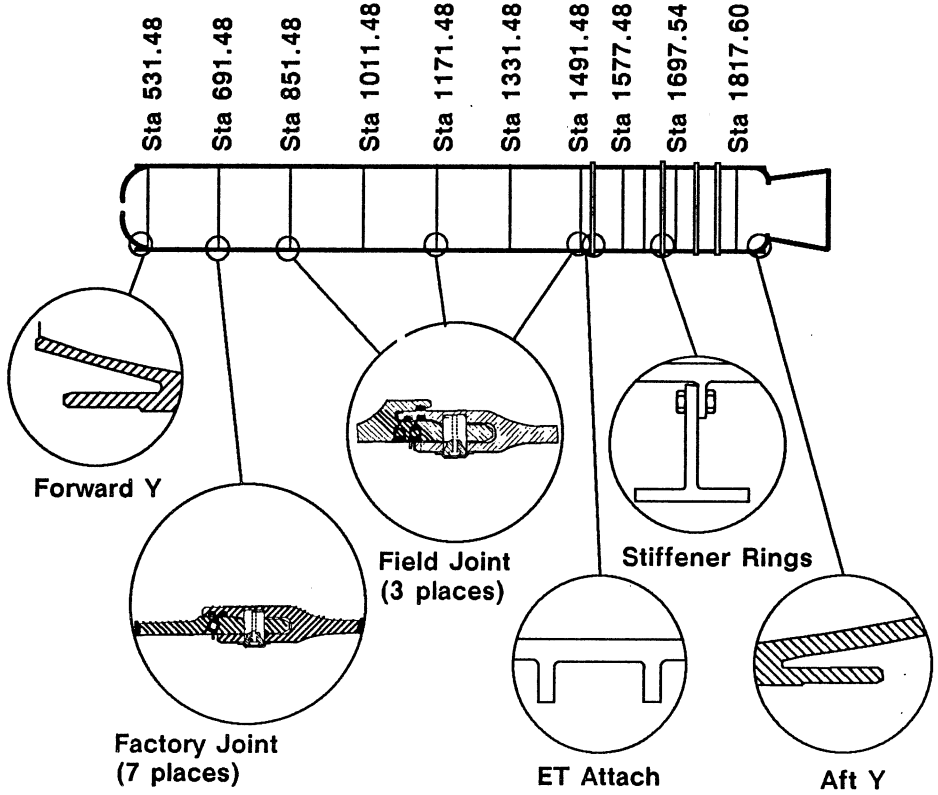
Case Design Description

Case Segments

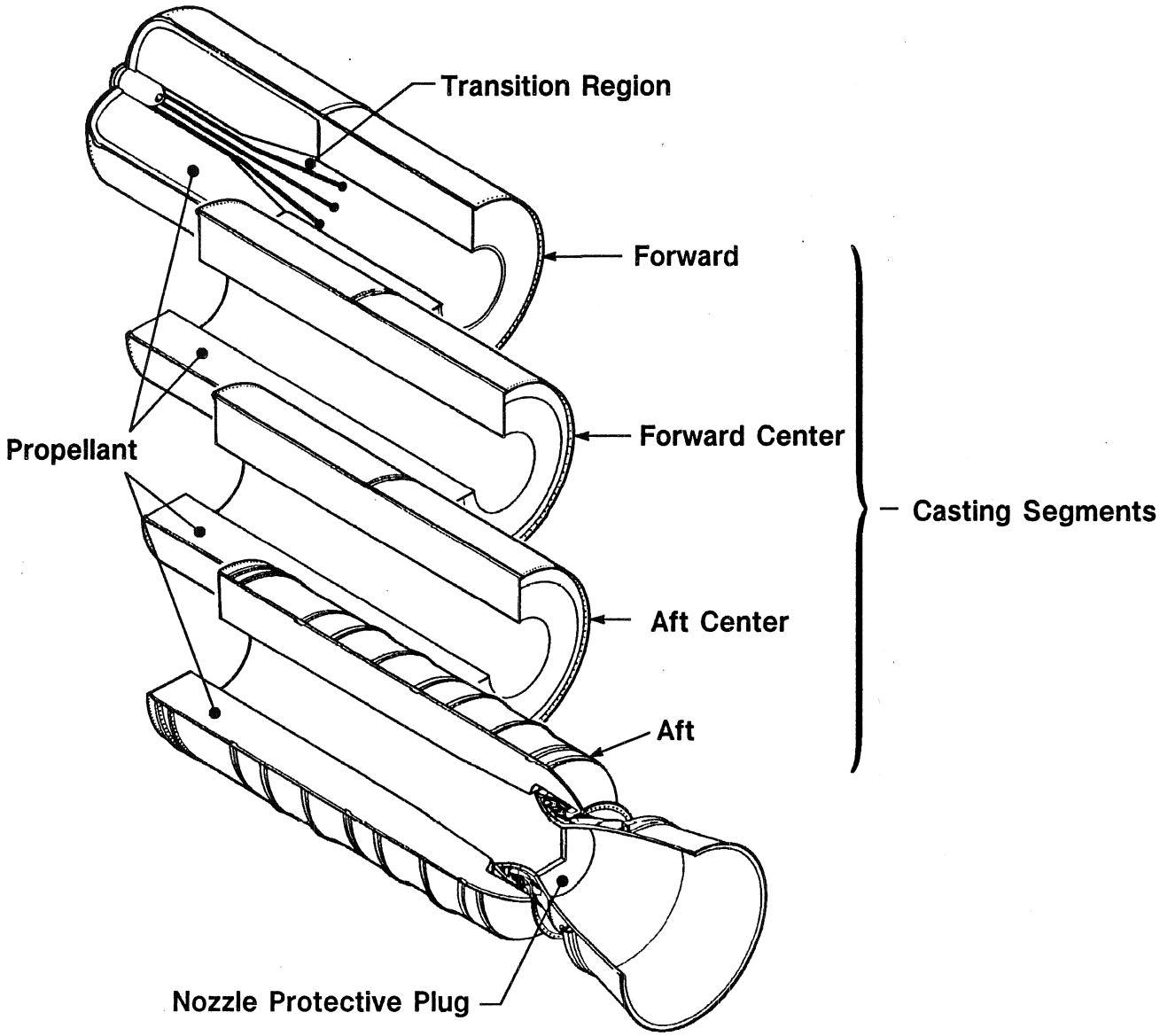


*Casting Segments

RSRM Case Design



Propellant Configuration



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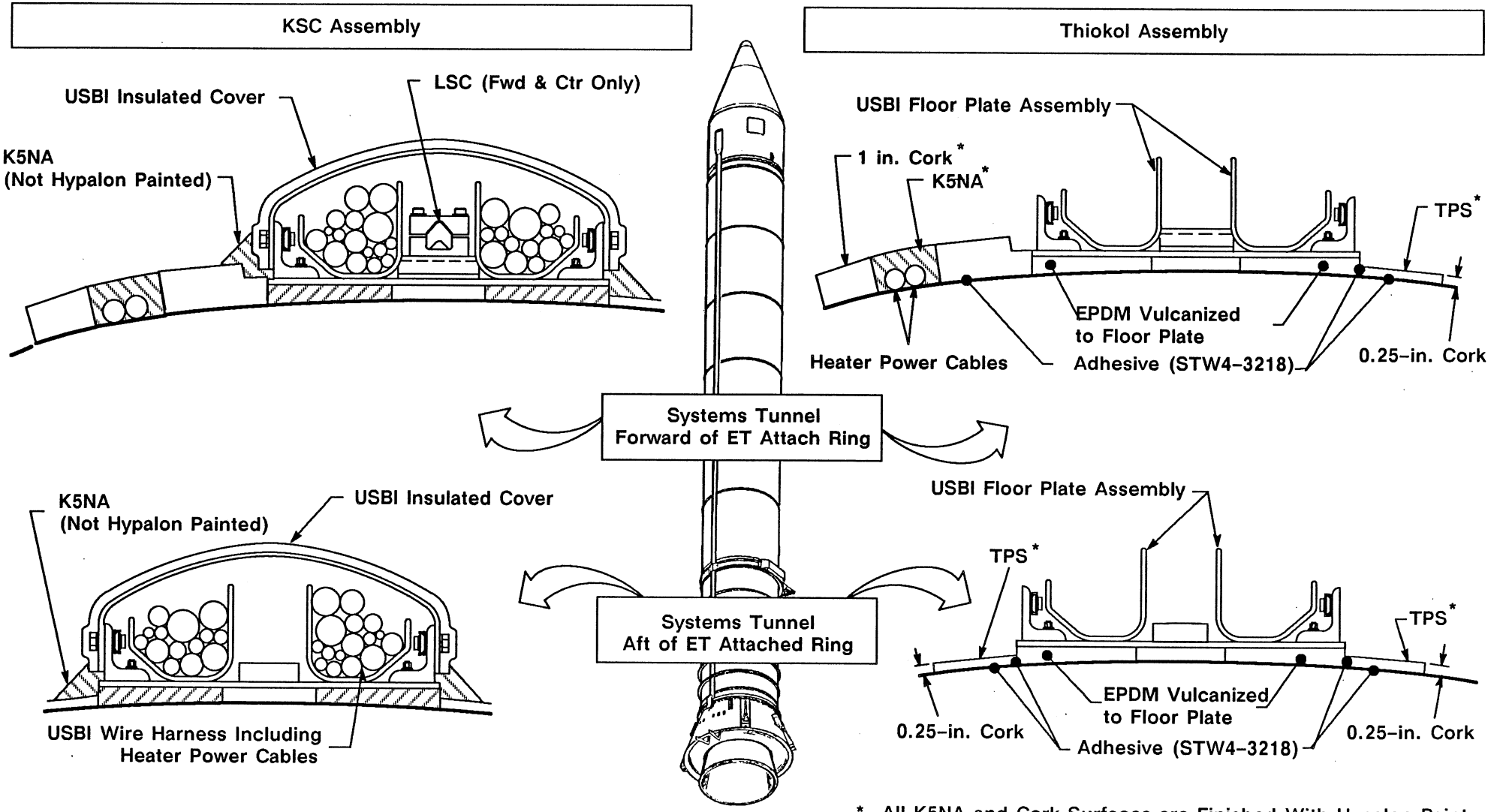
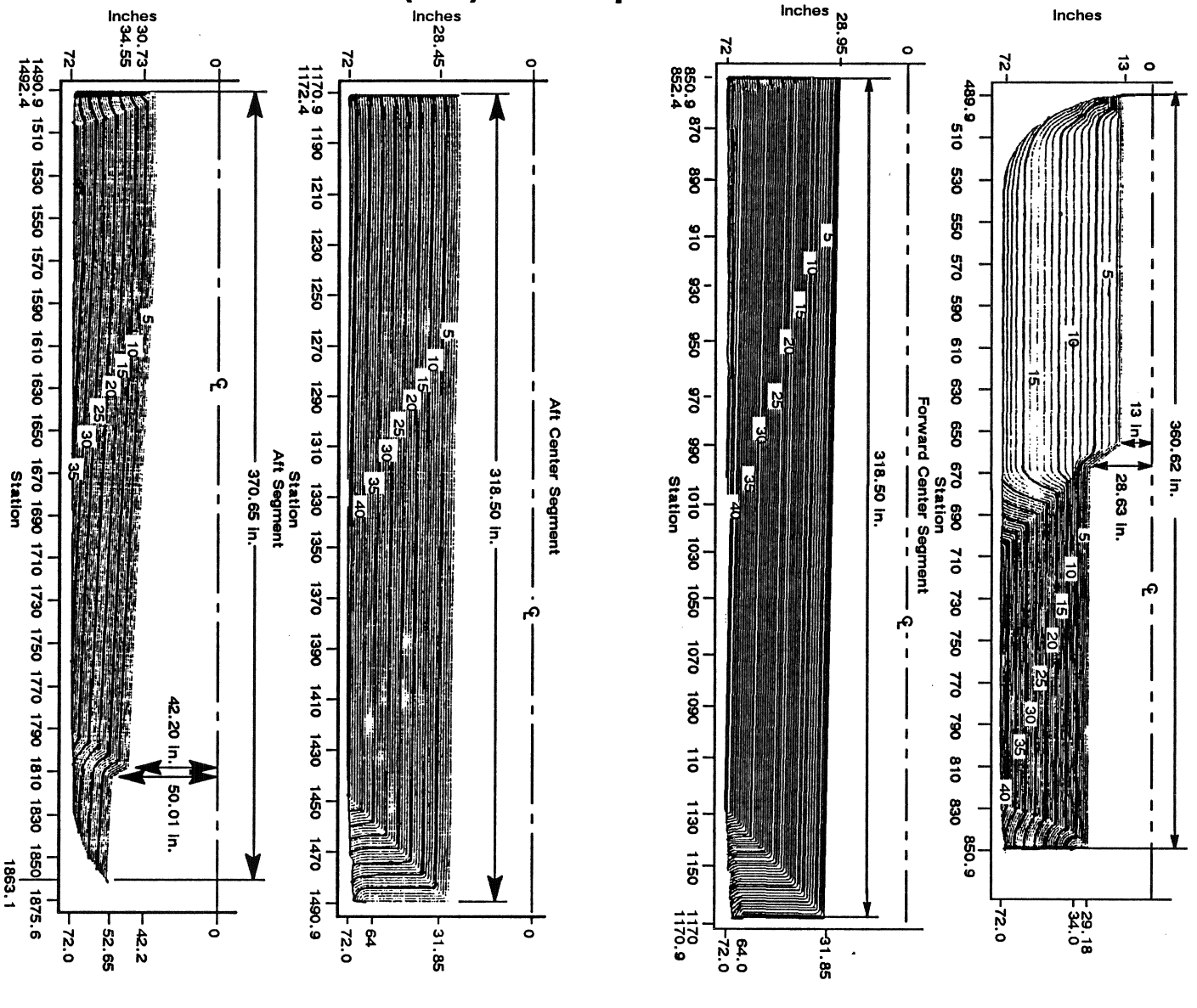
Systems Tunnel Description (Flight Set 35 and Subsequent)



Propellant/Liner/Insulation (PLI) Description



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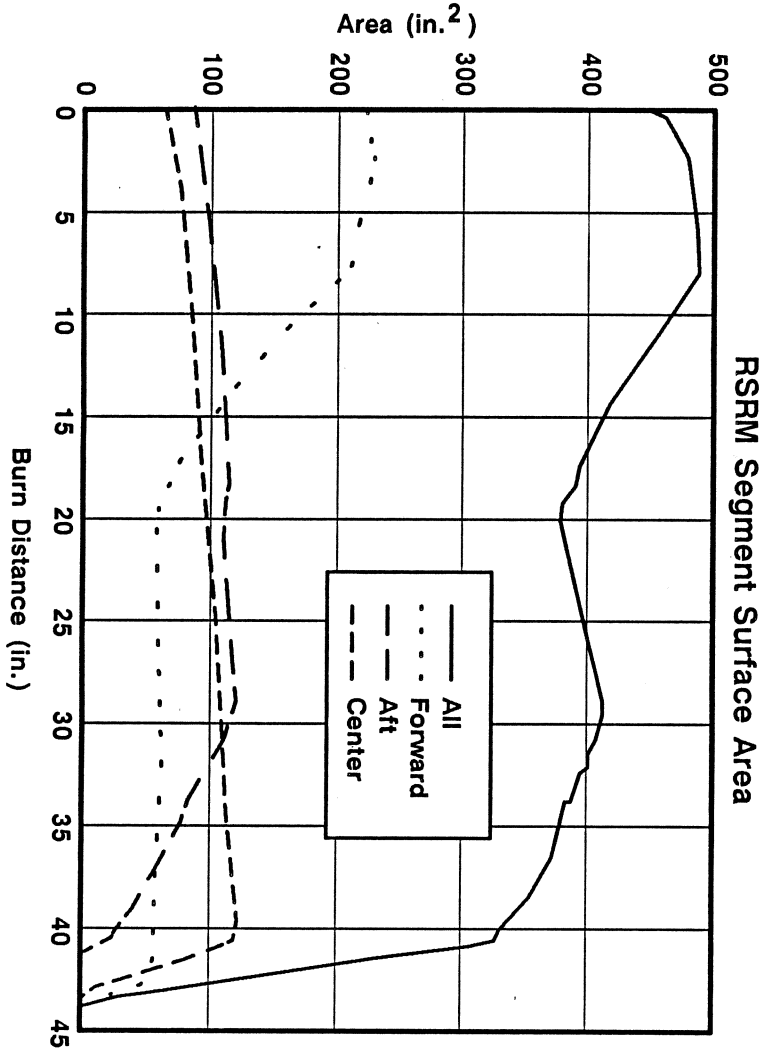
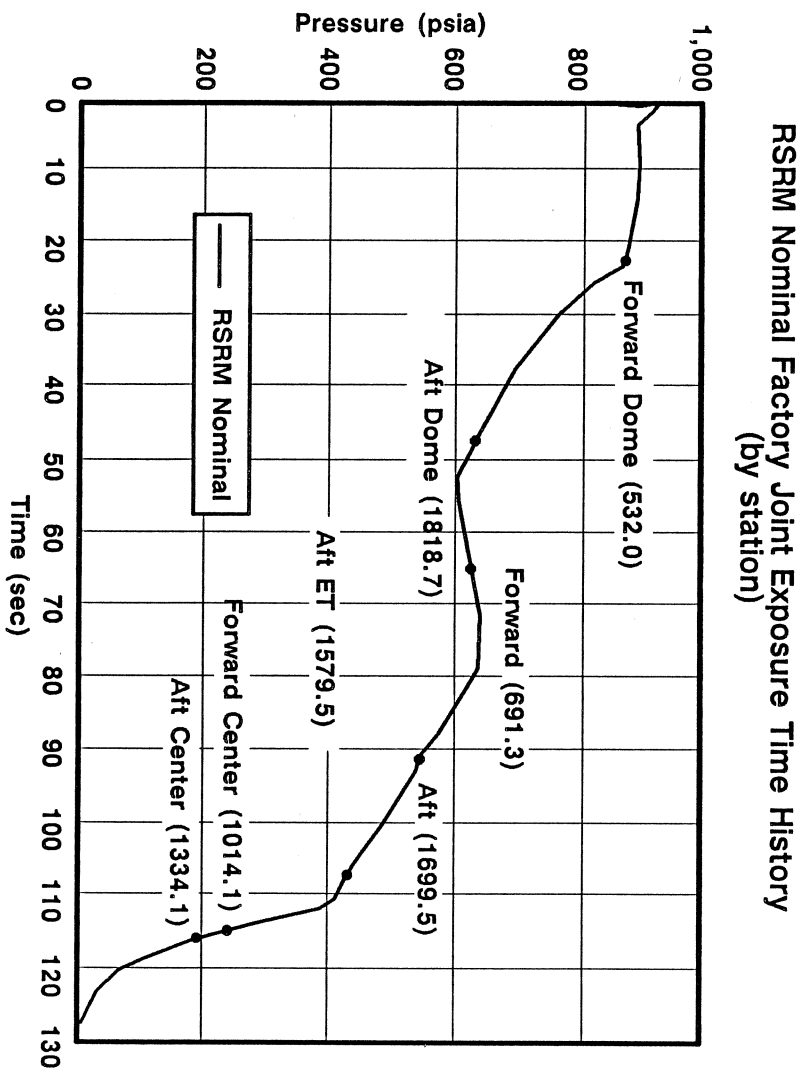
Propellant/Liner/Insulation (PLI) Description (Cont)

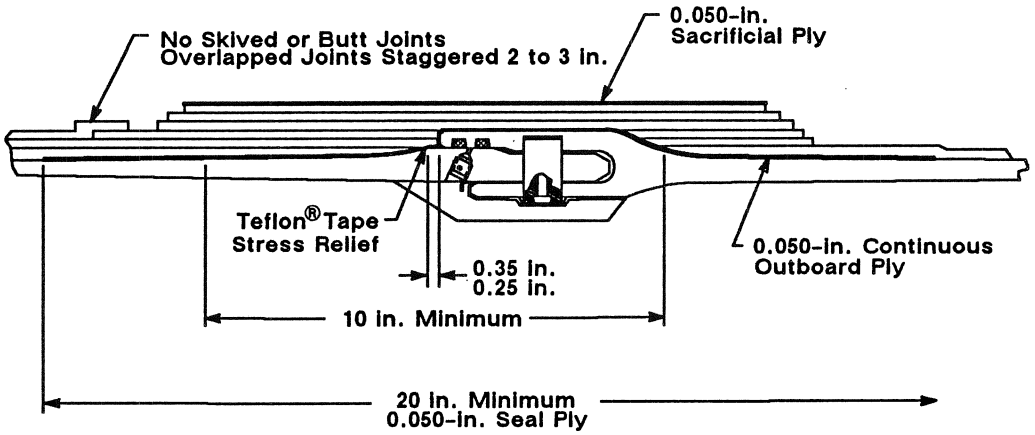




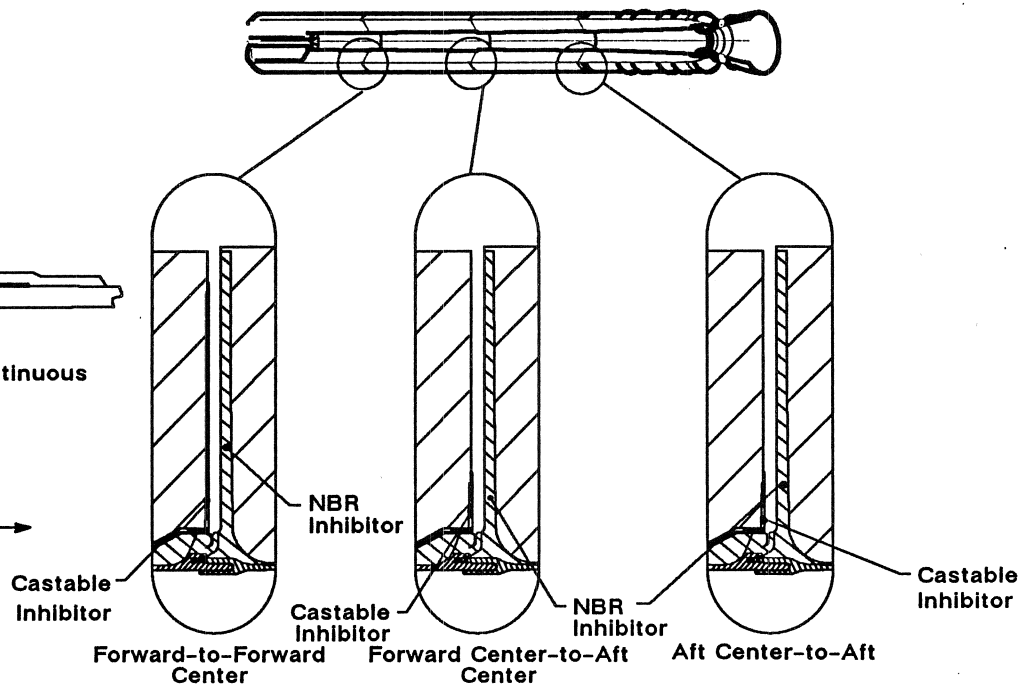
5.0R1

Propellant/Liner/Insulation (PLI) Description (Cont)

Factory Joint Insulation Design



RSRM Inhibitor Configurations



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6.0 Nozzle

Nozzle-to-Case Joint Temperature LCC

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-07

LCC VIOLATION CALL: SRM NOZZLE-TO-CASE JOINT TEMP ANOMALY | EMERG COND NONE

MEAS NO.	MEASUREMENT DESCRIPTION	CAT.	MIN	MAX	UNITS	CODE
	LH Nozzle-to-Case Joint Temps					
B06T7091A	PRI LH SRB STA 1876.6/50 Temp		75	115	deg F	CI
B06T7092A	PRI LH SRB STA 1876.6/130 Temp		75	115	deg F	CI
B06T7093A	PRI LH SRB STA 1876.6/270 Temp		75	115	deg F	CI
	RH Nozzle-to-Case Joint Temps					
B06T8091A	PRI RH SRB STA 1876.6/50 Temp		75	115	deg F	CI
B06T8092A	PRI RH SRB STA 1876.6/130 Temp		75	115	deg F	CI
B06T8093A	PRI RH SRB STA 1875/270 Temp		75	115	deg F	CI

TIME PERIOD: From Start of ET Cryo Tanking (T-6 hrs) to Go for APU Start (T-5 min)

REQUIREMENTS: Drawing:

(1) Two of three sensors per motor required functional. All functional sensors must be within the redlines.

PREPLANNED CONTINGENCY PROCEDURE:

(2) In the event the minimum redline is exceeded, a change will be processed which will specify the minimum redline for the affected joint, thereby allowing the countdown to continue. This change will be consistent with the temperature data presented at the Space Shuttle Program FRR (CoFR6).
(3) In the event of instrumentation failure for more than 1 sensor on a given motor, the following flex bearing aft end ring sensors may be used as backup measurements to allow the countdown to continue. The minimum redline for these backup measurements is +3 deg F greater than the redline for the nozzle-to-case joint sensors to allow for differential temperatures. The maximum redline remains at 115 deg F.

MEAS NO.	DESCRIPTION
B06T7087A	PRI LH SRB Sta 1847/50 Temp
B06T7088A	PRI LH SRB Sta 1847/130 Temp
B06T7089A	PRI LH SRB Sta 1847/230 Temp
B06T7090A	PRI LH SRB Sta 1847/310 Temp
B06T8087A	PRI RH SRB Sta 1847/50 Temp
B06T8088A	PRI RH SRB Sta 1847/130 Temp
B06T8089A	PRI RH SRB Sta 1847/230 Temp
B06T8090A	PRI RH SRB Sta 1847/310 Temp

NOTES:
(4) Manual hold - Do not automate

REDLINE DERIVATION: CRITICALITY:

(5) Redline development:

	Min	Max
Basic Redline (6) (7)	75.0 deg F	115 deg F
O-ring/RTD Differential (8) (9)	+0.0 deg F	NA
Cooldown	NA	N/A
Circumferential Joint Temp (10)	+0.0 deg F	+0.0 deg F
Heater Gap Depression	NA	N/A
Instrumentation error	NA	NA
Redline (Rounded)	75.0 deg F	115.0 deg F

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-07

REDLINE DERIVATION (CONT):

(6) The minimum redline ensures nozzle-to-case joint O-ring seals are at least 75 deg F to assure a 2.0 tracking safety factor based on worst-case tolerances.
(7) The maximum redline ensures the nozzle bondlines are below 115 deg F for proper bondline adhesive strength at launch.
(8) RTD = Resistance temperature detector
(9) Assumes same seal/sensor temperature due to high heat conductive nature of aft dome and fixed housing steel.
(10) Empirical data review and model analysis indicate minimal circumferential variation once steady-state condition is achieved; variations occur during warmup/cooldown periods, only.
(11) Instrumentation error is absorbed in conservative 2.0 safety factors.

CONSEQUENCES OF EXCEEDING REDLINE:

(12) Nozzle-to-case joint O-ring seals will not meet the required seal tracking safety factor at temperatures below 75 deg F.
(13) Adhesive temperatures above 115 deg F will result in loss of redundancy in nozzle phenolic bondline margins of safety.

CAUSES OF EXCEEDING REDLINE:

(14) Extreme ambient air temperature
(15) Cryogenic leakage
(16) Instrumentation failure
(17) Aft skirt purge heater failure

BIT VALUE	PCM RANGE LOW	PCM RANGE HIGH	METER RANGE LOW	METER RANGE HIGH	C AND W MIN	C AND W MAX	SM MIN	SM MAX
1.6	-211	+188.8						

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO. SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO. VS72-948099 SHEET 24 ZONE B4

NASA: MSFC, S. Thornton CONTRACTOR: TC, D. Nisonger

ELEMENT: SRM SUBSYSTEM: SRM MISSION: STS-59,60,62-999

OMRSD Reference

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FA0.777	1	RSRM NOZZLE TO CASE TEMPERATURE LIMIT		HAZL02	A:B062-999
	0-000				B:
	0-001	VERIFY THE RSRM NOZZLE-TO	B06T7091A	75 TO 115	C: C-1: SPECIFICATION TO BE MET AT
	0-002	CASE JOINT SENSORS ARE WITHIN	B06T8091A	DEGREES F	T-6 HOURS.
	0-003	THE SPECIFIED TEMPERATURE LIMITS	B06T7092A		
	0-004		B06T8092A		C-2: A MINIMUM OF 2 OUT OF 3 GEI
	0-005		B06T7093A		TEMPERATURE SENSORS ON THE
	0-006		B06T8093A		NOZZLE TO CASE JOINT SHALL BE
	0-007				OPERATIVE.
	0-008				
	0-009				R-1: IF CONDITIONING IS REQUIRED,
	0-010				THE PURGE GAS GN2 TEMPERATURE
	0-011				(GHYT8013A) WILL BE SET AT 95+/-5
	0-012				DEGREES F.
	0-013				
	0-014				R-2: THE FLEX BEARING TEMPERATURE
	0-015				WILL BE MAINTAINED WITHIN
	0-016				ACCEPTABLE LIMITS BY KEEPING THE
	0-017				NOZZLE TO CASE SENSORS WITHIN THE
	0-018				75 TO 115 DEGREES F LIMITS FROM
	0-019				T-6 HOURS UNTIL T-5 MINUTES AS
	0-020				REQUIRED BY THE LCC.
	0-021				
	0-022				D: CRIT 1
	0-023				ICD-2-0A002, ICD-3-44005
	0-024				HAZ #: RSRM BC-04, BN-04
	0-025				

OMRSD Reference

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FA0.776	1	RSRM NOZZLE FLEX BEARING TEMP LIMIT		HAZL02	A:B062,064-999 B: C: C-1: RSRM NOZZLE TO CASE GEI TEMPERATURE SENSOR AND THE NOZZLE FLEX BEARING GEI TEMPERATURE SENSORS SHALL BE A MAXIMUM OF 115 DEGREES F. C-2: THE AVERAGE RSRM NOZZLE FLEX BEARING TEMPERATURE IS OBTAINED BY AVERAGING RSRM NOZZLE FLEX BEARING LOWEST GEI TEMPERATURE SENSOR READING (ONE POINT EVERY 3 HOURS) FOR THE PREVIOUS TWO WEEKS. C-3: THE GN2 FLOW PRESSURE SHALL BE A MINIMUM OF 35 PSIG. C-4: A MINIMUM OF 2 OUT OF 4 GEI TEMPERATURE SENSORS FOR THE FLEX BEARING SHALL BE OPERATIVE. R-1: NOTED GN2 SPECIFICATIONS ARE AT THE GROUND PANEL SUPPLY. R-2: THE PURGE GAS GN2 TEMPERATURE (GHYT8013A) WILL BE SET AT 115 DEGREES F UNTIL THE FIRST NOZZLE TO CASE OR NOZZLE FLEX BEARING GEI TEMPERATURE SENSOR REACHES 95 DEGREES F. THE PURGE GAS GN2 TEMPERATURE WILL THEN BE SET AT 95+/-5 DEGREES F UNTIL LAUNCH. D: CRIT 1 ICD-2-0A002, ICD-3-44005 HAZ #: RSRM BC-04, BN-04, BN-06, BN-08
	0-000				
	0-001	VERIFY THE RSRM NOZZLE FLEX BEARING			
	0-002	IS AT AN ACCEPTABLE TEMPERATURE AS			
	0-003	FOLLOWS:			
	0-004				
	0-005	A. FROM 85 HOURS PRIOR TO T-6 HOURS	B06T7087A	AVERAGE	
	0-006	UNTIL START OF AFT END PURGE	B06T8087A	TEMPERATURE 60	
	0-007	VERIFY NOZZLE FLEX BEARING AVERAGE	B06T7088A	DEG F MINIMUM	
	0-008	TEMPERATURE	B06T8088A	(SEE C-2)	
	0-009	OR	B06T7089A		
	0-010		B06T8089A		
	0-011		B06T7090A		
	0-012		B06T8090A		
	0-013				
	0-014	B. THERMALLY CONDITION AFT END WITH		REFERENCE TABLE	
	0-015	AFT END PURGE FOR THE SPEFICIED		S00FA0776-1	
	0-016	TIME PERIOD			
	0-017				
	0-018				
	0-019				
	0-020				
	0-021				
	0-022				
	0-023				
	0-024				
	0-025				
	0-026				
	0-027				
	0-028				
	0-029				
	0-030				
	0-031				
	0-032				
	0-033				
	0-034				
	0-035				
	0-036				
	0-037				
	0-038				
	0-039				

OMRSD Reference

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS

TABLE S00FA0.776-1. RSRM NOZZLE FLEX BEARING TEMPERATURE LIMIT

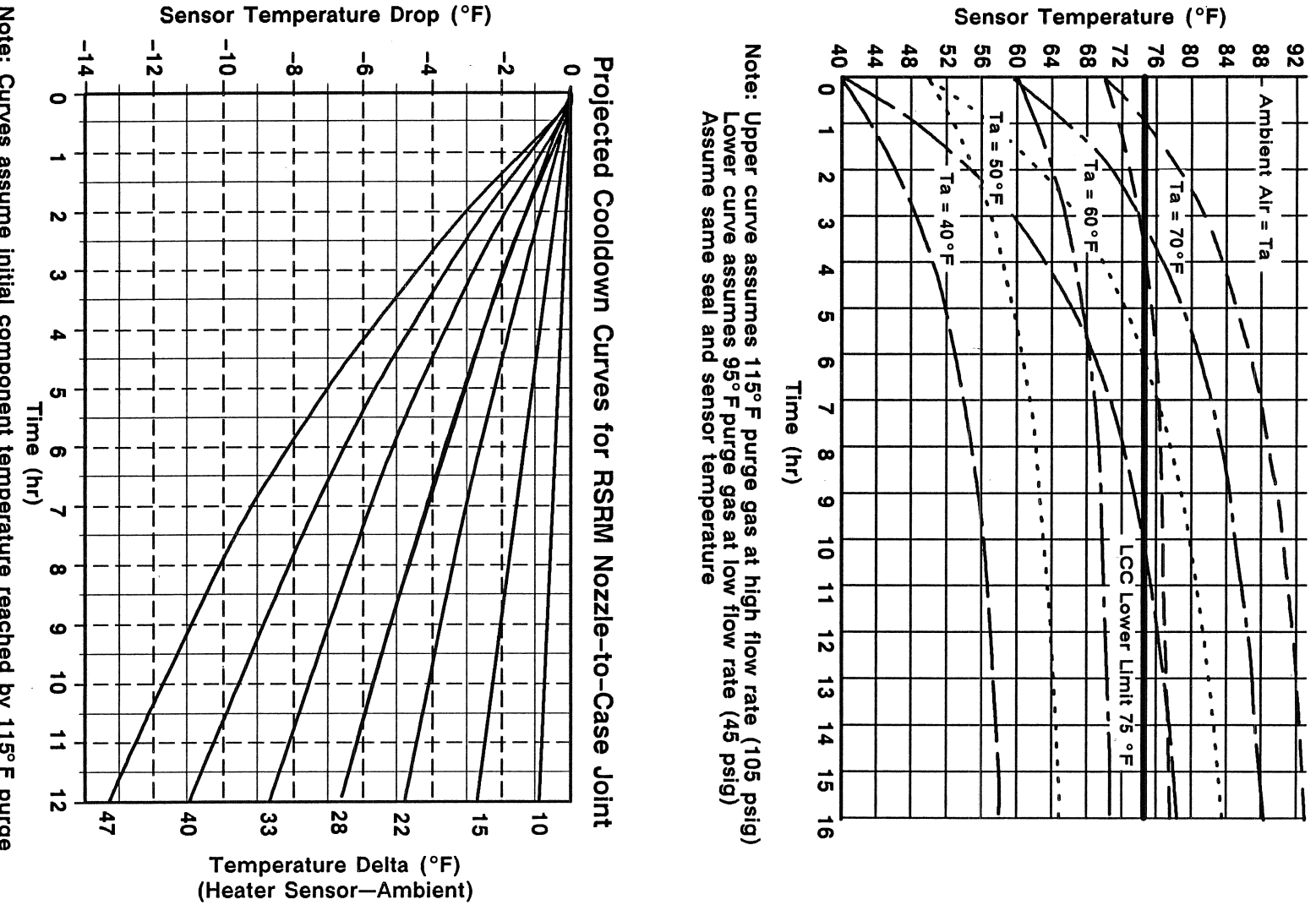
AVERAGE FLEX BEARING TEMPERATURE (DEGREES F)	GEI SENSOR READING	AFT END MINIMUM CONDITIONING TIME (HOURS)
40		85
50		60
59		27

1. A LINEAR INTERPOLATION SHALL BE MADE TO OBTAIN THE AFT END CONDITIONING TIME IF THE AVERAGE FLEX BEARING TEMPERATURE IS BETWEEN THE VALUES ABOVE.

2. THE ABOVE MINIMUM CONDITIONING TIME IS BASED ON 115 DEGREES F PURGE GAS UNTIL THE HIGHEST NOZZLE TO CASE OR NOZZLE FLEX BEARING GEI TEMPERATURE SENSOR READING INDICATES 95 DEGREES F. IF CONDITIONING TIME REMAINS, THE PURGE GAS SHALL BE MAINTAINED AT 95+/-5 DEGREES F UNTIL T-6 HOURS (CONDITION COMPLETION).

6.0 Nozzle (Cont)

Projected Nozzle–to–Case Joint Heating/Cooldown Curves

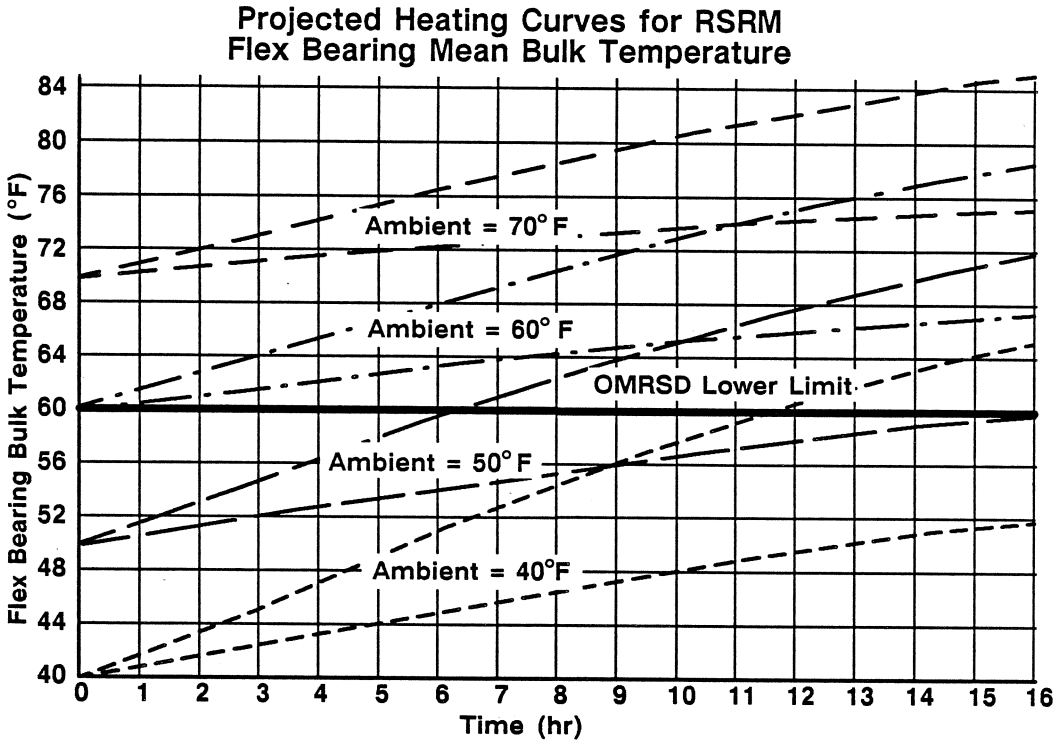


Note: Upper curve assumes 115°F purge gas at high flow rate (105 psig)
Lower curve assumes 95°F purge gas at low flow rate (45 psig)
Assume same seal and sensor temperature

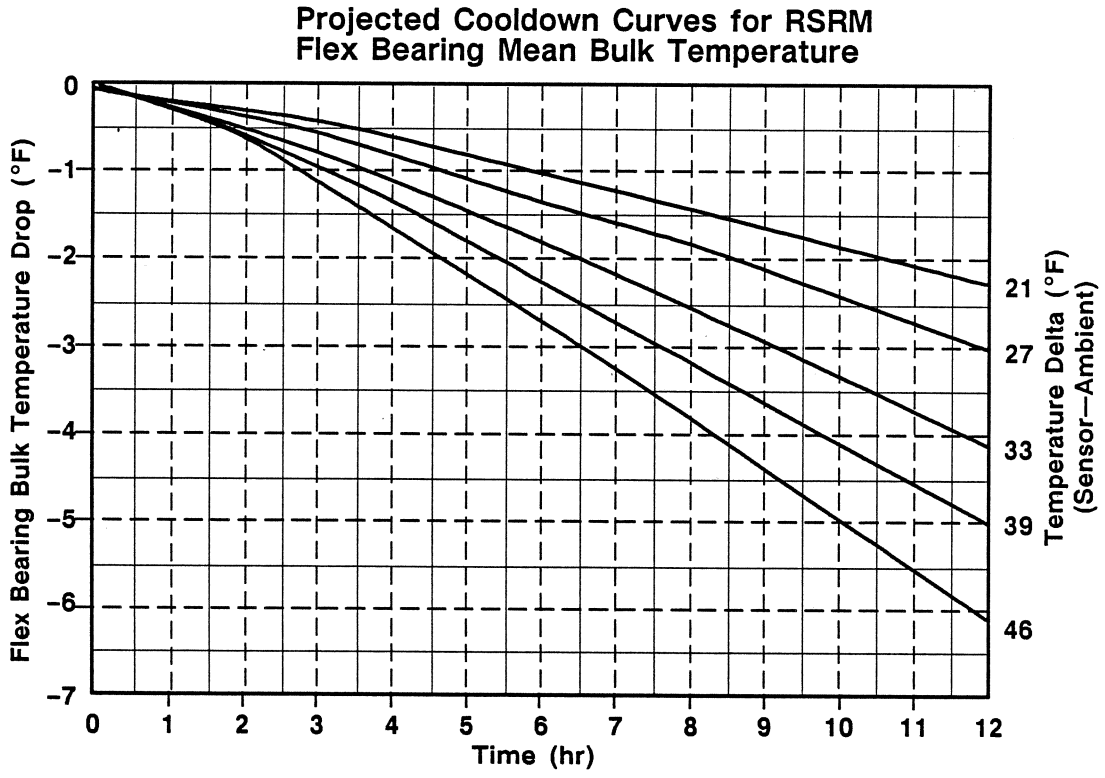
Note: Curves assume initial component temperature reached by 115°F purge gas at high flow rate (105 psig). Cooling assumes no purge operation and same seal/sensor temperature

6.0 Nozzle (Cont)

Projected Flex Bearing Mean Bulk Temperature Heating/Cooldown Curves



Note: Upper curve assumes 115°F purge gas at high flow rate (105 psig)
Lower curve assumes 95°F purge gas at low flow rate (45 psig)



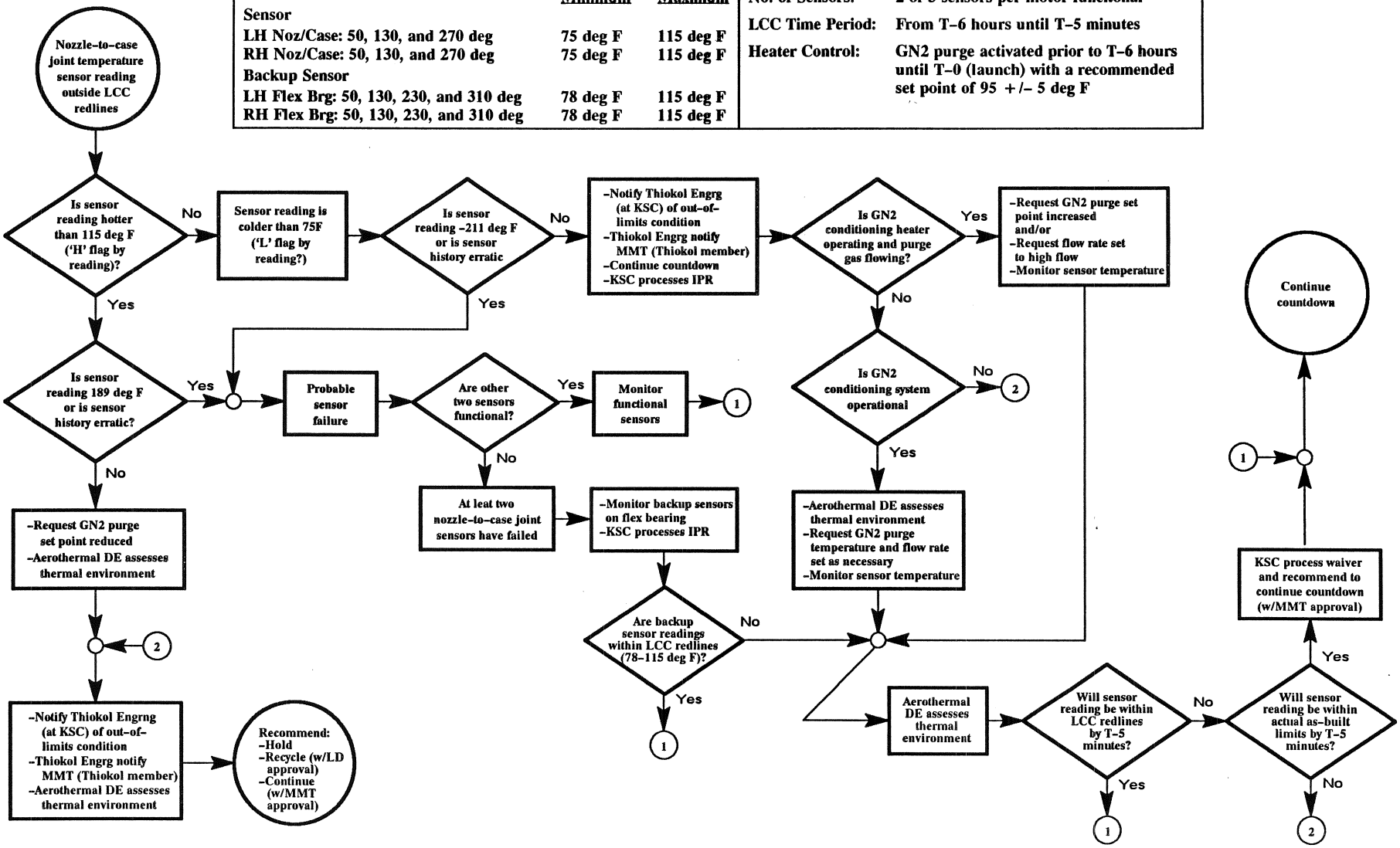
Note: Curves assume initial component temperature reached by 115° F purge gas at flow rate (105 psig)
Cooling assumes no purge operation

6.0 Nozzle (Cont)

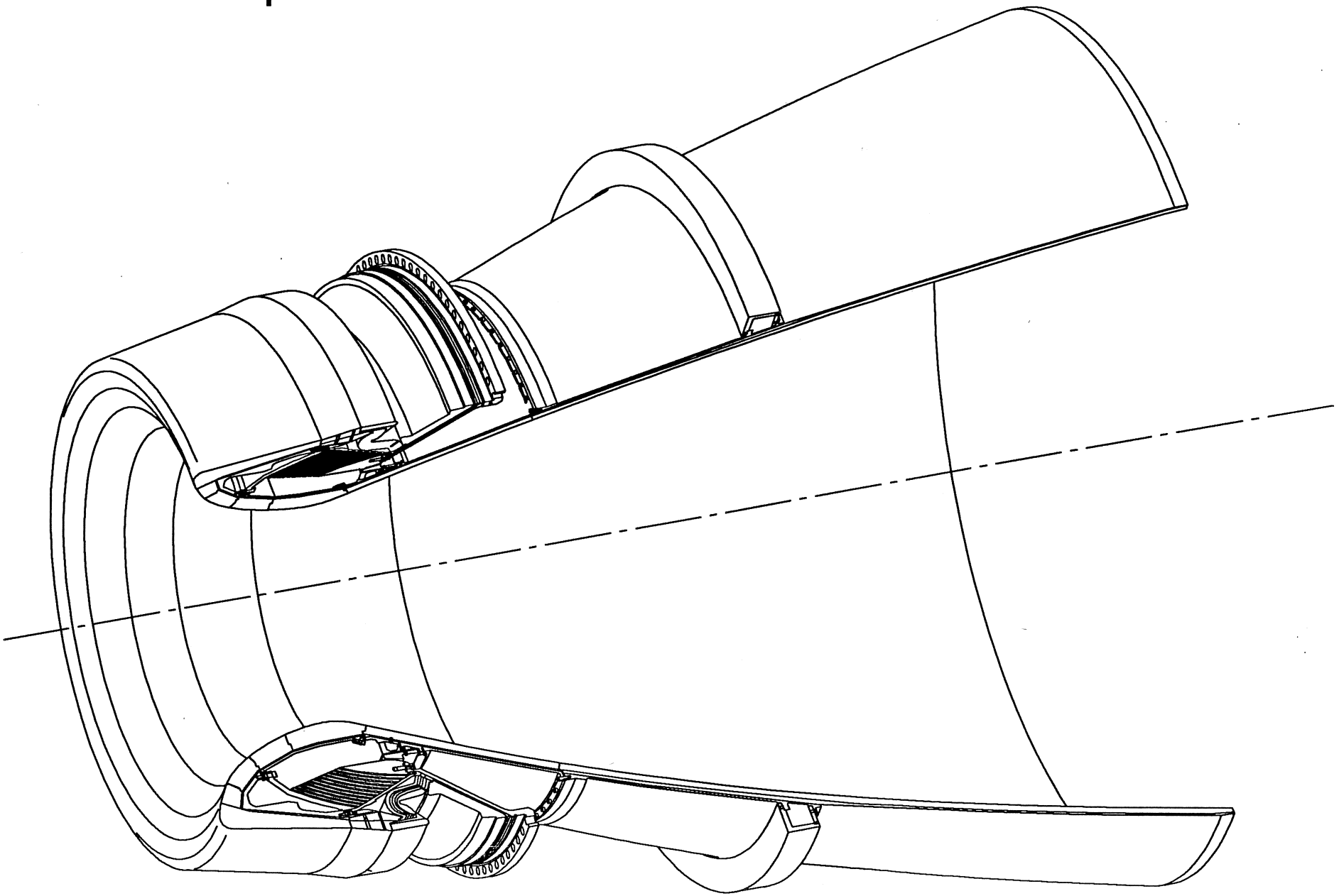
Nozzle–to–Case Joint Temperature (Decision Tree)

Sensor	Minimum	Maximum
LH Noz/Case: 50, 130, and 270 deg	75 deg F	115 deg F
RH Noz/Case: 50, 130, and 270 deg	75 deg F	115 deg F
Backup Sensor		
LH Flex Brg: 50, 130, 230, and 310 deg	78 deg F	115 deg F
RH Flex Brg: 50, 130, 230, and 310 deg	78 deg F	115 deg F

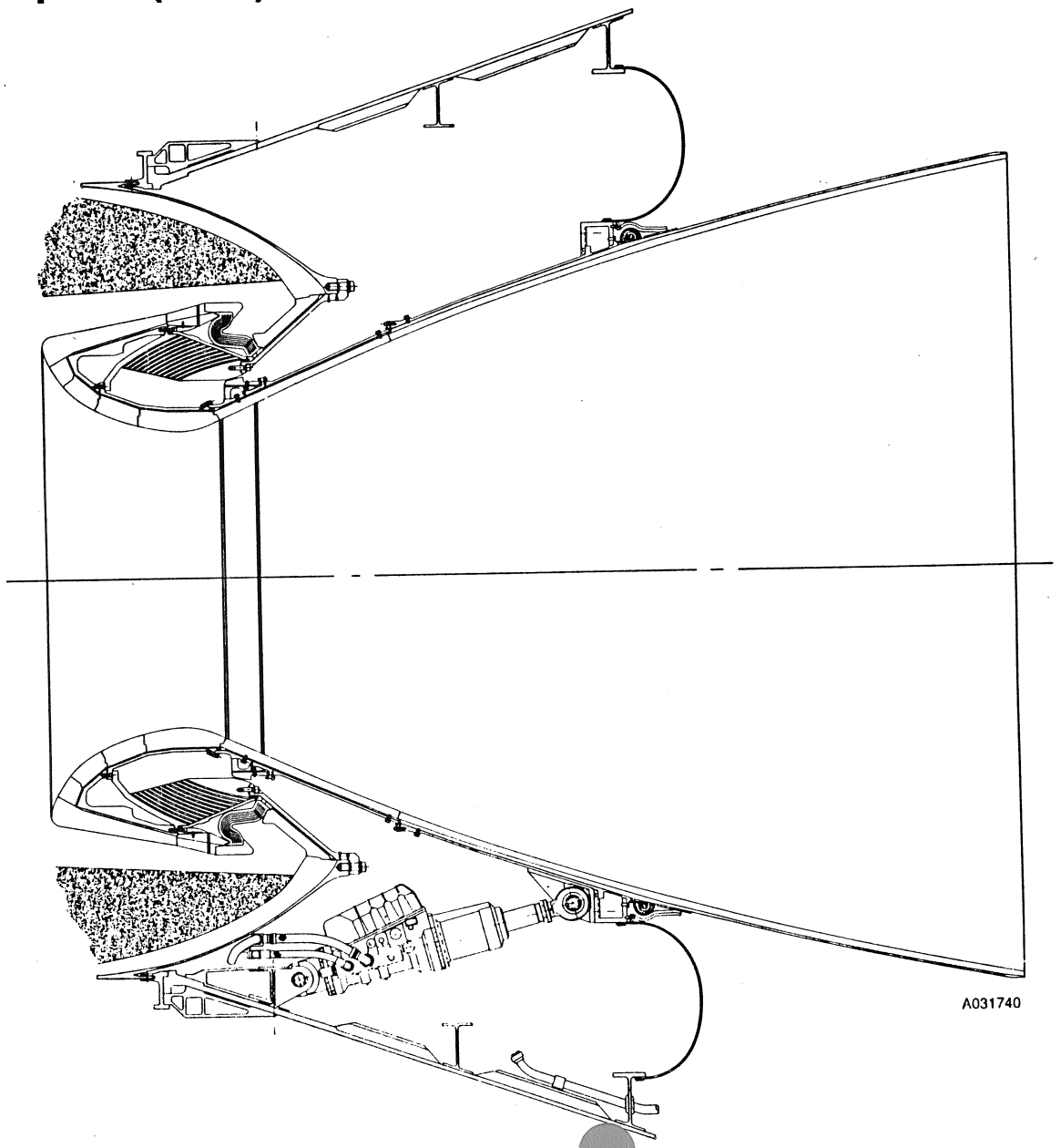
No. of Sensors:	2 of 3 sensors per motor funcitonal
LCC Time Period:	From T–6 hours until T–5 minutes
Heater Control:	GN2 purge activated prior to T–6 hours until T–0 (launch) with a recommended set point of 95 +/– 5 deg F



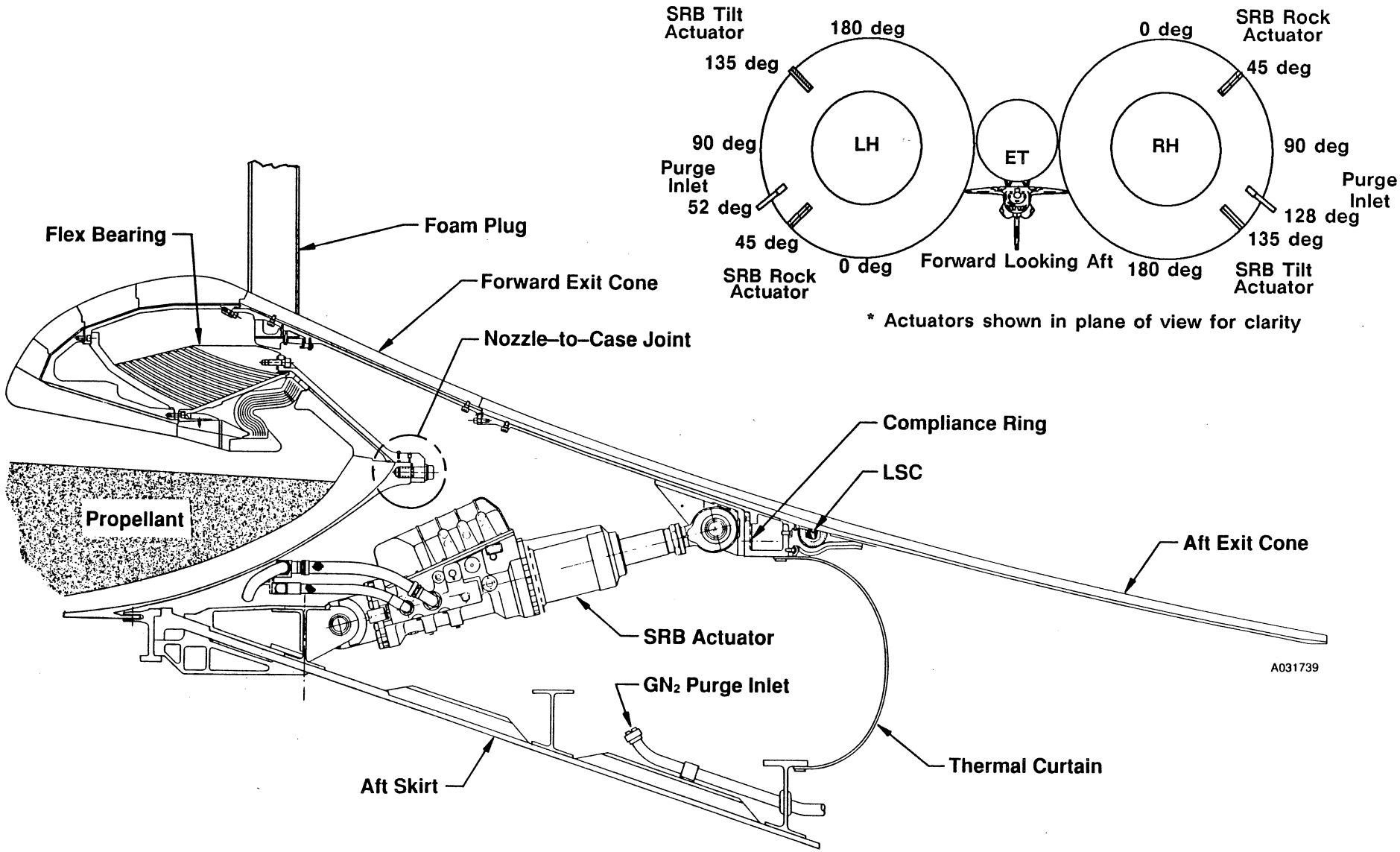
Nozzle Description



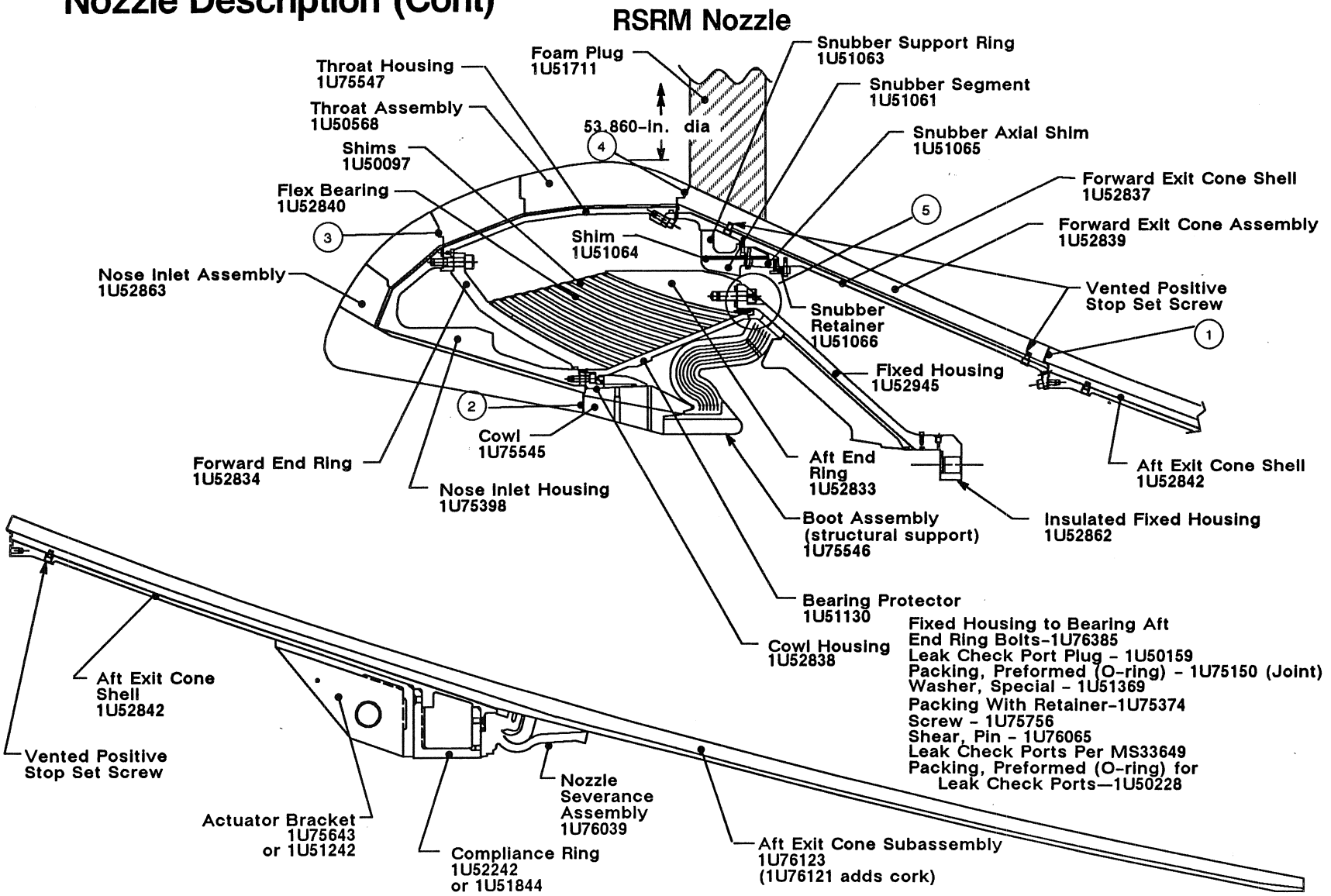
Nozzle Description (Cont)



Nozzle Description (Cont)



Nozzle Description (Cont)



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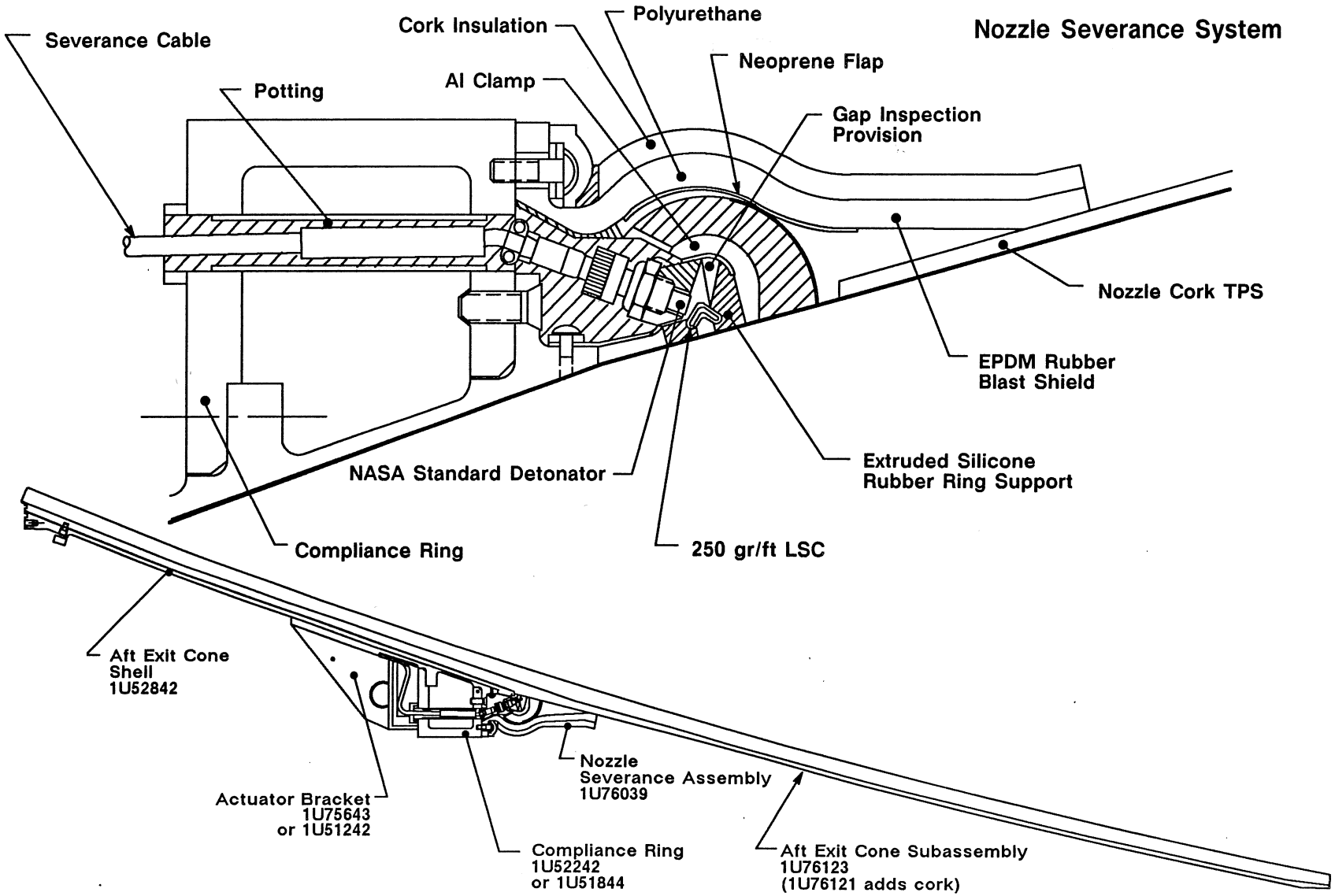
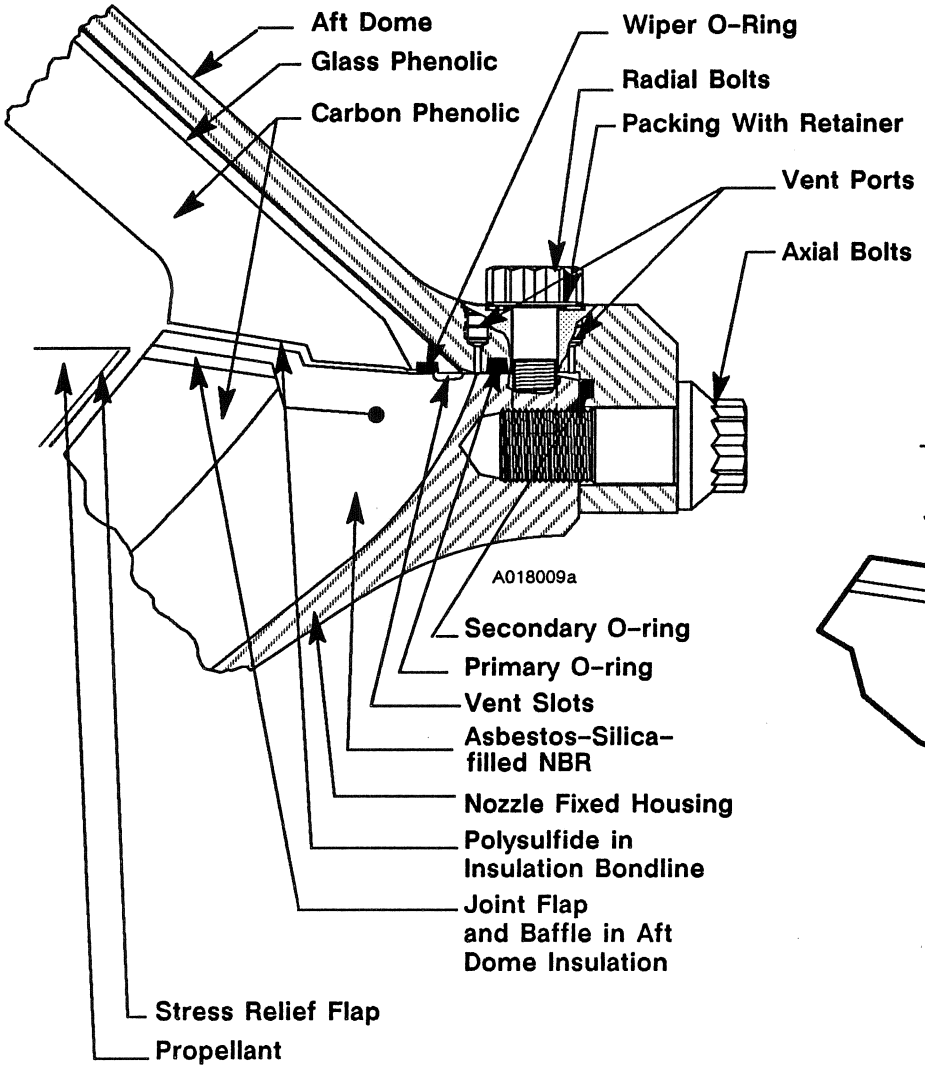
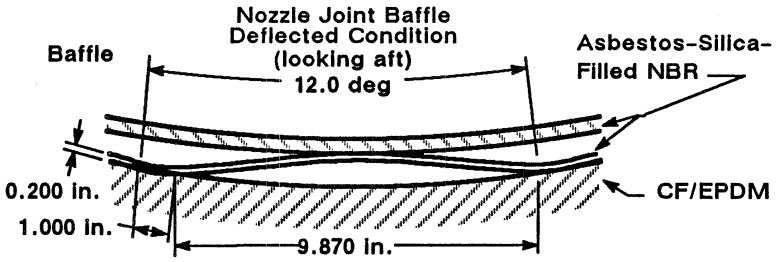
6.0 Nozzle (Cont)

Nozzle Description (Cont)

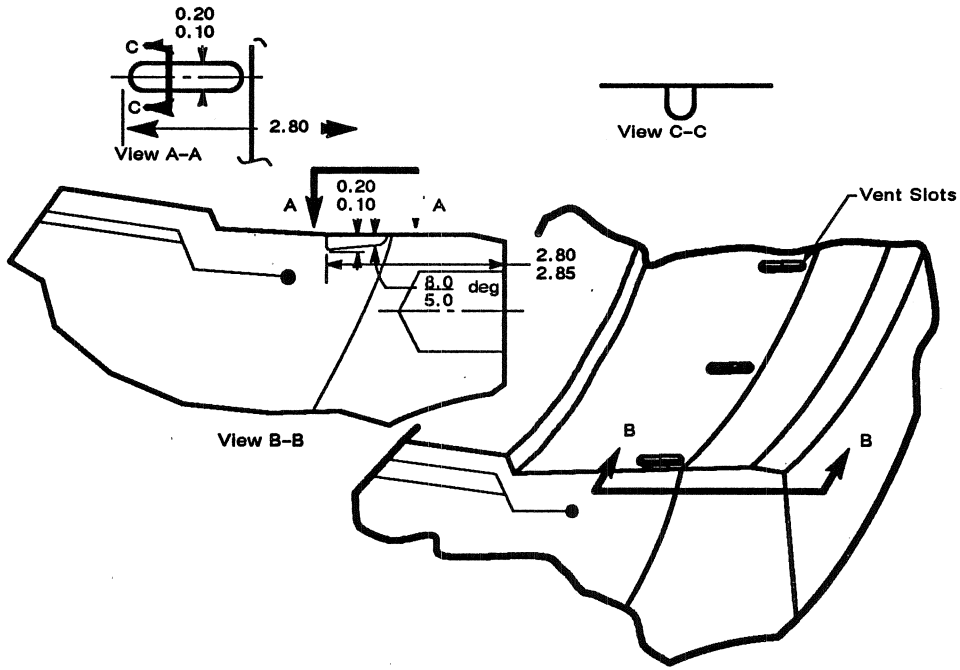


Nozzle–to–Case Joint Description (Cont)





Aft Dome Nozzle-to-Case Joint—Wiper Vent Slots



7.0 Instrumentation

Chamber Pressure LCC

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-04

LCC VIOLATION CALL: SRM CHAMBER PRESSURE ANOMALY | EMERG COND NONE

MEAS NO.	MEASUREMENT DESCRIPTION	CAT.	MIN	MAX	UNITS	CODE
B47P1300C	LH Press A SRM Chamber		-7.0	33.0	psia	CI
B47P1301C	LH Press B SRM Chamber		-7.0	33.0	psia	CI
B47P1302C	LH Press C SRM Chamber		-7.0	33.0	psia	CI
B47P2300C	RH Press A SRM Chamber		-7.0	33.0	psia	CI
B47P2301C	RH Press B SRM Chamber		-7.0	33.0	psia	CI
B47P2302C	RH Press C SRM Chamber		-7.0	33.0	psia	CI

TIME PERIOD: From Completion of Chamber Pressure Simulation Test
(1) (Approx T-1 hr, 30 min) to Go for RSLS Start (T-31 sec)

REQUIREMENTS: DRAWING:

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

(1) Ref OMRS S00FF0.180

REDLINE DERIVATION: CRITICALITY:

(2) Redline development:

	Minimum	Maximum
Ambient Pressure	14.7 psia	14.7 psia
Allowable OPT bias (3)	- 10.0 psia	30.0 psia
KSC LPS bias	- 11.3 psia	-11.3 psia
Redline (rounded)	-7.0 psia	33.0 psia

(3) OPT = Operational Pressure Transducer

(4) Two of three chamber pressure indications ($\leq$ 50 psia) are voted to begin SRB separation. This redline ensures that the transducers and monitor circuits are functional

CONSEQUENCES OF EXCEEDING REDLINE:

(5) Loss of primary SRB/ET separation cue and SRM nozzle vector limiting criteria (multiple failures)

NSTS 16007 LAUNCH COMMIT CRITERIA AND BACKGROUND SSID: SRM-04

CAUSES OF EXCEEDING REDLINE:

(6) Chamber pressure monitor circuits failure
(7) Chamber pressure transducer failure
(8) Instrumentation failure

BIT VALUE	PCM RANGE LOW	PCM RANGE HIGH	METER RANGE LOW	METER RANGE HIGH	C AND W MIN	C AND W MAX	SM MIN	SM MAX
2.0	0	1000						

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO. JSC 11174 SHEET 10.2 ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO. VS72-948099 SHEET 24 ZONE B4

NASA: MSFC, S. Thornton CONTRACTOR: TC, R. Rasmussen

ELEMENT: SRB SUBSYSTEM: SRM MISSION: STS-42-999

OMRSD Reference

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FF0.180	1R	RSRM CHAMBER PRESS BIAS AND CAL CHECK		HAZ	A:SAF1-90
	0-000				B:
	0-001	VERIFY THE OPERATION OF THE RSRM CHAMBER			C: C-1: ALLOW 30 MINUTES AFTER POWER IS APPLIED TO RSRM CHAMBER PRESSURE TRANSDUCER BEFORE READINGS ARE NOTED/RECORDED OR SIM CMDS INITIATED.
	0-002	PRESSURE TRANSDUCER CIRCUITS A/B/C			
	0-003				R-1: CALIBRATION LEVEL FOR THE CHAMBER PRESSURE TRANSDUCER IS 75% FULL SCALE PLUS THE AMBIENT PRESSURE.
	0-004	A. COMMANDS:			
	0-005	LH RSRM CHAMBER PRESS A SIM CMD	B47K3005X	ON	
	0-006	LH RSRM CHAMBER PRESS B SIM CMD	B47K3006X	ON	
	0-007	LH RSRM CHAMBER PRESS C SIM CMD	B47K3007X	ON	
	0-008	RH RSRM CHAMBER PRESS A SIM CMD	B47K4005X	ON	
	0-009	RH RSRM CHAMBER PRESS B SIM CMD	B47K4006X	ON	
	0-010	RH RSRM CHAMBER PRESS C SIM CMD	B47K4007X	ON	
	0-011				R-2: AMBIENT LIMITS ARE SELECTED TO ALLOW FOR TRANSDUCER BIAS VALUES BETWEEN 0-100 MILLIVOLTS (AT 0 PSIA) AND +/-50 MILLIVOLTS FOR TRANSDUCER ERROR.
	0-012	B. RESPONSES:			
	0-013	LH RSRM CHAMBER PRESS A	B47P1300C	729 TO 799 PSIA	
	0-014	LH RSRM CHAMBER PRESS B	B47P1301C	729 TO 799 PSIA	
	0-015	LH RSRM CHAMBER PRESS C	B47P1302C	729 TO 799 PSIA	
	0-016	RH RSRM CHAMBER PRESS A	B47P2300C	729 TO 799 PSIA	
	0-017	RH RSRM CHAMBER PRESS B	B47P2301C	729 TO 799 PSIA	
	0-018	RH RSRM CHAMBER PRESS C	B47P2302C	729 TO 799 PSIA	R-3. TRANSDUCER CALIBRATION LIMITS ARE SELECTED TO ALLOW FOR SCALE FACTOR (GAIN) VARIATION OF 4.90 TO 5.10 MV/PSIA AND ALLOW FOR TRANSDUCER BIAS SHIFT OF 0-100 MILLIVOLTS (AT 0 PSIA) AND TRANSDUCER ERROR OF +/-50 MILLIVOLTS.
	0-019				
	0-020				
	0-021	LH EVENT RSRM PRESS A SIM CMD	B47X1901X	ON	
	0-022	LH EVENT RSRM PRESS B SIM CMD	B47X1902X	ON	
	0-023	LH EVENT RSRM PRESS C SIM CMD	B47X1903X	ON	
	0-024	RH EVENT RSRM PRESS A SIM CMD	B47X2901X	ON	
	0-025	RH EVENT RSRM PRESS B SIM CMD	B47X2902X	ON	
	0-026	RH EVENT RSRM PRESS C SIM CMD	B47X2903X	ON	
	0-027				
	0-028	C. COMMANDS:			
	0-029	LH RSRM CHAMBER PRESS A SIM CMD	B47K3005X	OFF	
	0-030	LH RSRM CHAMBER PRESS B SIM CMD	B47K3006X	OFF	
	0-031	LH RSRM CHAMBER PRESS C SIM CMD	B47K3007X	OFF	
	0-032	RH RSRM CHAMBER PRESS A SIM CMD	B47K4005X	OFF	
	0-033	RH RSRM CHAMBER PRESS B SIM CMD	B47K4006X	OFF	
	0-034	RH RSRM CHAMBER PRESS C SIM CMD	B47K4007X	OFF	
	0-035				
	0-036	D. RESPONSES:			
	0-037	LH RSRM CHAMBER PRESS A	B47P1300C	-7 TO 33 PSIA	
	0-038	LH RSRM CHAMBER PRESS B	B47P1301C	-7 TO 33 PSIA	
	0-039	LH RSRM CHAMBER PRESS C	B47P1302C	-7 TO 33 PSIA	
	0-040	RH RSRM CHAMBER PRESS A	B47P2300C	-7 TO 33 PSIA	
	0-041	RH RSRM CHAMBER PRESS B	B47P2301C	-7 TO 33 PSIA	
	0-042	RH RSRM CHAMBER PRESS C	B47P2302C	-7 TO 33 PSIA	
	0-043				
	0-044	LH EVENT RSRM PRESS A SIM CMD	B47X1901X	OFF	
	0-045	LH EVENT RSRM PRESS B SIM CMD	B47X1902X	OFF	
	0-046	LH EVENT RSRM PRESS C SIM CMD	B47X1903X	OFF	
	0-047	RH EVENT RSRM PRESS A SIM CMD	B47X2901X	OFF	
	0-048	RH EVENT RSRM PRESS B SIM CMD	B47X2902X	OFF	
	0-049	RH EVENT RSRM PRESS C SIM CMD	B47X2903X	OFF	
	0-050				
	0-051				D: HAZ #: SRB HA B-00-17
	0-052				REF:

OMRSD Reference

REQUIREMENT NUMBER	REV	DESCRIPTION	MEAS/STIMU	SPECIFICATION	INTERVALS/CONSTRAINTS/REMARKS
S00FF0.161	1R	RSRM CHAMBER PRESS XDUCER CALIB		HAZ	A:SAF1-90
	0-000				B:
	0-001	RSRM PRESS VERIF AND LOAD IN GNC09			C: C-1: PERFORM IN GNC09 OPS
	0-002				CODE 1001000 WITHIN 9 HOURS
	0-003	CHECK PRESSURE BIAS OF RSRM		-17.5 TO -2.5	OF LAUNCH.
	0-004	PRESSURE TRANSDUCERS AND		PSIA	
	0-005	PERFORM GPC UPDATE IF REQUIRED			C-2: A GPC UPDATE OF THE
	0-006	(SEE C-2)			PRESSURE BIAS IS REQUIRED WHEN
	0-007				COMPUTED PRESSURE BIAS IS
	0-008	LH PRESS A RSRM CHAMBER	B47P1300C		GREATER THAN -2.5 PSIA OR
	0-009	RH PRESS A RSRM CHAMBER	B47P2300C		LESS THAN -17.5 PSIA.
	0-010	LH PRESS B RSRM CHAMBER	B47P1301C		
	0-011	RH PRESS B RSRM CHAMBER	B47P2301C		
	0-012	LH PRESS C RSRM CHAMBER	B47P1302C		
	0-013	RH PRESS C RSRM CHAMBER	B47P2302C		
	0-014				C-3: ALLOW 30 MINUTES AFTER
	0-015				PWR IS APPLIED TO RSRM CHAMBER
	0-016				PRESSURE TRANSDUCERS BEFORE
	0-017				READINGS ARE RECORDED OR
	0-018				SIMULATIONS ARE INITIATED.
	0-019				
	0-020				R-1: PRESSURE BIAS VALUE
	0-021				CALCULATION:
	0-022				A. RECORD THE XDUCER AMBIENT
	0-023				OUTPUTS USING THE RAW DATA
	0-024				READ OF THE MDM AND CONVERT TO
	0-025				MILLIVOLT READINGS.
	0-026				B. DIVIDE THE AMBIENT OUTPUTS
	0-027				(MV) RECORDED IN "A" BY THE
	0-028				TRANSDUCER SCALE FACTOR
	0-029				(4.989 MV/PSIA)
	0-030				C. SUBTRACT THE VALUES OBTAINED
	0-031				IN "B" FROM THE AMBIENT PRESSURE
	0-032				14.7 PSIA (SEA LEVEL)
	0-033				D. THE VALUES OBTAINED IN "C"
	0-034				IS THE COMPUTED PRESSURE BIAS
	0-035				VALUE FOR EACH TRANSDUCER.
	0-036				
	0-037				D: ICD 2-14001
	0-038				HAZ #: RSRM AI-01, BI-01
	0-039				

7.0 Instrumentation (Cont)

Operational Pressure Transducer/Calibration

Explanation of OPT Calibration Reports

Item 1. Range—Represents the precise test pressure range (psia) to which the gage was subjected to during calibration.

Item 2. Open Vdc output (at 100%)—Represents the gage dc voltage output at the range value plus ambient atmospheric pressure.

Item 3. Open Vdc or output at 0%—Represents the gage dc voltage output at 0 psig or ambient atmospheric pressure.

Item 4. Span Vdc—Represents the gage dc voltage output over the range of 1,000 psi and is derived by subtracting the open or 0% voltage from the voltage at 100% (Item 2 minus Item 3). It is the specific gage conversion or scale factor in V/1,000 psi or mV/psi.

Item 5. Ambient Pressure in psia—The ambient absolute pressure (in pounds per square inch) at the time of the calibration.

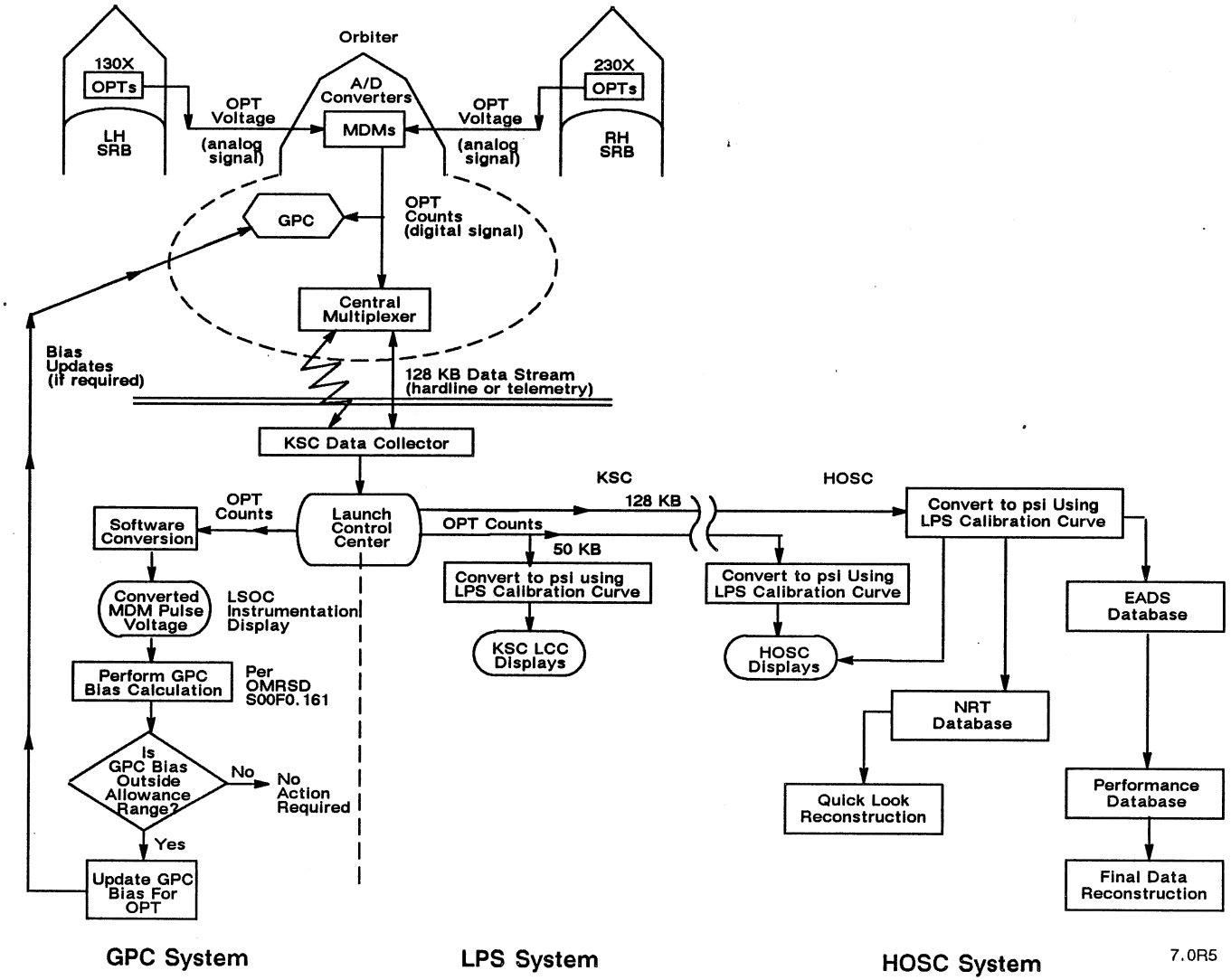
Item 6. Shorted Vdc—The dc voltage output from the gage when Pins E and F are shorted, causing a precision resistor to be placed (in series) in the circuit. The output reading caused by this resistor is 75% (± 1.5%) of full scale.

Item 7. Difference—The shorted (75% cal) value minus the ambient reading.

C.E.C.	1U50188-10R	N/A	0000072R3	26 Jul 90
MFG	MODEL	MFG SN	THIOKOL SN:	CALIB DATE
1000 PSIA (1)	75	12.55 PSIA (5)	4.993 (4)	28
RANGE	TEMP °F	BAROMETER IN HG	SPAN—VOLTS DC	EXCITATION VDC

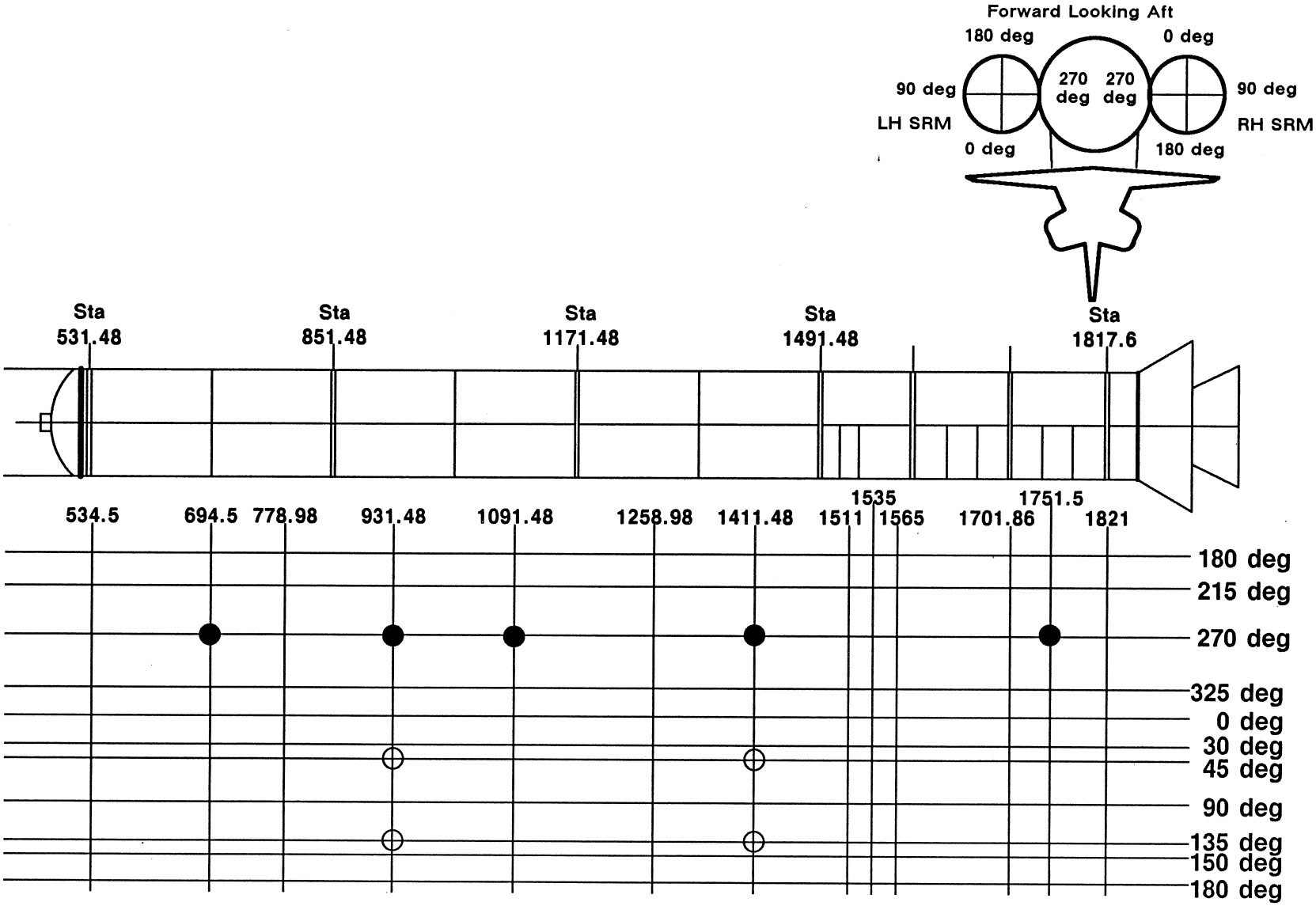
Electrical Simulation		PSIG VDC Output (2)		Linearity		Hysteresis	
PINS E&F:	(3)	100% =	5.093	100% =	100.00		
Open: VDC =	0.100	80% =	4.093	80% =	79.96	80% =	-0.02
Shorted: VDC =	3.856 (6)	60% =	3.093	60% =	59.94	60% =	-0.04
Difference =	3.756	40% =	2.095	40% =	39.96	40% =	-0.03
	(7)	20% =	1.098 (3)	20% =	19.99	20% =	-0.02
% =	75.22	0% =	0.100	0% =	0.00	0% =	-0.01

OPT Data Flow Schematic



7.0 Instrumentation (Cont)

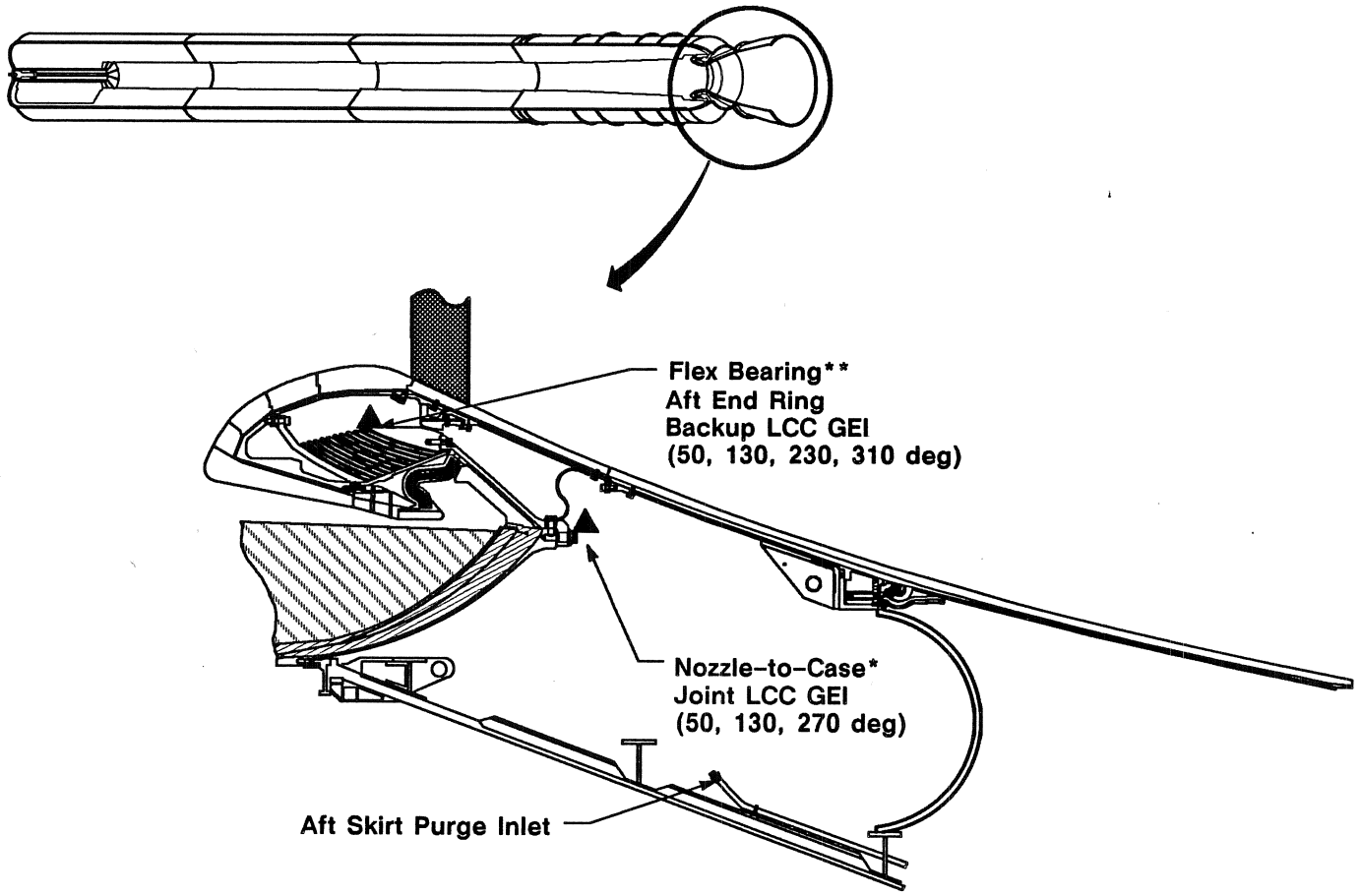
Case Ground Environmental Instrumentation (GEI)



○ Denotes Case GEI Temperature Sensors

● Denotes Case GEI Temperature Sensors Required for LCC(3 of 5 per motor required for LCC compliance)

Nozzle/Exit Cone



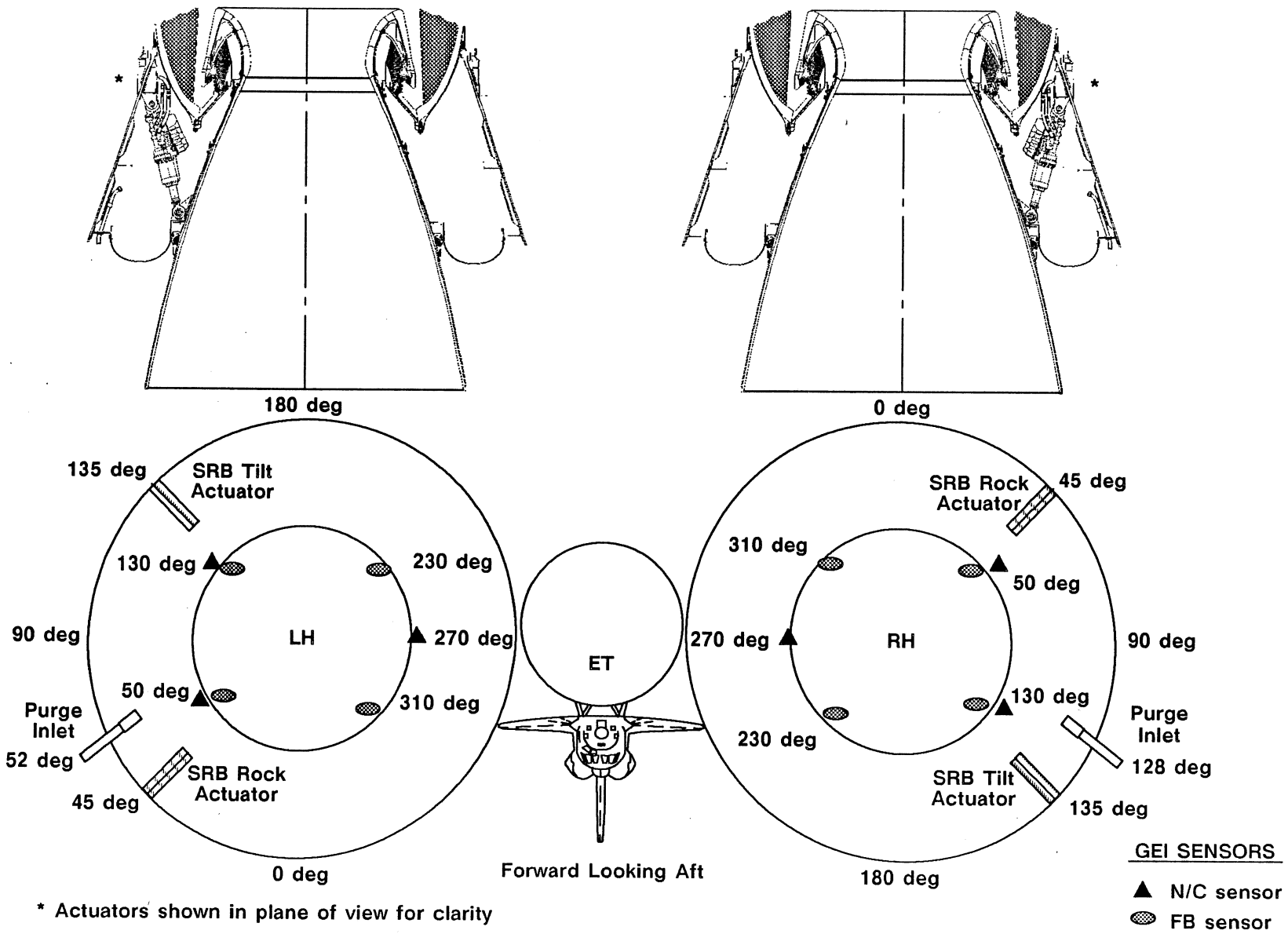
Legend

▲ GEI Temperature Sensor

*2 of 3 required for LCC compliance
** Flex Bearing sensors are designated nozzle/case backup LCC sensors

7.0 Instrumentation (Cont)

Aft Skirt



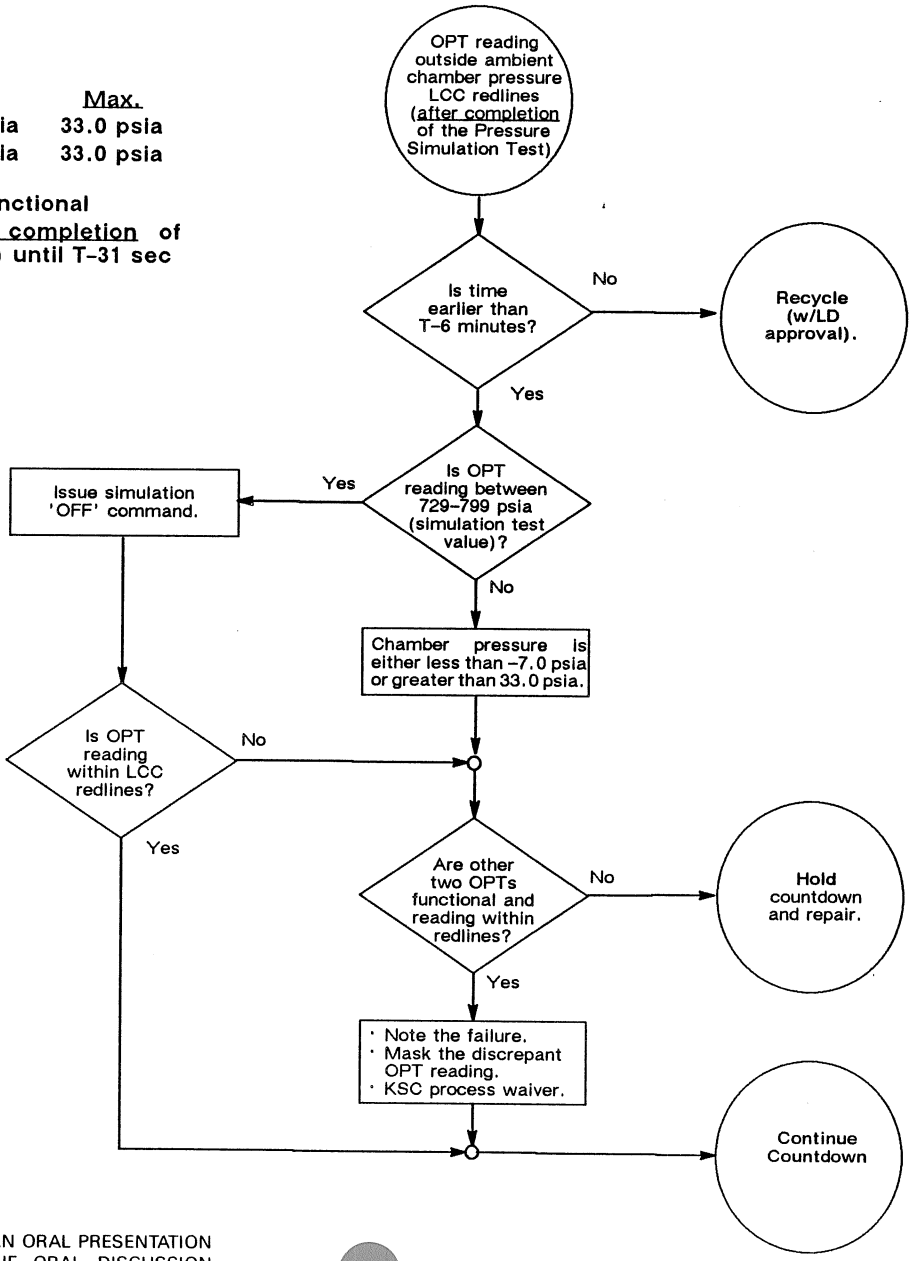
* Actuators shown in plane of view for clarity

7.0 Instrumentation (Cont)

Ambient Chamber Pressure (Decision Tree)

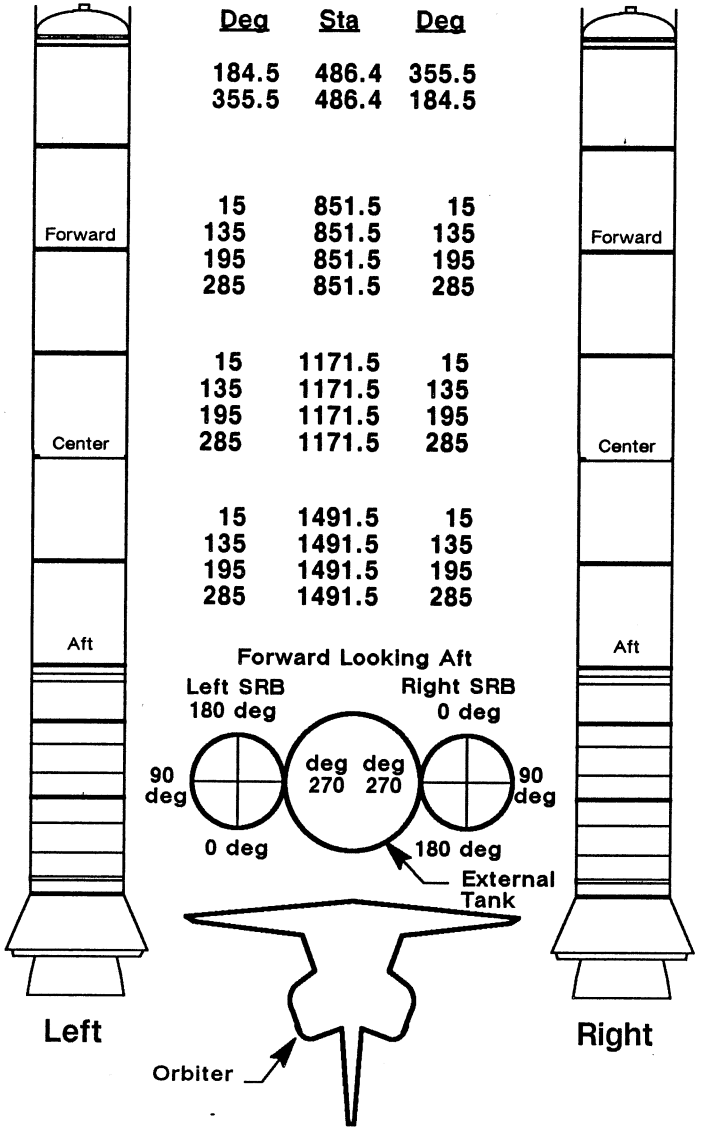
Sensor	Min.	Max.
LH OPT 40°, 180°, 270°	-7.0 psia	33.0 psia
RH OPT 40°, 180°, 270°	-7.0 psia	33.0 psia

No. of Sensors: 3 of 3 OPTs per motor functional
LCC Time Period: From T-1.5 hr (After completion of pressure simulation test) until T-31 sec



Joint Instrumentation Overview

	Instrumentation No.	Setpoint Temp (°F)	LCC (Max/Min °F)
Igniter	B06T7085 B06T7086	100 ± 1	125 74
Forward Field Joint	B06T7060 B06T7061 B06T7062 B06T7063	97.5 ± 1	123 80
Center Field Joint	B06T7064 B06T7065 B06T7066 B06T7067	97.5 ± 1	123 80
Aft Field Joint	B06T7068 B06T7069 B06T7070 B06T7071	97.5 ± 1	123 80

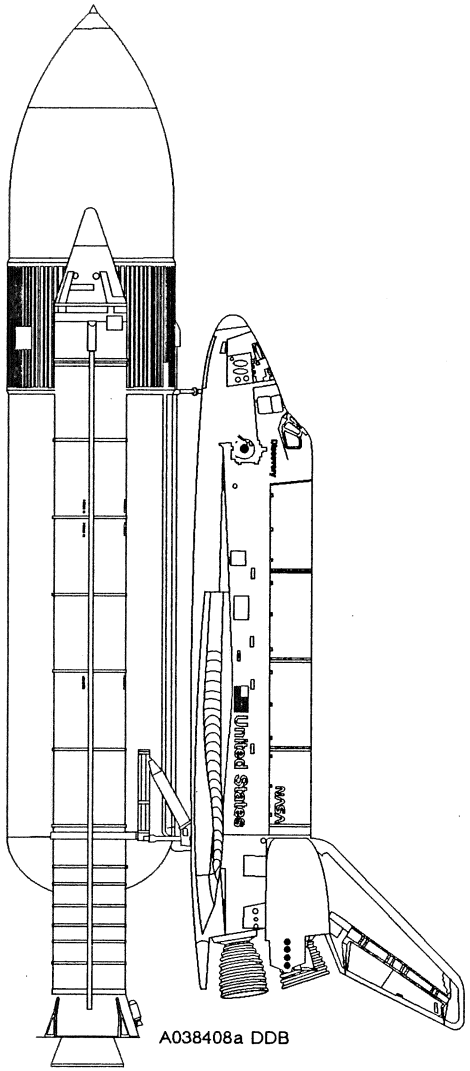


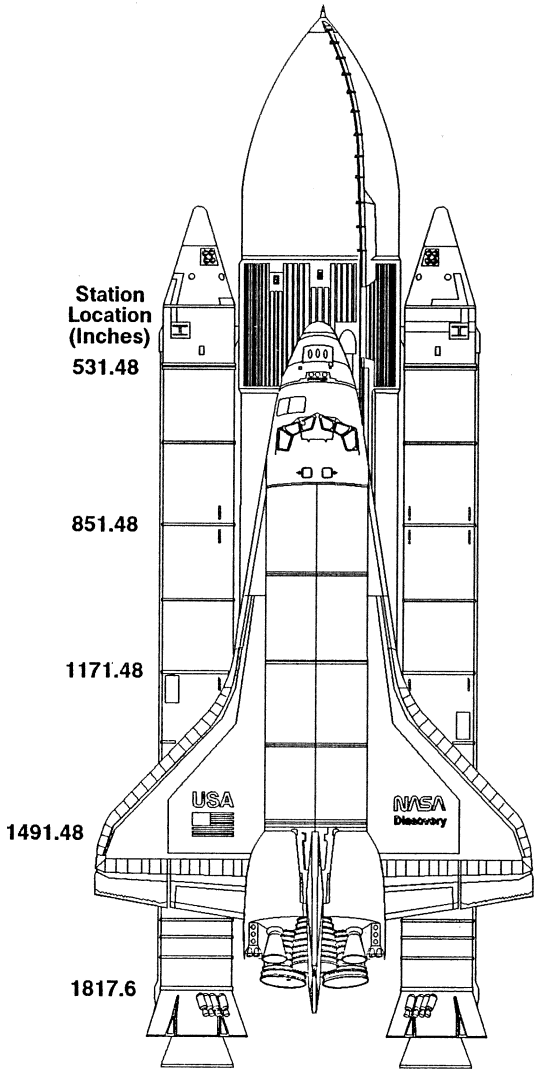
LCC (Max/Min °F)	Setpoint Temp (°F)	Instrumentation No.	
125 74	100 ± 1	B06T8085 B06T8086	Igniter
123 80	97.5 ± 1	B06T8060 B06T8061 B06T8062 B06T8063	Forward Field Joint
123 80	97.5 ± 1	B06T8064 B06T8065 B06T8066 B06T8067	Center Field Joint
123 80	97.5 ± 1	B06T8068 B06T8069 B06T8070 B06T8071	Aft Field Joint

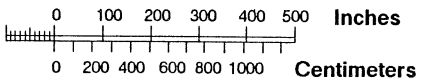
A020748aR8

7.0 Instrumentation (Cont)

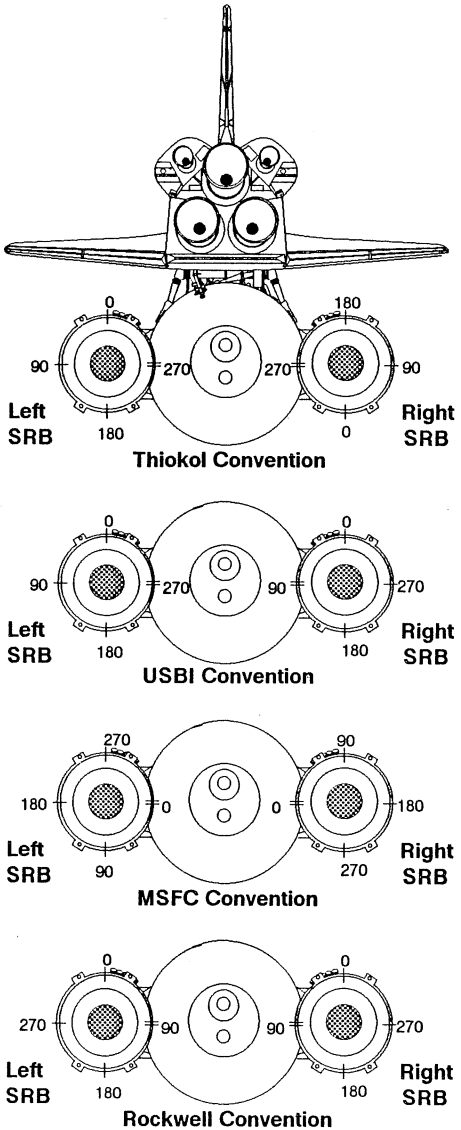
Instrumentation Orientation Summary







1/400th Scale



Aft Looking Forward

Joint Heater Temperature Sensors

INSTRUMENT No.	SRB	ANGLE LOCATION	STATION	RANGE (°F) FROM - TO	REMARKS
B06T7085A	LH	184.5	486.4	-4 TO 158	IGNITER JOINT
B06T7086A	LH	355.5	486.4	-4 TO 158	IGNITER JOINT
B06T7060A	LH	15	851.5	-4 TO 158	FORWARD JOINT
B06T7061A	LH	135	851.5	-4 TO 158	FORWARD JOINT
B06T7062A	LH	195	851.5	-4 TO 158	FORWARD JOINT
B06T7063A	LH	285	851.5	-4 TO 158	FORWARD JOINT
B06T7064A	LH	15	1171.5	-4 TO 158	CENTER JOINT
B06T7065A	LH	135	1171.5	-4 TO 158	CENTER JOINT
B06T7066A	LH	195	1171.5	-4 TO 158	CENTER JOINT
B06T7067A	LH	285	1171.5	-4 TO 158	CENTER JOINT
B06T7068A	LH	15	1491.5	-4 TO 158	AFT JOINT
B06T7069A	LH	135	1491.5	-4 TO 158	AFT JOINT
B06T7070A	LH	195	1491.5	-4 TO 158	AFT JOINT
B06T7071A	LH	285	1491.5	-4 TO 158	AFT JOINT
B06T8085A	RH	355.5	486.4	-4 TO 158	IGNITER JOINT
B06T8086A	RH	184.5	486.4	-4 TO 158	IGNITER JOINT
B06T8060A	RH	15	851.5	-4 TO 158	FORWARD JOINT
B06T8061A	RH	135	851.5	-4 TO 158	FORWARD JOINT
B06T8062A	RH	195	851.5	-4 TO 158	FORWARD JOINT
B06T8063A	RH	285	851.5	-4 TO 158	FORWARD JOINT
B06T8064A	RH	15	1171.5	-4 TO 158	CENTER JOINT
B06T8065A	RH	135	1171.5	-4 TO 158	CENTER JOINT
B06T8066A	RH	195	1171.5	-4 TO 158	CENTER JOINT
B06T8067A	RH	285	1171.5	-4 TO 158	CENTER JOINT
B06T8068A	RH	15	1491.5	-4 TO 158	AFT JOINT
B06T8069A	RH	135	1491.5	-4 TO 158	AFT JOINT
B06T8070A	RH	195	1491.5	-4 TO 158	AFT JOINT
B06T8071A	RH	285	1491.5	-4 TO 158	AFT JOINT

Joint Heater Control Sensors

INSTRUMENT No. Primary	INSTRUMENT No. Secondary	SRB	REMARKS
B06C7085A	B06C7185A	LH	IGNITER HEATER CURRENT
B06V7040A	B06V7140A	LH	IGNITER HEATER VOLTAGE
B06K7045A	B06K7145A	LH	IGNITER HEATER SET POINT
B06C7010A	B06C7110A	LH	FORWARD HEATER CURRENT
B06V7010A	B06V7110A	LH	FORWARD HEATER VOLTAGE
B06K7015A	B06K7115A	LH	FORWARD HEATER SET POINT
B06C7020A	B06C7120A	LH	CENTER HEATER CURRENT
B06V7020A	B06V7120A	LH	CENTER HEATER VOLTAGE
B06K7025A	B06K7125A	LH	CENTER HEATER SET POINT
B06C7030A	B06C7130A	LH	AFT HEATER CURRENT
B06V7030A	B06V7130A	LH	AFT HEATER VOLTAGE
B06K7035A	B06K7135A	LH	AFT HEATER SET POINT
B06C8085A	B06C8185A	RH	IGNITER HEATER CURRENT
B06V8040A	B06V8140A	RH	IGNITER HEATER VOLTAGE
B06K8045A	B06K8145A	RH	IGNITER HEATER SET POINT
B06C8010A	B06C8110A	RH	FORWARD HEATER CURRENT
B06V8010A	B06V8110A	RH	FORWARD HEATER VOLTAGE
B06K8015A	B06K8115A	RH	FORWARD HEATER SET POINT
B06C8020A	B06C8120A	RH	CENTER HEATER CURRENT
B06V8020A	B06V8120A	RH	CENTER HEATER VOLTAGE
B06K8025A	B06K8125A	RH	CENTER HEATER SET POINT
B06C8030A	B06C8130A	RH	AFT HEATER CURRENT
B06V8030A	B06V8130A	RH	AFT HEATER VOLTAGE
B06K8035A	B06K8135A	RH	AFT HEATER SET POINT

Case Ground Environmental Instrumentation (GEI)

INSTRUMENT No.	SRB	ANGLE LOCATION	STATION	RANGE (°F) FROM - TO	REMARKS
B06T7007A	LH	270	694.5	-200 TO 200	FORWARD SEGMENT
B06T7010A	LH	45	931.48	-200 TO 200	FORWARD CENTER SEGMENT
B06T7011A	LH	135	931.48	-200 TO 200	FORWARD CENTER SEGMENT
B06T7013A	LH	270	931.48	-200 TO 200	FORWARD CENTER SEGMENT
B06T7018A	LH	270	1091.48	-200 TO 200	FORWARD CENTER SEGMENT
B06T7021A	LH	45	1411.48	-200 TO 200	AFT CENTER SEGMENT
B06T7022A	LH	135	1411.48	-200 TO 200	AFT CENTER SEGMENT
B06T7024A	LH	270	1411.48	-200 TO 200	AFT CENTER SEGMENT
B06T7038A	LH	270	1751.5	-200 TO 200	AFT SEGMENT
B06T8007A	RH	270	694.5	-200 TO 200	FORWARD SEGMENT
B06T8010A	RH	135	931.48	-200 TO 200	FORWARD CENTER SEGMENT
B06T8011A	RH	45	931.48	-200 TO 200	FORWARD CENTER SEGMENT
B06T8013A	RH	270	931.48	-200 TO 200	FORWARD CENTER SEGMENT
B06T8018A	RH	270	1091.48	-200 TO 200	FORWARD CENTER SEGMENT
B06T8021A	RH	135	1411.48	-200 TO 200	AFT CENTER SEGMENT
B06T8022A	RH	45	1411.48	-200 TO 200	AFT CENTER SEGMENT
B06T8024A	RH	270	1411.48	-200 TO 200	AFT CENTER SEGMENT
B06T8038A	RH	270	1751.5	-200 TO 200	AFT SEGMENT

SRM Igniter S&A MSID

B55K3000X1	LH	Arm	Command
B55K4000X1	RH	Arm	Command
B55K3002X1	LH	Safe	Command
B55K4002X1	RH	Safe	Command
B55X1842X1	LH	Igniter	Armed
B55X2842X1	RH	Igniter	Armed
B55X1843X1	LH	Igniter	Safed
B55X2843X1	RH	Igniter	Safed

Ambient MSID at Camera Site No. 3

KMTTA001A	Ambient Temperature 6 ft level
KMTTA004A	Ambient Temperature 60 ft level
KMTLA002A	Wind Speed
KMTHA002A	Wind Direction
KMTQA001A	Relative Humidity
KMTPA001A	Barometric Pressure

Ambient MSID at Camera Site No. 6

KMTTA005A	Ambient Temperature 60 ft level
KMTLA001A	Wind Speed
KMTHA001A	Wind Direction

Nozzle/Exit Cone Ground Environmental Instrumentation (GEI)

INSTRUMENT No.	SRB	ANGLE LOCATION	STATION	RANGE (°F) FROM – TO	REMARKS
B06T7087A	LH	50	1847	–200 TO 200	FLEX BEARING
B06T7088A	LH	130	1847	–200 TO 200	FLEX BEARING
B06T7089A	LH	230	1847	–200 TO 200	FLEX BEARING
B06T7090A	LH	310	1847	–200 TO 200	FLEX BEARING
B06T7091A	LH	50	1876.6	–200 TO 200	NOZZLE–TO–CASE JOINT
B06T7092A	LH	130	1876.6	–200 TO 200	NOZZLE–TO–CASE JOINT
B06T7093A	LH	270	1876.6	–200 TO 200	NOZZLE–TO–CASE JOINT
B06T8087A	RH	50	1847	–200 TO 200	FLEX BEARING
B06T8088A	RH	130	1847	–200 TO 200	FLEX BEARING
B06T8089A	RH	230	1847	–200 TO 200	FLEX BEARING
B06T8090A	RH	310	1847	–200 TO 200	FLEX BEARING
B06T8091A	RH	50	1876.6	–200 TO 200	NOZZLE–TO–CASE JOINT
B06T8092A	RH	130	1876.6	–200 TO 200	NOZZLE–TO–CASE JOINT
B06T8093A	RH	270	1876.6	–200 TO 200	NOZZLE–TO–CASE JOINT
GHYP8014A	NA				AFT SKIRT GN2 PURGE PRESSURE (SENSOR LOCATED IN MLP)
GHYT8013A	NA				AFT SKIRT GN2 PURGE TEMPERATURE (SENSOR LOCATED IN MLP)

8.0 HOSC Console

HOSC Voice Communication Guide

MLP-2 MULTILINE PHONE USER'S QUICK REFERENCE CARD

FEATURE	PROCEDURE
CONFERENCE To establish a three-party/ progressive conference call	Press **RECALL DIAL** key to place party on consultation hold, dial third party. Press **CONFERENCE** key. Continue as above until all parties have been added.
To establish a preset multi-party call	Dial #24 and two-digit number assigned to preset conference.
CAMP ON To have call returned when called party is busy	Press **RECALL DIAL** key, dial #23, listen for confirmation tone, and hang up.
CALL FORWARD To automatically forward calls to another SDN	Dial *7 and number to which you wish calls forwarded. To cancel, dial *27, listen for confirmation tone, and hang up.
To forward calls to another SDN when busy or no answer	Dial #7 and number to which you wish calls forwarded.
SPEED DIAL To place a call by entering two-digit speed dial code	Press **SPEED DIAL** and two-digit code for number you want to call.
To display number reached by speed dial code	Press **DISPLAY** and **SPEED DIAL**. Enter code for number you want displayed.
To store new speed dial number	Press **SET** and **SPEED DIAL**. Enter code and new number you want stored. Press **SET** a second time to store.
To exit from set or display modes	Press **RELEASE** key.
RELEASE To hang up speakerphone or headset	Press **RELEASE** key.
RECALL DIAL To place current party on consultation hold to call or answer second party or to set up three-party conference	Press **RECALL DIAL** key.
RETURN To return to party on consultation hold	Press **RETURN** key.
HOLD To place party on station hold while dialing or answering a second call on another line	Press **HOLD** key.
TRANSFER To transfer an incoming call to another party	Press **RECALL DIAL** key, dial new number, announce call. Press **TRANSFER** key and hang up.
GROUP PICKUP To pick up a call ringing at another phone in your call group.	Press an idle line button, press **GROUP PICK UP** key, answer call.
VOLUME To display ringer frequency or volume setting for handset/headset 1, handset/headset 2, speakerphone, ringer, or a conference net	Press **DISPLAY** and **VOLUME**. Each time **VOLUME** is pressed, a new setting is displayed.
To set or change the ringer frequency or volume of handset/headset 1, handset/headset 2, speakerphone, ringer, or a conference net	Press **SET** and **VOLUME**. Press → to increase volume and ← to decrease. Press **SET** to store new volume. Press **VOLUME** to change to next control. Press **SPEAKER PHONE**, **SET**, and **VOLUME** to change speakerphone volume.
To exit from display or set mode	Press **RELEASE** key.

HOSC Communication Directory

OIS Voice Channels

OIS Channels available on HOSC switchable circuits:

Channel	Discipline
132	Orbiter Test Conductor
133	Payloads Test Director
134	Payloads Test Conductor
135	Landing/Recovery Director
136*	SRB/ET Test Conductor (TCB)
137	Booster Test Conductor
144	SRB Retrieval
145	Orbiter Instrumentation
146	SSME/SSMEC-1
151	EPDC-1
152	DPS-1
156	LO_2
161	PE-1
166	LH_2
168	MPS-1
171	Flight Cont-1
175	SRSS
176	SRB/ET Electrical
177	Hazardous Gas Detection System
181	GSE Troubleshooting
182	Orbiter Hydraulics
183	Troubleshooting
185	SRB Electrical
186	ET Pneumatics
187	SRB Hydraulics
212	A/G 1
213	A/G 2
214	Intercom A (crew-to-crew)
215	Intercom B (crew-to-crew)
217	GSFC GCN-1 (same as A/G 1)
218	GSFC GCN-1 (same as A/G 2)
222	ET Ice
231	Weather
232*	NASA Test Director
237	ET/SRB
245	ESA (talk capability for SAC)
261	Project Engineer 2
263	MSFC Management Coordination

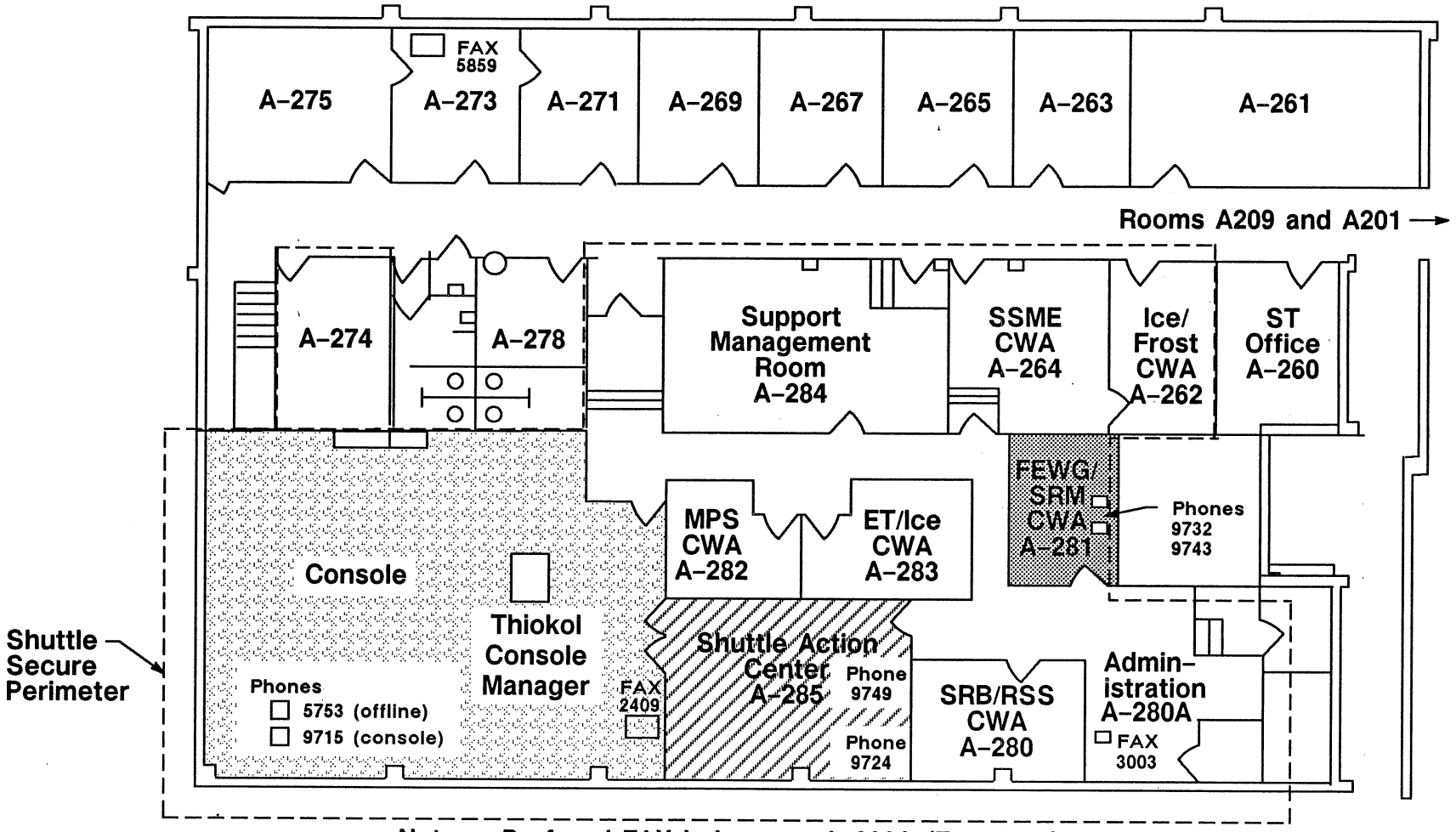
Video Matrix Channel Assignments

Channel	Terminal
11	MIDSS/McIDAS Video
23	SAC
24*	SRM
25	MPS Support
26	ET Manager
27	MPS Manager
28	MPS Manager
29	SSME-3
30	SSME-2
31	SSME-1
32	SSME Anomaly
33	SSME MEC
34	SSME Sys
35	SRB TVC
36	SRB Manager
37	SRB E&I
38	SRSS
39	SAC
40	SMR
41	SSME CWA
42	ET CWA
43	OIS Configuration
51	JSC (MER) Video
54	Ice/Frost Video
55	CNN
56	NASA Select
58	MOPS Status Page

*Monitored by SRM Console

8.0 HOSC Console (Cont)

HOSC Communication Directory (Cont)



Note: Prefered FAX is in room A-280A (Ext. 3003)

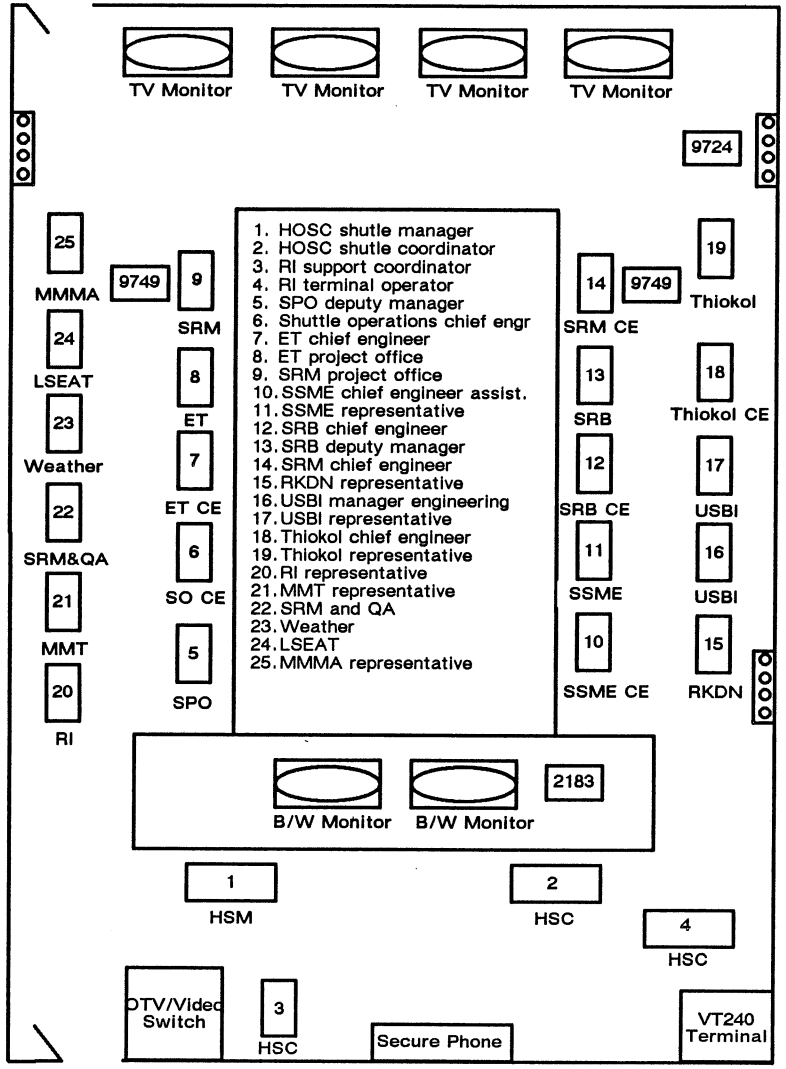
Project Integration, Thermal, Ballistics, and FEWG personnel

SAC Floor Plan on page 1-8

Console Room Floor Plan on page 1-8

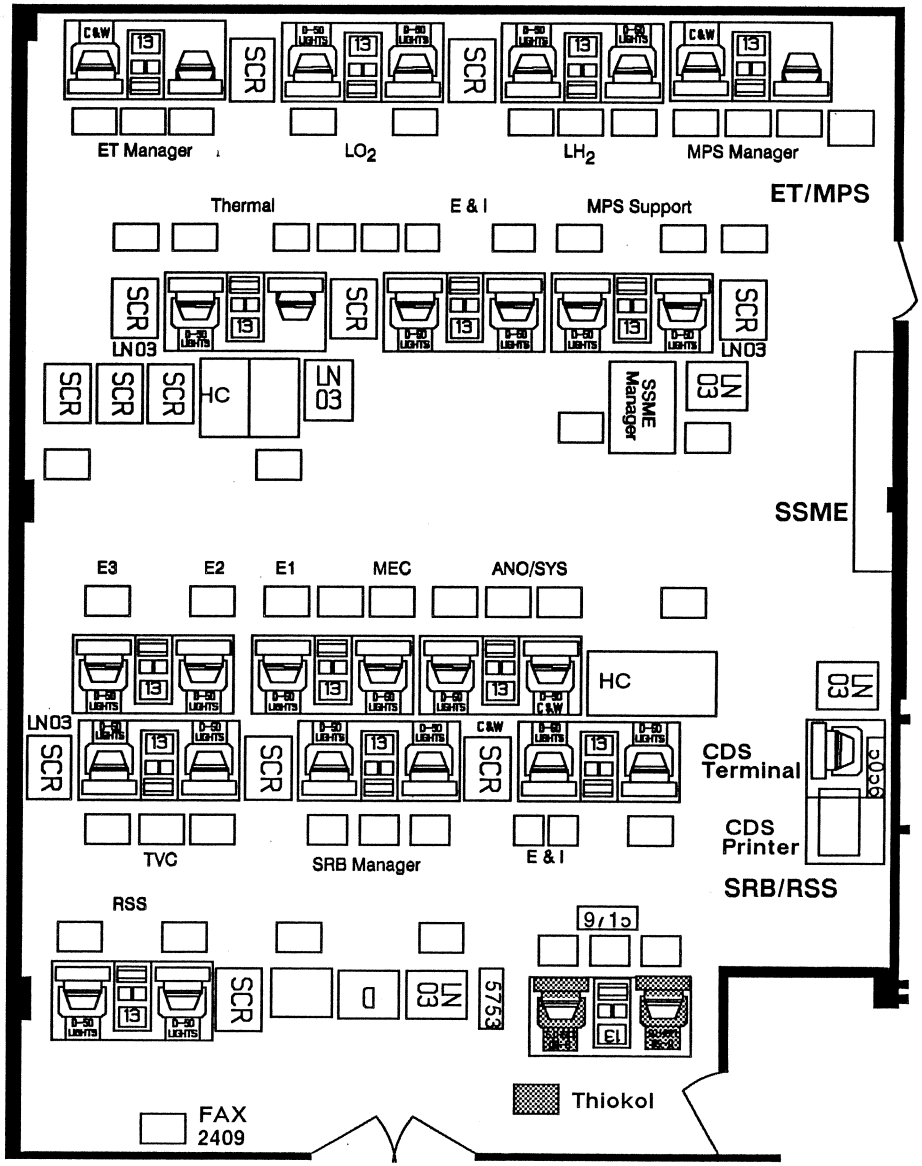
HOSC Communication Directory (Cont)

Shuttle Action Center (SAC) Floor Plan



A031687a

Shuttle Engineering Console Room (A–286)



```
GMT 299:15:47:44 MET 008:00:54:35 LAUNCH COMMIT DATA   DM RT  TC01  - 0 06-17-93
                                                                      FR-1
                    LEFT IGN        LEFT  S&A          RIGHT S&A       RIGHT IGN
LOCATION          184.5   355.5  ~SAFE  SAFE  ~     ~SAFE  SAFE  ~ 355.5   184.5
IGNITER            85 ~     80 ~                                        81 ~     74V~
                SET PT  -0.1L  CTL 0      0 V     0 V                SET PT  -0.1L  CTL 0
JOINT      15     135     195     285     0 A     0 A          15     135     195     285
FORWARD    80V~   78L~    78L~    76L~                         78L~   80L~    78L~    76L~
                SET PT  -0.1L  CTL 0      0 V     0 V             SET PT  -0.1L  CTL 0
CENTER     77L~   77L~    76L~    77L~    0 A     0 A          78L~   74L~    77L~    78L~
                SET PT  -0.1L  CTL 0      0 V     0 V             SET PT  -0.1L  CTL 0
AFT        79L~   80V~    79L~    85V~    0 A     0 A          82V~   80L~    78L~    78L~
                SET PT  -0.1L  CTL 0                           SET PT  -0.1L  CTL 0

          50      130     270            PURGE                  50      130     270
N/C        80 ~    82 ~    77V~        TEMP   PRESS              82 ~    80 ~    78V~
          50      130     230     310    -4      0             50      130     230     310
F/B        80 ~    78 ~    80 ~    78 ~                         80 ~    78 ~    77 ~    82 ~

     AMBIENT TEMP CS#3    9 ~    WIND SPEED CS#3    0 ~    WIND DIR CS#3    0 ~
                                                                             N
```

TC01

GET DBI: COMPLETE

1 1(012,022) Printer: Ready

```
GMT 299:15:50:31 MET 008:00:57:22 CASE ACREAGE TEMP    DM RT  TC02  - 0 04-22-9

                    LEFT SRM                          RIGHT SRM
STATION        45       135      270          45       135      270
 694.5                           77                               78
 931.5          80 ~     77 ~    78           78 ~     80 ~     78
1091.5                           78                               82
1411.5          78 ~     78 ~    80           77 ~     75 ~     77
1751.5                           75                               77

  WIND SPEED   0    WIND DIRECTION   0   N      AMBIENT TEMPERATURE   9
```

TC02

GET DBI: COMPLETE

1 1(023,001) Printer: Ready

GMT 299:15:26:34 MET 008:00:33:25 LCC TABLE DM RT TC04 - 0 06-17-93

~LH IGN	15	85	~LH FLB	50	78	~RH IGN	15	81	~RH FLB	50	80
~LH IGN	195	80	~LH FLB	130	78	~RH IGN	195	75	~RH FLB	130	78
			~LH FLB	230	80				~RH FLB	230	77
			~LH FLB	310	78				RH FLB	310	82
~LH JHF	15	80L				~RH JHF	15	78L			
~LH JHF	135	78L	~LH N/C	50	80	~RH JHF	135	80L	~RH N/C	50	82
~LH JHF	195	78L	~LH N/C	130	83	~RH JHF	195	78L	~RH N/C	130	80
~LH JHF	285	76L	~LH N/C	270	77v	~RH JHF	285	77L	~RH N/C	270	78v
~LH JHC	15	77L	~CASE	695	77	~RH JHC	15	78L	~CASE	695	80
~LH JHC	135	77L	~CASE	931	78	~RH JHC	135	74L	~CASE	931	77
~LH JHC	195	76L	~CASE	1091	80	~RH JHC	195	77L	~CASE	1091	82
~LH JHC	285	78L	~CASE	1411	80	~RH JHC	285	78L	~CASE	1411	77
			~CASE	1751	75				~CASE	1751	77
~LH JHA	15	80L				~RH JHA	15	82v			
~LH JHA	135	80v				~RH JHA	135	80L			
~LH JHA	195	80L				~RH JHA	195	78L			
~LH JHA	285	85v				RH JHA	285	78L			

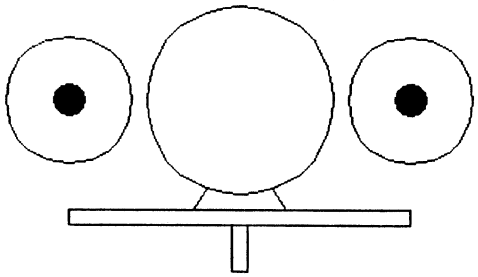
AMBIENT 9 WIND SPEED 0 WIND DIREC 0

TC04

GET DBI: COMPLETE

1 1(023,001) Printer: Ready

GMT 299:15:39:51 MET 008:00:46:42 SRM IGNITER TEMP DM RT TC05 - 0 06-24-92



CS #3

AMB TEMP [9]~

WIND SPD [0]~

WIND DIR [0]~

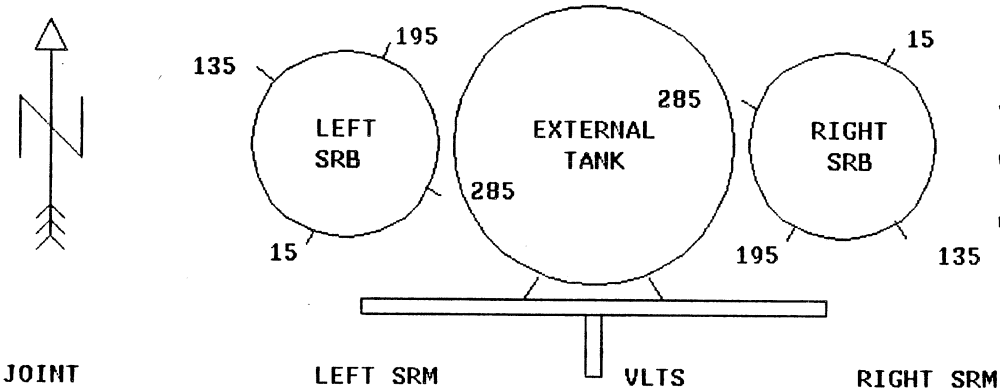
COMPONENT	LEFT SRM 15	LEFT SRM 195	RIGHT SRM 15	RIGHT SRM 195
IGNITER ADPT / FWD DOME JOINT	85	80	81	75v
IGNITER HEATER VOLTAGE/CURRENT	0.0	0.00	0.0	0.00

TC05

GET DBI: COMPLETE

1 1(023,001) Printer: Ready

GMT 299:15:41:38 MET 008:00:48:29 SRM FIELD JOINT TEMP DM RT TC06 - 0 07-21-9



CS #3

AMB TEMP	9
WIND SPD	0
WIND DIR	0

JOINT	LEFT SRM 15	135	195	285	VLTS AMPS	RIGHT SRM 15	135	195	285	VLTS AMPS
FORWARD	80L	78L	78L	76L	0 0	78L	80L	77L	77L	0 0
CENTER	77L	77L	76L	77L	0 0	78L	74L	77L	78L	0 0
AFT	79L	81v	80L	85v	0 0	82v	80L	78L	77L	0 0

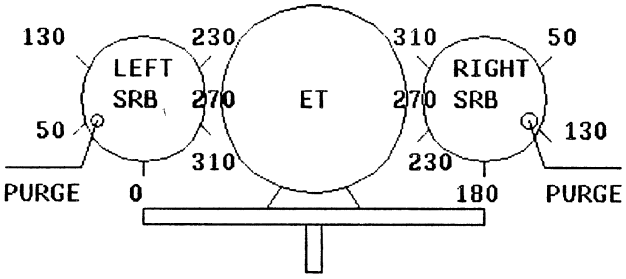
TC06

GET DBI: COMPLETE

1 1(001,063) Printer: Ready

GMT 299:15:31:33 MET 008:00:38:24 SRM NOZZLE TEMP DM RT TC07 - 0 06-17-93

CS #3



PURGE

TEMP	-4
PRES	0

AMB TEMP	9
WIND SPD	0
WIND DIR	0

COMPONENT	50	130	230	270	310
LH NOZZLE/CASE JOINT	80	83		77v	
RH NOZZLE/CASE JOINT	82	80		78v	
LH FLEX BEARING	78	78	80		78
RH FLEX BEARING	80	78	77		82

TC07

GET DBI: COMPLETE

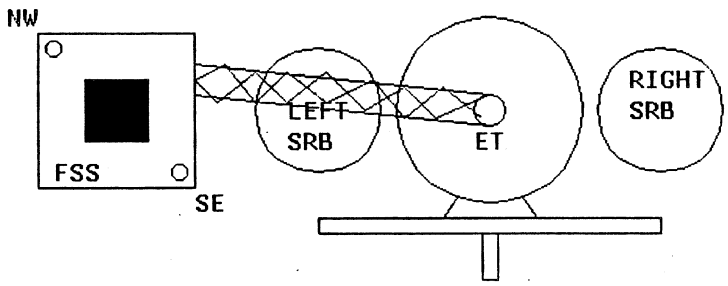
1 1(023,001) Printer: Ready

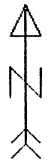
GMT 299:15:33:29 MET 008:00:40:20 SRM AMB ENVIRONMENT DM RT TC08 - 0 11-30-92

60 FT POLE CS #6 — WIND SPD 0 ~KNOTS; WIND DIR 0 ~DEG AZ; N

FSS CORNERS AT 275 FT

NW WIND SPD	60 ~KNOTS
NW WIND DIR	318 ~DEG AZ
SE WIND SPD	60 ~KNOTS
SE WIND DIR	318 ~DEG AZ





CS #4

60 FT POLE CS #3

AMB TEMP	9 ~DEG F
WIND SPD	0 ~KNOTS
WIND DIR	0 ~DEG AZ
BAR PRES	31.0 ~IN HG
REL HUMD	****# ~PCT

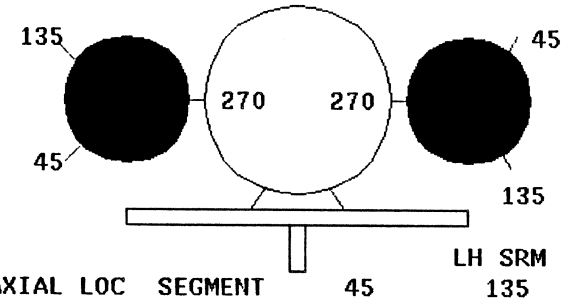
TC08

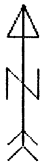
GET DBI: COMPLETE

1 1(023,001) Printer: Ready

GMT 299:15:21:48 MET 008:00:28:39 SRM CASE TEMP DM RT TC09 - 0 04-05-93

CS #3





AMB TEMP	9
WIND SPD	0
WIND DIR	0

AXIAL LOC	SEGMENT	LH SRM 45	LH SRM 135	LH SRM 270	RH SRM 45	RH SRM 135	RH SRM 270
694.5	FWD			77			80
931.5	FWD/CNTR	80	77	78	78	80	77
1091.5	FWD/CNTR			78			82
1411.5	AFT/CNTR	80	78	80	77	75	77
1751.5	AFT			75			77

TC09

GET DBI: COMPLETE

1 1(023,001) Printer: Ready

GMT 299:16:06:36 MET 008:01:13:27 LCC REPORT SUMMARY DM RT RANGE - 0 01-10-9

	LH MIN	RH MIN	LH MAX	RH MAX	MIN/ MAX	LH MAX POWER	RH MAX POWER
IGNITER	80.2	75.1v	84.8	80.9	75.1v 84.8	0.0	0.0
FORWARD	76.4L	77.0L	80.2v	80.2v		0.0	0.0
CENTER	75.7L	73.8L	77.0L	78.3L	73.8L	0.0	0.0
AFT	78.9L	77.0L	84.8v	79.6L	84.8v	0.0	0.0
NOZZLE	76.8v	78.4v	83.2	81.6	76.8v 83.2	PURGE PRESS 0.0L	TEMP -4.0L
CASE (LCC GAGES)	75.2	76.8	80.0	80.0	75.2 80.0	SPC START TIME 299:15:47:27	

AMBIENT CONDITIONS

TEMPERATURE CS#3 9 ~ WIND SPEED CS#3 0 ~ WIND DIR CS#3 0 ~ N

RANGE

GET DBI: COMPLETE

1 1(023,001) Printer: Ready

GMT 299:15:52:28 MET 008:00:59:19 HEATER SUMMARY DM RT POWER - 0 03-22-92

			SET PT	CTL	SYS	VOLT	AMP	POWER
LH IGN	84.8L	80.2L	-0.1L	0	0	0.0	0.00	0.0
RH IGN	81.5L	73.8L	-0.1L	0	0	0.0	0.00	0.0

	15	135	195	285	SET PT	CTL	SYS	VOLT	AMP	POWER
LH FWD	78.9L	77.6L	78.3L	76.4L	-0.1L	0	0	0.0	0.00	0.0
RH FWD	77.6L	79.6L	77.0L	77.0L	-0.1L	0	0	0.0	0.00	0.0
LH CTR	77.0L	76.4L	77.0L	77.0L	-0.1L	0	0	0.0	0.00	0.0
RH CTR	77.0L	74.4L	76.4L	77.6L	-0.1L	0	0	0.0	0.00	0.0
LH AFT	78.9L	80.2v	79.6L	84.8	-0.1L	0	0	0.0	0.00	0.0
RH AFT	81.5v	79.6L	78.3L	77.6L	-0.1L	0	0	0.0	0.00	0.0

AMBIENT CONDITIONS

TEMPERATURE CS#3 9 ~ WIND SPEED CS#3 0 ~ WIND DIR CS#3 0 ~

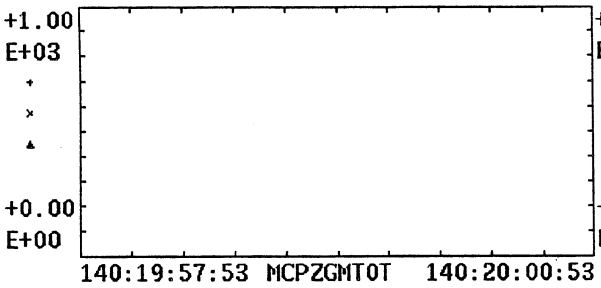
POWER

GET DBI: COMPLETE

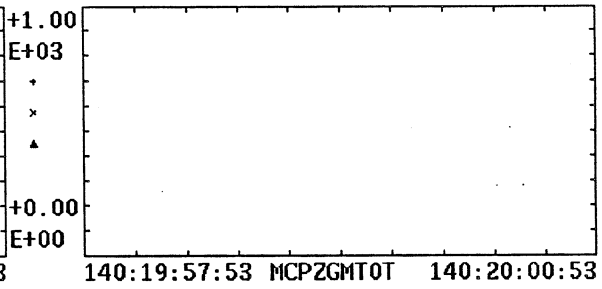
1 1(023,001) Printer: Ready

GMT 140:19:58:02 MET -00:16:02:00 PRESSURE PLOT DM RT MTI030- 0 02-18-91

B47P1300C B47P1301C B47P1302C



B47P2300C B47P2301C B47P2302C



LEFT HAND SRB CHAMBER PRESSURE

MSID	PRESSURE	MAXP
B47P1300C	-11.3L	U~
B47P1301C	-13.3L	U~
B47P1302C	-11.3L	U~

RIGHT HAND SRB CHAMBER PRESSURE

MSID	PRESSURE	MAXP
B47P2300C	-11.3L	U~
B47P2301C	-11.3L	U~
B47P2302C	-11.3L	U~

FIRST PRESSURE U AT GMT TIME U
AMBIENT PRESSURE U MET TIME U

MTI030
GET DBI: COMPLETE
1 1(001,017) Printer: Ready

GMT 299:16:04:35 MET 008:01:11:26 SIM1 DM RT OPTSIM- 0 06-24-92

DATA COLLECTED AT U COMP STATUS - U

	OPT MSID	START UP	75% CAL	POST CAL
LPS DATA				
	B47P1300C1	12.65	0.00	0.00
	B47P1301C1	18.64	0.00	0.00
	B47P1302C1	16.64	0.00	0.00
	B47P2300C1	20.64	0.00	0.00
	B47P2301C1	12.65	0.00	0.00
	B47P2302C1	16.64	0.00	0.00
OD DATA				
	B47P1300C	12.65	0.00	0.00
	B47P1301C	18.64	0.00	0.00
	B47P1302C	16.64	0.00	0.00
	B47P2300C	20.64	0.00	0.00
	B47P2301C	12.65	0.00	0.00
	B47P2302C	16.64	0.00	0.00

OPTSIM
GET DBI: COMPLETE
1 1(023,001) Printer: Ready

9.0 KSC Console

9.0 KSC Console (Cont)

KSC Communication Directory

Complex 39 STS OIS Channelization

TP

232 NASA Test Director (NTD)
231 NTD BU and Weather
131 NTD BU and CR Coordinator
132 Orbiter Test Conductor (OTC)
135 Landing Recovery Director (LRD)
136 ET/SRB Test Conductor (TBC)
137 Booster Test Conductor-VAB (BTC)
211 ORB UHF
212 A/G No. 1
213 A/G No. 2
214 IC-A
215 IC-B
217 GSFC GCN-1 (Monitor)
218 GSFC GCN-2 (Monitor)
216 JSC/RI Coordinator
223 See Note
224 See Note
225 See Note
226 See Note
227 See Note
228 See Note
235 See Note (Mission Audio)
111 Support Test Manager (STM)
188 Paging

SI

114 BOC TC (JSTC)

TE

115 CT Ops (GBCT)
116 Structures (QBSE)
117 OIS Cont (GYCC)
121 CCS Intg (JCTL)
122 CCS Pneu (JBPN)
123 CCS FIREX/Ind Wtr (JBFX/JBWC)
124 CCS HAVC (JBAC)
126 S/W Eng, S/W, C/O, CCMS CCC (JNTL)
127 CCMS Mstr Con FR-1/3 (LPS)
128 CCMS Maint and Test (LPS)
138 OTV Control (JYVO/JYVR)
148 ESMS/PMS Cal Ops (JCFM)
158 ESMS/PMS Setup and C/O
167 OIS Maint
178 Photo/Timing/Val/Ops/Main (JTCR/JPHO)
238 RPS Ops/Main (JRPS)
258 CDS Ops/Main (JCDS)
268 Video Main (JYVO)

MD

163 BIOMED (CBSE)

TV

141 G&N (CGNC)
142 Mech and Arms (CAFM/CGSS)
143 ECLSS-1 (CECL)
145 Orb Inst (CISL)
146 SSME/SSMEC (CSME/CCME)
147 Hygl Fuel-1 (COFS/CGFS)
151 EPDC (CEPD)
152 DPS (CDPS/CODS/CVFS)
153 Fuel Cells (CFCP/CROE/CRHE)
155 Orb Comm (CCSE)
156 LO_2 (CLOX)
157 Hygl Oxid-1 (COOS/CGOS)
161 PE-1 (CTPE)
162 Software (VFS, GLS)
166 LH_2 (CLHY)
168 MPS (CMPS/CAFC)
171 Flt Cont (COFC/CAFC)
172 ECS-1 (CPVD)
173 Nav Aids (CNSE)
175 R/S and SRB Inst (CBIS/CRSR)
176 ET/SRB Elect. (CPWR)
177 HGDS (CHYD)
182 Hyd/Orb (CHYD)
186 ET Pneu (CNUM)
187 Hyd/SRB (CBHY)
222 ET Ice (CICE)
236 CIG (CIG)
242 ECS-2 (CPVD/CAFM/CHYD) (Purge)
243 ECLSS-2 (CECL) (Cool)
245 ESA (ESA)
247 Hygl Fuel-2 (COFS/CHGD)
257 Hygl Oxid-2 (COOS)
261 PE-2/ESA (CTPE)
263 MSFC Coordinator

CS/DOD

133 Payload Test Director (PTD/AFTD)
134 Payload Test Conductor (PTC/AFT 1)
144 Integ Test/AFT 2
154 Integ Test/AFT 3
164 Payload 1/AFT 4
174 Payload 2/AFT 5
184 Payload 3/AFT 6
233 Quality/AFT 7
234 Payload 4/AFT 8
244 Trbl Shtg/AFT 9
254 Payload 5/AFT 10
264 Payload 6/AFT 11

RO

118 Quality

RT

221 Safety (SCC)

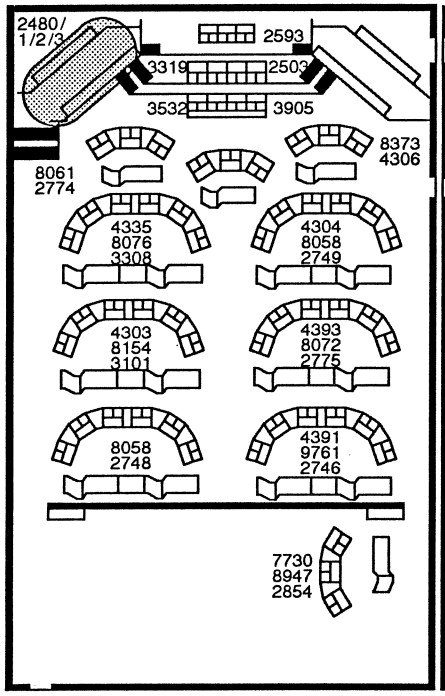
Note: Channel will be assigned by the NTD for troubleshooting or overflow

9.0 KSC Console (Cont)

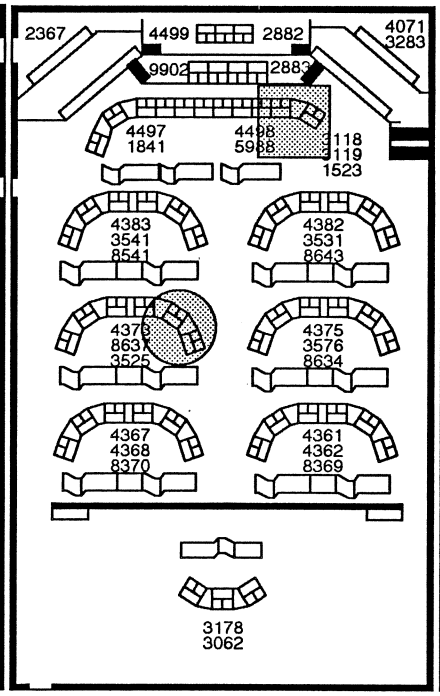
KSC Communication Directory (Cont)

KSC Launch Control Center

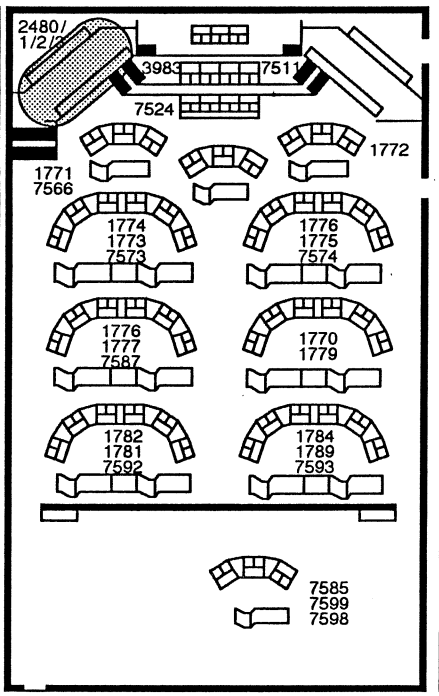
FR-1 Standard Configuration



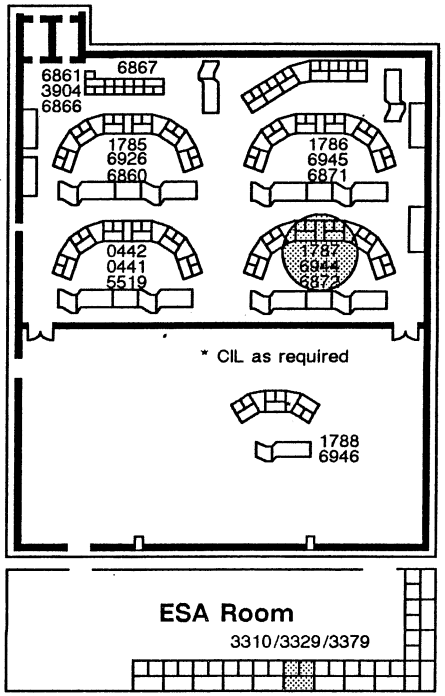
FR-2 Standard Configuration



FR-3 Standard Configuration

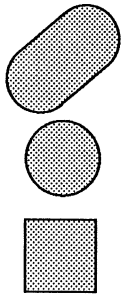


FR-4 Standard Configuration



ESA Room Used for all Launches

Ice Team in Firing Room 2 for All Launches

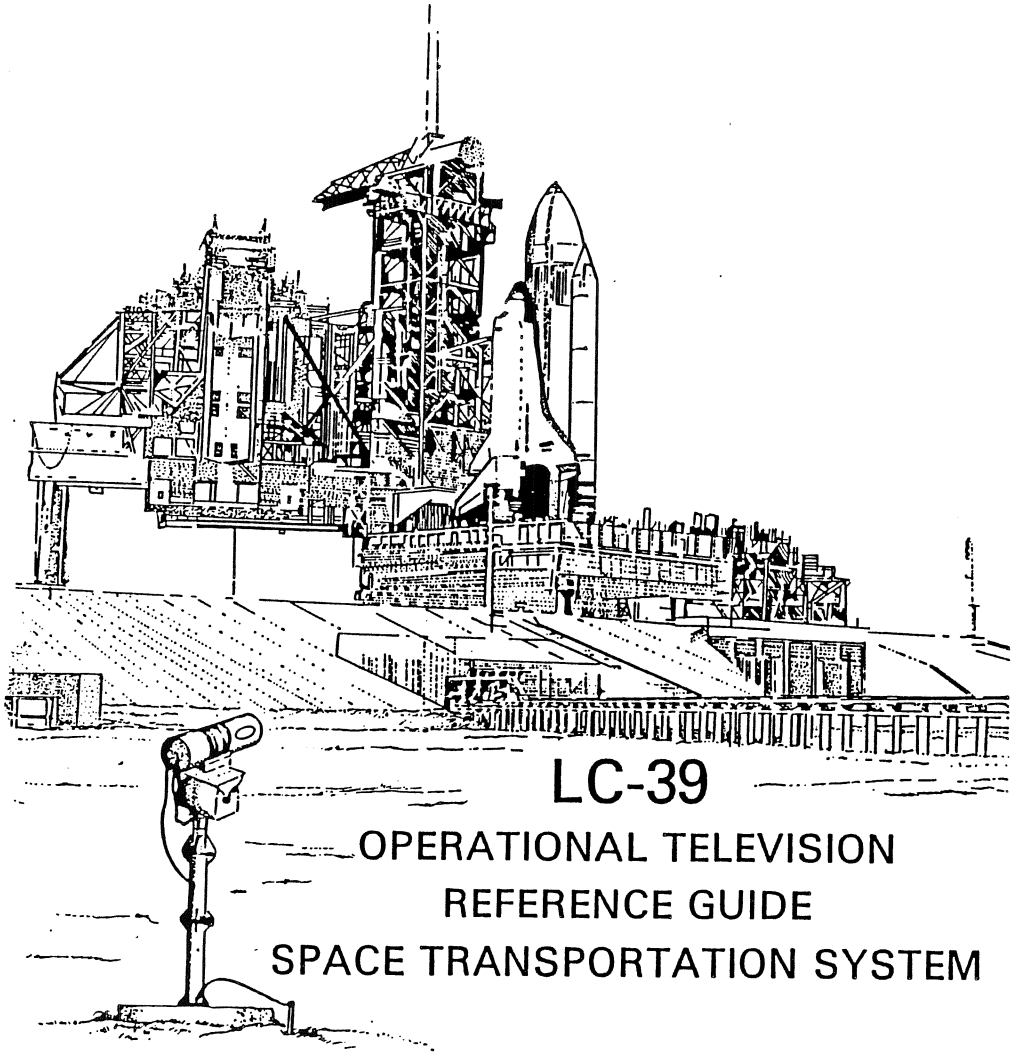


= Marshall/Thiokol Program Management

= Marshall/Thiokol Engineering Management

= Ice Team

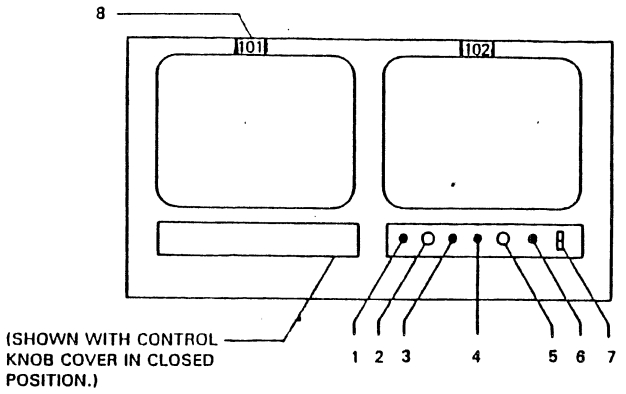
LC–39 Operational Television Reference Guide



LC-39

OPERATIONAL TELEVISION REFERENCE GUIDE

SPACE TRANSPORTATION SYSTEM

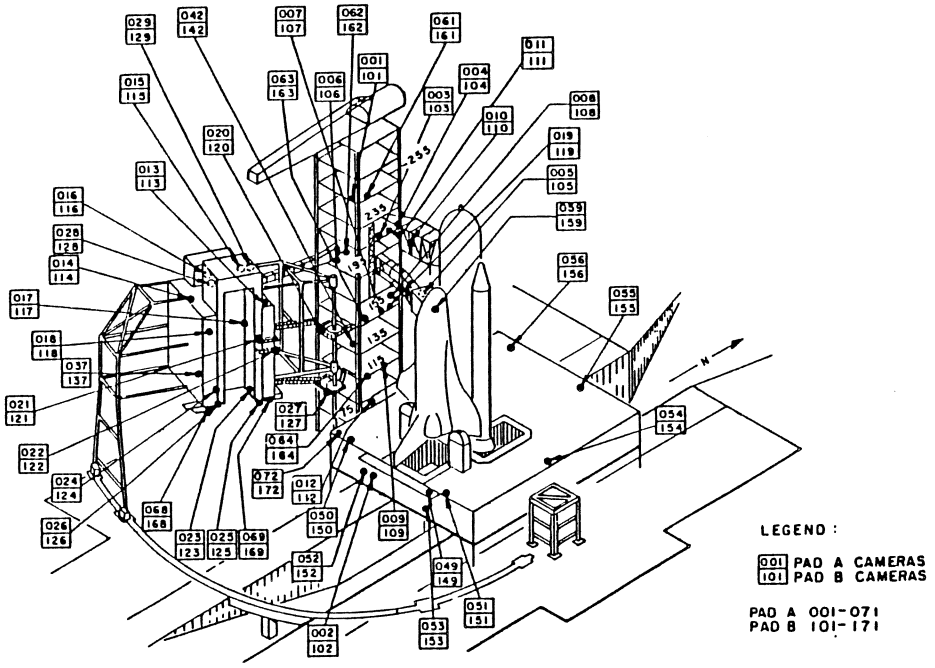


INDEX	CONTROL	FUNCTION
1	HORIZONTAL HOLD	ADJUSTMENT OF PICTURE HORIZONTAL STABILIZATION
2	BRIGHT	ADJUSTMENT OF DESIRED PICTURE BRIGHTNESS
3	FOCUS	ADJUSTMENT OF OPTIMUM PICTURE FOCUS
4	HEIGHT	ADJUSTMENT OF VERTICAL PICTURE HEIGHT
5	CONTRAST	ADJUSTMENT OF PICTURE CONTRAST
6	VERTICAL HOLD	ADJUSTMENT OF PICTURE VERTICAL HOLD
7	POWER ON/OFF	APPLIES POWER TO MONITOR
8	MONITOR NUMBER	USED FOR REPORTING TROUBLES TO JYVO OR FOR INPUT CAMERA CHANGES.

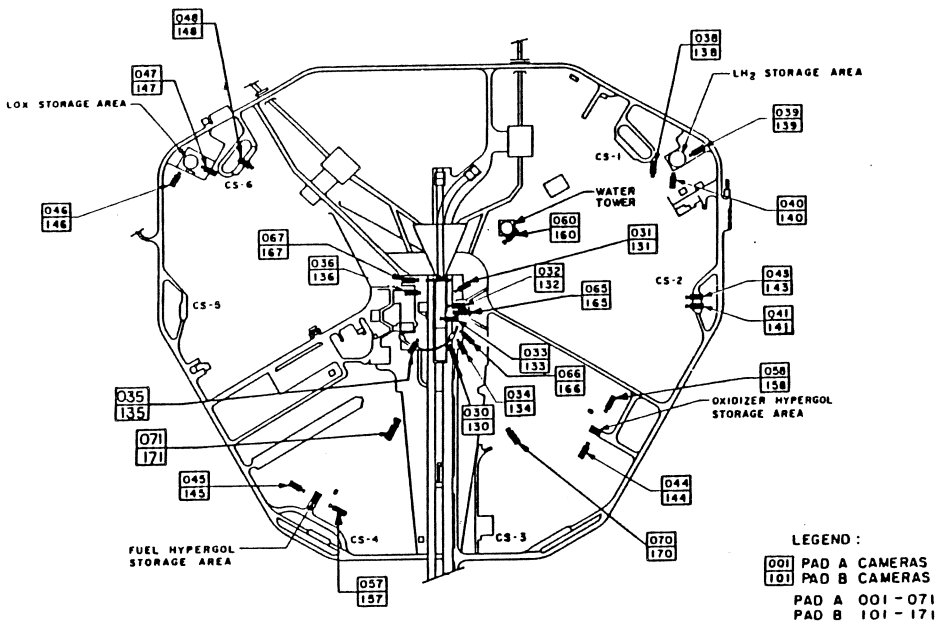
Video Monitor Controls and Functions

911736-9.2

LC–39 Operational Television Reference Guide (Cont)



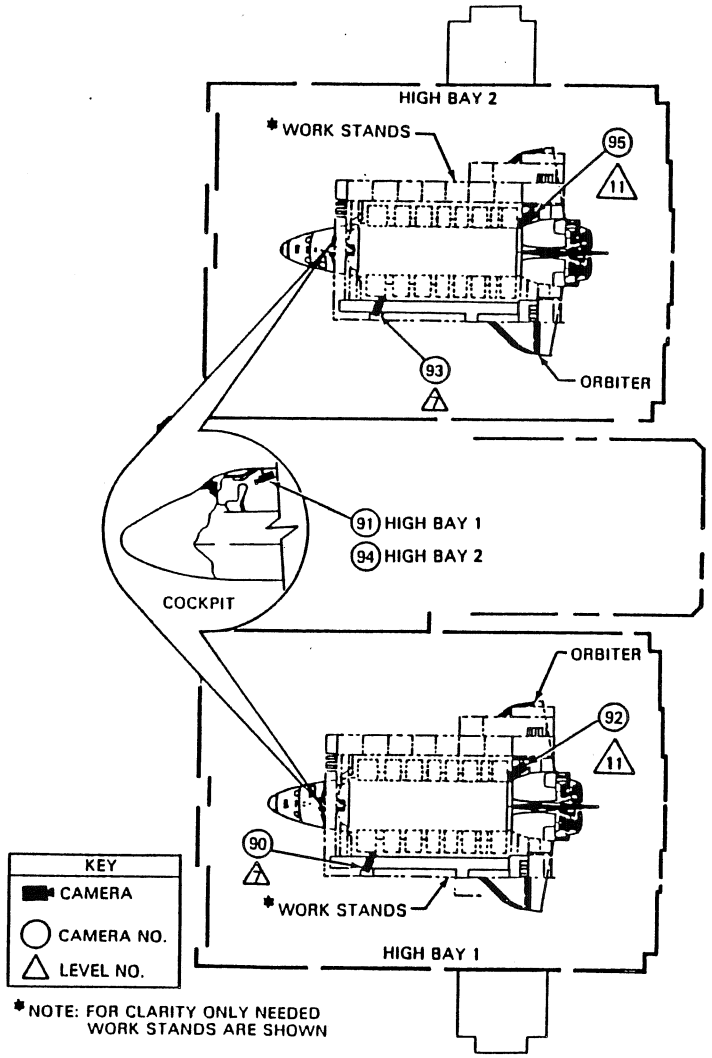
LC-39 MLP, FSS, and RSS Camera Locations



LC-39 Camera Locations

911736-9.3

LC–39 Operational Television Reference Guide (Cont)



OPF Camera Locations

Switcher Inputs

SW INPUT/ CAMERA NO	LOCATION	SUBJECT	PAGE
000	JYVO CONSOLE	BEST VIEW OF DECLARED PRIMARY EMERGENCY	—
001	PAD A FSS-255' SE CORNER	PAD AREAS, ET TPS, ET NOSE, GOX VENT ARM HOOD	20
002	PAD A MLP SIDE 1-WEST	LO2 REPLENISH VALVE (NO PAN AND TILT UNIT)	21
003	PAD A FSS-215' EAST SIDE	GH2 VENT ARM HOOD, ET INTERFACES AND TPS	21,22,23
004	PAD A FSS-215' NE SIDE	CABIN INGRESS/EGRESS, OAA DURING ROTATION, GH2 VENT	23,24
005	PAD A FSS-195' REAR WALL	INTERIOR OF WHITE ROOM, ORBITER CREW HATCH (NO PAN AND TILT)	24
006	PAD A FSS-195' SOUTH SIDE	EMERGENCY EGRESS ROUTE	25
007	PAD A FSS-155' SE CORNER	LH2 DEWAR AND GSE, ET AFT ATTACH POINTS, TPS	26
008	PAD A FSS-155' NE CORNER	LOX DEWAR AND GSE, LO2 FILL/DRAIN AND VENT LINES	27
009	PAD A FSS-115' EAST SIDE	HYPER GSE LINES, TPS, ET LH2 FEEDLINE, RECIRCULATION LINE, GH2 PRESSURIZATION LINE, ET/ORBITER LH2 INTERFACE	28
010	PAD A FSS-203' ET VENT ARM	ET LH2 BACK PRESSURE VENT LINE & VALVE, ET VENT ARM	29
011	FUTURE		30
012	PAD A FSS-75' SE CORNER	HYPER FUEL SCRUBBER, LOX LINES ON MLP, SIDE 2	31
013	PAD A RSS-207' WEST SIDE	RCS VALVE COMPLEX (FUEL)	32
014	PAD A RSS-207' EAST SIDE	RCS VALVE COMPLEX (OX.)	33
015	PAD A RSS-207' WEST SIDE	FRCS PURGE PANEL (FUEL) & SERVICE PANEL	34,35
016	PAD A RSS-207' EAST SIDE	FRCS PURGE PANEL (OX) & SERVICE PANEL	35,36
017	PAD A RSS-158'-5" (PCR) WEST SIDE	RSS WORK PLATFORM (PAYLOAD) PORTABLE CAMERA	37
018	PAD A RSS-158'5" (PCR) EAST SIDE	RSS WORK PLATFORM (PAYLOAD) PORTABLE CAMERA	37
019	FUTURE		38
020	PAD A RSS-158' (HINGE POINT)	CRYO FLEX LINES I/F	39
021	PAD A RSS-167' (OMBUU)	OMBUU UMBILICAL CARRIER INTERFACE (MANUAL PAN & TILT)	40
022	PAD A RSS-158' (OMBUU)	OMBUU LOX AND LH2 ACCUM/VALVE COMPLEX (MID LEVEL)	40
023	PAD A RSS-107' WEST SIDE	HYPER RCS/OMS (FUEL) PORTABLE CAMERA	41
024	PAD A RSS-107' EAST SIDE	HYPER RCS/OMS (OX) PORTABLE CAMERA	41
025	PAD A RSS-107' WEST SIDE	RCS/OMS UMBILICAL (FUEL)	42

LC–39 Operational Television Reference Guide (Cont)

Switcher Inputs (Continued)

SW INPUT/ CAMERA NO	LOCATION	SUBJECT	PAGE
026	PAD A RSS-107' EAST SIDE	RCS/OMS UMBILICAL (OX)	43
027	PAD A RSS-95' (HINGE POINT)	HYPER FLEX LINES	44
028	PAD A RSS-207' EAST SIDE	FRCS (OX) VALVE COMPLEX	45
029	PAD A RSS-207' WEST SIDE	FRCS (FUEL) VALVE COMPLEX	45
030	FUTURE		46
031	PAD A PAD APRON NE SIDE	LH2 FUEL/VENT LINE TRENCH AREA, LH2 FUEL/VENT LINES	47
032	PAD A PAD APRON EAST SIDE	HYPER LINES, ET CABLE TRAY GO2 PRESSURE LINE, GO2 VENT LH2 CROSS-COUNTRY LINE	48,49
033	PAD A PAD APRON EAST SIDE	T-0 EVENTS OF ANTIGEYSERING & TPS SCAN ET/ORB INTERFACES	50,51
034	PAD A PAD APRON SE SIDE	HYPER OX C.C. LINE, ET GO2 VENT, PYRO TUMBLE VALVE	51,52
035	PAD A PAD APRON SW SIDE	HYPER FUEL C.C. LINE AND 95' FLEX LINE AREA	52,53
036	PAD A PAD APRON 20' TOP OF NW STAIRS	ET VENT LINE N WEST SIDE OF PAD & UP FSS	54
037	PAD A RSS-130' EAST SIDE	SAFETY SURVEILLANCE OF ORBITER 50-2 DOOR	55
038	PAD A PERIMETER LH2 AREA	LH2 FACILITY STORAGE TANK, VALVES, CC LINES AND PUMPS	56
039	PAD A PERIMETER LH2 AREA	LH2 FACILITY STORAGE TANK, VALVES, LINES & REPLENISHMENT AREA	57,58
040	PAD A PERIMETER LH2 AREA	LH2 FACILITY STORAGE TANK, VALVES, LINES AND PUMPS	59
041	PAD A CAMERA SITE 2	PHOTO TRACKER BORESIGHT	60
042	PAD A FSS-135' SE CORNER	SAFETY SURVEILLANCE OF ORBITER 50-1 DOOR	60
043	PAD A CAMERA SITE 2	OVERALL LIFTOFF	61
044	PAD A PERIMETER OXID AREA SOUTH SIDE	HYPER OXID STORAGE TANK AND VALVE COMPLEX	61,62
045	PAD A PERIMETER FUEL AREA WEST SIDE	HYPER FUEL STORAGE TANK AND VALVE COMPLEX	63
046	PAD A PERIMETER LOX AREA NW SIDE	LOX FACILITY STORAGE TANK, VALVES, CC LINES AND PUMPS	64
047	PAD A PERIMETER LOX AREA NW SIDE	LOX FACILITY STORAGE TANK, VALVES, LINES AND PUMPS	65
048	PAD A CAMERA SITE 6	PHOTO TRACKER BORESIGHT	66
049	PAD A MLP "0" LEVEL SIDE 1-E	T-0 LO2 UMBILICAL DISCONNECT	66
050	PAD A MLP SIDE 1-WEST	LH2 AFT UMBILICAL INTERFACE, APU EXHAUST NOS. 1 & 2 AND MAIN ENGINE AREA	67

Switcher Inputs (Continued)

SW INPUT/ CAMERA NO	LOCATION	SUBJECT	PAGE
051	PAD A MLP SIDE 1-E	LO2 AFT UMBILICAL INTERFACE, APU EXHAUST NO. 3 & MAIN ENGINE AREA	68
052	PAD A MLP SIDE 1-WEST	LO2 VALVE/PIPE SYSTEM/REPLENISH VALVE	69
053	PAD A MLP SIDE 1-EAST	LH2 VALVE/PIPE SYSTEM	70
054	PAD A MLP SIDE 4 "0" LEVEL	ORBITER TO ET INTERFACE UNDER-SIDE OF ORBITER WING AND TIPS	71
055	PAD A MLP SIDE 3-EAST "0" LEVEL	SRB SKIRT AND HOLDDOWN, NORTH BRIDGE PIPING, LO2 TOWER & ET SIDEWALL	72,73
056	PAD A MLP SIDE 3-WEST "0" LEVEL	SRB SKIRT AND HOLDDOWN, NORTH BRIDGE PIPING, LH2 TOWER, FSS NORTH PIPING & ET SIDEWALL	74,75
057	PAD A PERIMETER FUEL AREA E	HYPER FUEL STORAGE TANK AND VALVE COMPLEX	76
058	PAD A PERIMETER OXID AREA N	HYPER OXID STORAGE TANK AND VALVE COMPLEX	76
059	PAD A ORBITER	ORBITER COCKPIT DATA DISPLAY CRT (MCDS) (NO PAN & TILT UNIT)	77
060	PAD A WATER TOWER	LOX VENT ARM HOOD SEALS (COLOR)	77,78
061	PAD A FSS-255'	ET SCAN (COLOR) FIRE SURVEIL-LANCE	78
062	PAD A FSS-215'	ET SCAN	79
063	PAD A FSS-155'	ET SCAN, FIRE SURVEILLANCE (COLOR)	79
064	PAD A FSS-115'	ET SCAN	80
065	PAD A EAST	ET SCAN	81
066	PAD A SOUTHEAST	ET SCAN	81
067	PAD A APRON NW	ET SCAN	82
068	PAD A RSS-107' EAST SIDE OXID	APU 613 CARTS (OXID)	82
069	PAD A RSS-107' WEST SIDE FUEL	APU 613 CARTS (FUEL)	83
070	PAD A WEST OF CAMERA SITE 3	FIRE SURVEILLANCE (COLOR)	83
071	PAD A NE OF CAMERA SITE 4	FIRE SURVEILLANCE (COLOR)	84
072	NOT ASSIGNED		84
073	NOT ASSIGNED		85
074	NOT ASSIGNED		85
075	NOT ASSIGNED		86
076	NOT ASSIGNED		86
077	NOT ASSIGNED		87
078	NOT ASSIGNED		87
079	VAB KATS LABORATORY	KATS CRT DISPLAY	88
080	VAB ROOF SE CORNER	CRAWLERWAY EAST AND PAD AREA, KENNEDY PARKWAY SOUTH	89
081	VAB ROOF NW CORNER	SLF, TOWWAY, KENNEDY PARKWAY NORTH, OPF	90

LC–39 Operational Television Reference Guide (Cont)

Switcher Inputs (Continued)

SW INPUT/ CAMERA NO	LOCATION	SUBJECT	PAGE
082	VAB TRANSFER AISLE, LEVEL 5 TOWER D CATWALK	TRANSFER AISLE OPERATIONS	91
083	VAB LEVEL 5 CROSSOVER BETWEEN TOWERS D & E (HB1) OR TOWERS E & F (HB3)	SPEED BRAKE & RUDDER MOVEMENTS AND PORTABLE USE IN HB-1 AND HB-3	91
084	VAB MLP "0" LEVEL	PORTABLE USE IN HB-1 AND HB-3	92
085	VAB MLP SIDE 1-WEST	PORTABLE USE IN HB-1 AND HB-3	92
086	VAB MLP SIDE 1-EAST	PORTABLE USE IN HB-1 AND HB-3	93
087	VAB ORBITER HB1	MCDS COCKPIT DISPLAY (NO PAN & TILT UNIT)	93
088	VAB ORBITER HB3	MCDS COCKPIT DISPLAY (NO PAN & TILT UNIT)	94
089	HPG BLDG K7-853	TRANSFERS VAB/PAD	94,95
090	OPF HB1, FWD OF ORBITER BAY	ORBITER PAYLOAD BAY	95
091	OPF HB1 ORBITER COCKPIT	MCDS COCKPIT DISPLAY	96
092	OPF HB1 PORT/AFT OF ORB BAY	ORBITER PAYLOAD BAY	96
093	OPF HB2 FWD OF ORBITER BAY	ORBITER PAYLOAD BAY	95
094	OPF HB2 ORBITER COCKPIT	MCDS COCKPIT DISPLAY	96
095	OPF HB2 PORT/AFT OF ORB BAY	ORBITER PAYLOAD BAY	96
096	PAO CAMERA SITE 2 PAD A & B	OVERALL LIFTOFF (COLOR)	
097	PAO WHITE ROOM PADS A & B	INTERIOR OF WHITE ROOM, ORBITER CREW HATCH (NO PAN & TILT UNIT) (COLOR)	
098	CCFF WEATHER TV (1TVC2107)	WEATHER CHARTS AND INFORMATION	
099	ETR WEATHER VISION (1TVC2077)	WEATHER CHARTS AND INFORMATION	
100	LCC ROOM 1P2	ALTERNATE VIEW OF DECLARED SECONDARY EMERGENCY	
101	PAD B FSS-260' SE CORNER	PAD AREAS, ET TPS, ET NOSE, GOX VENT ARM HOOD	20
102	PAD B MLP SIDE 1-WEST	LO2 REPLENISH VALVE (NO PAN & TILT UNIT)	21
103	PAD B FSS-220' EAST SIDE	GH2 VENT ARM HOOD, ET INTERFACES & TPS	21,22,23
104	PAD B FSS-220' NE SIDE	CABIN INGRESS/EGRESS OAA DURING ROTATION, GH2 VENT	23,24
105	PAD B FSS-200' REAR WALL	INTERIOR OF WHITE ROOM, ORBITER CREW HATCH (NO PAN & TILT)	24
106	PAD B FSS-200' SOUTH SIDE	EMERGENCY EGRESS ROUTE	25
107	PAD B FSS-160' SE CORNER	LH2 DEWAR AND GSE, ET AFT ATTACH POINTS, TPS	26
108	PAD B FSS-160' NE CORNER	LOX DEWAR AND GSE, LO2 FILL/ DRAIN AND VENT LINES	27

Switcher Inputs (Continued)

SW INPUT/ CAMERA NO	LOCATION	SUBJECT	PAGE
109	PAD B FSS-120' EAST SIDE	HYPER GSE LINES, TPS, ET LH2 FEEDLINE, RECIRCULATION LINE, GH2 PRESSURIZATION LINE, ET/ORBITER LH2 INTERFACE	28
110	PAD B FSS-207' ET VENT ARM	ET LH2 BACK PRESSURE VENT LINE & VALVE, ET VENT ARM	29
111	PAD B FSS 215' EAST SIDE	H2 FIRE DETECTION ONLY	30
112	PAD B FSS-80' SE CORNER	HYPER FUEL SCRUBBER, LOX LINES ON MLP 1, SIDE 2	31
113	PAD B RSS-212' WEST SIDE	RCS VALVE COMPLEX (FUEL)	32
114	PAD B RSS-212' EAST SIDE	RCS VALVE COMPLEX (OXID)	33
115	PAD B RSS-212' WEST SIDE	FRCS PURGE PANEL (FUEL) & SERVICE PANEL	34,35
116	PAD B RSS-212' EAST SIDE	FRCS PURGE PANEL (OXID) & SERVICE PANEL	35,36
117	PAD B RSS-163' (PCR) W SIDE	RSS WORK PLATFORM (PAYLOAD) PORTABLE CAMERA	37
118	PAD B RSS-163' (PCR) EAST SIDE	RSS WORK PLATFORM (PAYLOAD) PORTABLE CAMERA	37
119	PAD B FSS 155' EAST SIDE	H2 FIRE DETECTION ONLY	38
120	PAD B RSS-161' (HINGE POINT)	CRYO FLEX LINES I/F	39
121	PAD B RSS-172' (OMBUU)	OMBUU UMBILICAL CARRIER INTERFACE (MANUAL PAN & TILT)	40
122	PAD B RSS-163' (OMBUU)	OMBUU LOX AND LH2 ACCUM/VALVE COMPLEX (MID LEVEL)	40
123	PAD B RSS-112' WEST SIDE	HYPER RCS/OMS (FUEL) PORTABLE CAMERA	41
124	PAD B RSS-112' EAST SIDE	HYPER RCS/OMS (OXID) PORTABLE CAMERA	41
125	PAD B RSS-112' WEST SIDE	RCS/OMS UMBILICAL (FUEL)	42
126	PAD B RSS-112' EAST SIDE	RCS/OMS UMBILICAL (OXID)	43
127	PAD B RSS-100' (HINGE POINT)	HYPER FLEX LINES	44
128	PAD B RSS-212' EAST SIDE	FRCS (OXID) VALVE COMPLEX	45
129	PAD B RSS-212' WEST SIDE	FRCS (FUEL) VALVE COMPLEX	45
130	PAD APRON S.E. SIDE	H2 FIRE DETECTION ONLY	46
131	PAD B PAD APRON NE SIDE	LH2 FUEL/VENT LINE TRENCH AREA, LH2 FUEL/VENT LINES	47
132	PAD B PAD APRON EAST SIDE	HYPER LINES, ET CABLE TRAY GO2 PRESSURE LINE, GO2 VENT LH2 CROSS COUNTRY LINE	48,49
133	PAD B PAD APRON EAST SIDE	T-0 EVENTS OF ANTIGEYSERING & TPS SCAN ET/ORB INTERFACES	50,51
134	PAD B PAD APRON SE SIDE	HYPER OXID CC LINE, ET GO2 VENT, PYRO TUMBLE VALVE	51,52

LC–39 Operational Television Reference Guide (Cont)

Switcher Inputs (Continued)

SW INPUT/ CAMERA NO	LOCATION	SUBJECT	PAGE
135	PAD B PAD APRON SW SIDE	HYPER FUEL CC LINE AND 95' FLEX LINE AREA	52,53
136	PAD B PAD APRON 20' NW TOP OF STAIRS	VENT LINE ON WEST SIDE OF PAD AND UP FSS	54
137	PAD B RSS-135' EAST SIDE	SAFETY SURVEILLANCE OF ORBITER 50-2 DOORS	55
138	PAD B PERIMETER LH2 AREA	LH2 FACILITY STORAGE TANK, VALVES, CC LINES AND PUMPS	56
139	PAD B PERIMETER LH2 AREA	LH2 FACILITY STORAGE TANK, VALVES, LINES & REPLENISHMENT AREA	57,58
140	PAD B PERIMETER LH2 AREA	LH2 FACILITY STORAGE TANK, VALVES, LINES AND PUMPS	59
141	PAD B CAMERA SITE 2	PHOTO TRACKER BORESIGHT	60
142	PAD B FSS-140' SE CORNER	SAFETY SURVEILLANCE OF ORBITER 50-1 DOOR	60
143	PAD B CAMERA SITE 2	OVERALL LIFTOFF	61
144	PAD B PERIMETER OXID AREA SOUTH SIDE	HYPER OXID STORAGE TANK AND VALVE COMPLEX	61,62
145	PAD B PERIMETER FUEL AREA WEST SIDE	HYPER FUEL STORAGE TANK AND VALVE COMPLEX	63
146	PAD B PERIMETER LOX AREA NW SIDE	LOX FACILITY STORAGE TANK, VALVES, CC LINES AND PUMPS	64
147	PAD B PERIMETER LOX AREA NW SIDE	LOX FACILITY STORAGE TANK, VALVES, LINES AND PUMPS	65
148	PAD B CAMERA SITE 6	PHOTO TRACKER BORESIGHT	66
149	PAD B MLP "0" LEVEL SIDE 1-EAST	T-0 LO2 UMBILICAL DISCONNECT	66
150	PAD B MLP SIDE 1-WEST	LH2 AFT UMBILICAL INTERFACE, APU EXHAUST NOS. 1 & 2 AND MAIN ENGINE AREA	67
151	PAD B MLP SIDE 1-EAST	LO2 AFT UMBILICAL INTERFACE, APU EXHAUST NO. 3 & MAIN ENGINE AREA	68
152	PAD B MLP SIDE 1-WEST	LO2 VALVE/PIPE SYSTEM/REPLENISH VALVE	69
153	PAD B MLP SIDE 1-EAST	LH2 VALVE/PIPE SYSTEM	70
154	PAD B MLP SIDE 4-"0" LEVEL	ORBITER TO ET INTERFACE UNDERSIDE OF ORBITER WING AND TIPS	71
155	PAD B MLP SIDE 3-EAST "0" LEVEL	SRB SKIRT AND HOLDDOWN, NORTH BRIDGE PIPING, LO2 TOWER & ET SIDEWALL	72,73
156	PAD B MLP SIDE 3-WEST "0" LEVEL	SRB SKIRT AND HOLDDOWN, NORTH BRIDGE PIPING, LH2 TOWER, FSS NORTH PIPING & ET SIDEWALL	74,75

Switcher Inputs (Continued)

SW INPUT/ CAMERA NO	LOCATION	SUBJECT	PAGE
157	PAD B PERIMETER FUEL AREA E	HYPER FUEL STORAGE TANK AND VALVE COMPLEX	76
158	PAD B PERIMETER OXID AREA N	HYPER OXID STORAGE TANK AND VALVE COMPLEX	76
159	PAD B ORBITER	ORBITER COCKPIT DATA DISPLAY CRT (MCDS) (NO PAN & TILT UNIT)	77
160	PAD B STRUT ON WATER TWR-97'	LOX VENT ARM HOOD SEALS (COLOR)	77,78
161	PAD B FSS-260'	ET SCAN (COLOR) FIRE SURVEILLANCE	78
162	PAD B FSS-220'	ET SCAN	79
163	PAD B FSS-160'	ET SCAN, FIRE SURVEILLANCE (COLOR)	79
164	PAD B FSS-120'	ET SCAN	80
165	PAD B EAST	ET SCAN	81
166	PAD B SE	ET SCAN	81
167	PAD B APRON NW SIDE	ET SCAN	82
168	PAD B RSS-112' EAST SIDE	APU 613 CART (OXID)	82
169	PAD B RSS-112' WEST SIDE	APU 613 CART (FUEL)	83
170	PAD B WEST OF CAMERA SITE 3	FIRE SURVEILLANCE (COLOR)	83
171	PAD B NE OF CAMERA SITE 4	FIRE SURVEILLANCE (COLOR)	84
172	NOT ASSIGNED		
173	NOT ASSIGNED		
174	NOT ASSIGNED		
175	NOT ASSIGNED		
176	NOT ASSIGNED		
177	NOT ASSIGNED		
178	NOT ASSIGNED		
179	KSCNF (NASA SELECT VIDEO)	SELECTED PAO CAMERA VIEWS	
180	LCC RM 1P2	VTR PLAYBACK	
181	TRACKING SEQUENCES	CLOSEOUT CREW, FLIGHT CREW INGRESS/EGRESS, L/O SEQUENCE, LH2 SAFING	
182	TRACKING SEQUENCES	ICE INSPECTION, LO2 SAFING	
183	NOT ASSIGNED		
184	CONVOY/SLF	RTLS (TV-2)	
185	VAB ROOF	RTLS (TV-5)	
186	HELICOPTER	RTLS	
187	1TVC2050	JSC VIDEO DISPLAYS	
188	1TVC400	RSDS-(RANGE SAFETY DISPLAY SYSTEM, AS THE WORLD TURNS)	
189	ESMS NO. 1	MEASUREMENT DATA	
190	ESMS NO. 2	MEASUREMENT DATA	
191	MINI MENU	SHOWS SOURCE/CAMERA NUMBER INFO FOR SPECIFIC OPERATIONS	

9.0 KSC Console (Cont)

Displays

034:1412/02 SA036B 4-08 CDT -00:0127/58 HC IN PROGRESS FRZN 1
SM SA 0123 D123 E123 1AB 2AB 3AB 4AB 5AB 6AB SEP03 /BAI01 P123456
0

SRB POWER — BAI01 — **SRB OVERVIEW** — BOI01 — **OPS STATUS** — 3

MEC 1 2 CMDS INH

OL/HW	LEFT	RIGHT
BUS A	29.0	29.0
BUS B	28.9	29.0
BUS C	29.1	

BATTERY POWER

VLT	37.8	37.8
AMP	0.00	0.01
VLT	35.2	35.3
AMP	0.00	0.01
DEG	71.8	71.2
VLT	37.8	38.1
AMP	0.00	0.00

INST

SIM	LEFT	RIGHT
CHAM PRESS A	763.8	763.8
CHAM PRESS B	767.8	761.8
CHAM PRESS C	763.8	785.8
BATT POWER	ON	ON
BATT AMP	0.50	0.90
BEACON CMD	ENA	ENA

DATA VALID: L R FR 3
GPC MEM CONFIG GN9
OI/GPC FMT 129/44/12/ 0

MDM	LL1	LL2	LR1	LR2
MOD 0	ULK	ULK	ULK	ULK
MOD 4	ULK	ULK	ULK	ULK
P/S	XSTR	SEP	XSTR	SEP

S&A'S

	LEFT	ET	RIGHT
IGN	SAF		SAF
RSS	SAF	SAF	SAF

SRB APU

ISO VLV	LEFT	RIGHT
SYS A	CLS	CLS
SYS B	CLS	CLS

CTL VLV	PRI	SEC	PRI	SEC
SYS A	0PN	CLS	0PN	CLS
SYS B	0PN	CLS	0PN	CLS

TURBINE SPEED		
MPU 1A	0.2	0.2
MPU 1B	0.2	0.2
MPU 2A	0.2	0.2
MPU 2B	0.2	0.2

FLT CONTROLS

ACTUATOR	LEFT	RIGHT	
ROCK POS	-0.51	-0.41	IN
TILT POS	-0.49	-0.38	IN

GYRO	LEFT SMRD RATE	RIGHT SMRD RATE
PCH 1	ON 0.02	ON 0.0
PCH 3	ON 0.04	ON 0.0
YAW 1	ON -0.02	ON -0.0
YAW 3	ON -0.04	ON -0.0

IGN/HDP PICS

LA	LB	IGN	RA	RB
0.00	-0.08	0.00		0.00

HDP SYS A/B: PRI

3	0.02	0.08	0.04	0.0
	0.0	0.0	0.0	0.0
3	0.05	0.01	0.02	0.0
	0.0	0.0	0.0	0.0

SRB HYD

HYD PRESS	LEFT	RIGHT
SYS A	14	7
SYS B	35	21
FSM PRESS		
SYS A	371.7	402.7
SYS B	368.1	402.7

RANGE SAFETY SYSTEM

HOLDFIRE= GO

	PWR	AGC	PIC
LHA	OFF	0.0	0.0
LHB	OFF	0.0	0.0
RHA	OFF	0.0	0.0
RHB	OFF	0.0	0.0
ET	OFF	0.0	0.0A
CLASSIFICATION DETERMINATION			0.0B

TO SE
UNCLASSIFIED
REVIEWED:
DATE: 03 Feb 90

034:1220/40 SA036B 4-05 CDT -00:0300/00 HC IN PROGRESS 1
SM SA 0123 D123 E123 1AB 2AB 3AB 4AB 5AB 6AB SEP03 /BEE11 P123456
0EP03

STS-36 S0017
SRB JOINT HEATER ESA OVERVIEW BVE11

GS1A GS2A HIMS 3

POWER	DC	SUP	MOD	AC
PRI		ON	ON	OFF
SEC		ON	ON	OFF

TEMPS (DEGF)

	PRI	SEC	
	71.8	69.9	1
	72.5	73.1	2
SETPNT	-0.1	DEGF	
	71.8	72.5	1
	72.5	71.8	2
	69.2	69.9	3
	73.8	73.8	4
SETPNT	-0.1	DEGF	
	72.5	71.8	1
	70.5	70.5	2
	71.8	71.8	3
	74.4	75.1	4
SETPNT	-0.1	DEGF	
	71.8	71.8	1
	67.9	67.9	2
	68.6	68.6	3
	73.1	73.1	4
SETPNT	-0.1	DEGF	

HTR PWR: OFF | HTR PWR: OFF | HTR PWR: OFF | HTR PWR: OFF

IGN

PRI	SEC SEL	PRI
0.0	VAC	0.0
0.0	AMPAC	0.0

FWD

PRI	SEC SEL	PRI
0.0	VAC	0.0
0.0	AMPAC	0.0

MID

PRI	SEC SEL	PRI
0.0	VAC	0.0
0.0	AMPAC	-0.2

AFT

PRI	SEC SEL	PRI
0.0	VAC	-3.6
0.0	AMPAC	0.0

HTR PWR: OFF | HTR PWR: OFF | HTR PWR: OFF | HTR PWR: OFF

TEMPS (DEGF)

PRI	SEC	
71.2	71.2	1
69.9	69.9	2
SETPNT	-0.1	DEGF
69.2	69.2	1
70.5	70.5	2
71.2	71.2	3
75.1	75.1	4
SETPNT	-0.1	DEGF
69.2	70.5	1
70.5	70.5	2
71.2	71.2	3
73.1	73.8	4
SETPNT	-0.1	DEGF
69.9	70.5	1
72.5	72.5	2
73.1	73.8	3
73.8	73.8	4
SETPNT	-0.1	DEGF

CONTENTS ... CLASSIFICATION DETERMINATION
UNCLASSIFIED
REVIEWED:

Displays (Cont)

```
034:1220/57 SA036B      4-08 CDT -00:0300/00 HC IN PROGRESS                1
SM SA 0123 D123 E123 1AB 2AB 3AB 4AB 5AB 6AB  SEP03   /BAT91      P123456
EP03
                        STS-36 S0017
            BAT91  SRB TVC HYDRAULICS   BDT91
                                                   LEFT    VEHCLE    RGHT
                                                  AU UB              AU UB
                                                        HBG   44F
                                                          POLL
                                                 FUEL SUPPLY MODULE
                                                 73   73 FSM TEMP  73  73
                                                372  368 FSM PRES 403 403
                                                 CL   CL ISO  VLV  CL  CL
                                                 OP   OP PRI  VLV  OP  OP
                                                 CL   CL SEC  VLV  CL  CL
SRB AFT SKIRT GN2 PURGE          T    70 B  70
               HL    HL               70 B  69   GAS GENRTR
                                      72 N  75   74   72 TEMP   72  75
DC PWR         PRI       CMD          70 N  72   OF   OF HTR1 CMD  OF OF
       GN2 SUP  XCL      O-F            PRG      OF   OF HTR2 CMD  OF OF
 PRI    CMD     XCL                   L OFF R    TURBINE SPEED (KRPM)
 O-F    O-F     LOW  CTL   85  HTR                O    O MPU 1   O   O
       XOP      XCL  OF        OF      -4    0    O    O MPU 2   O   O
 O-F            XCL                          0   HYDRAULICS
 SEC            SEC                   DEG  PSI    21   35 PSIA    7  21
                                                  71   71 TMP1   72  73
                                                  70   72 LEVL   71  71
                                                  72   72 TMP2   72  74
                                                 ACTUATOR
                                                SEC   SEC SYSTEM SEC  SEC
                                               -0.5 -0.5 POSITN-0.4 -0.4
                                                 OF   OF P BYP VL  OF  OF
                                                 OF   OF PRES CAL  OF  OF
```

CLASSIFICATION DETERMINATION
CONTENTS HAVE BEEN REVIEWED AND DETERMINED
TO BE
UNCLASSIFIED
REVIEWED: [signature]
DATE: 03 Feb 90

```
079:0941/44 SB31RA1      3-10 CDT -00:0318/16 HC IN PROGRESS                 B
SM SA 0123 D123 E123 1AB 2AB 3AB 4AB 5AB 6AB  SEP03   /BEQ01      P123456
SEP03
40/38 AINT101 SEP03    HAS BEEN INITIATED IN TCB T4 AT C900
                   BEQ01 SRB DATA DISPLAY BVQ01
OI ↑ 129 GPC ↑ 44 12 LDBA ↑ UPLK ↑                                          B
  RESELECT OPTIONS
PRESSURES
<B47P1300C1>  LH PRESS A SRM CHAMBER                 12.645603 PSIA
<B47P2300C1>  RH PRESS A SRM CHAMBER                 12.645603 PSIA
<B47P1301C1>  LH PRESS B SRM CHAMBER                 16.641204 PSIA
<B47P2301C1>  RH PRESS B SRM CHAMBER                 16.641204 PSIA
<B47P1302C1>  LH PRESS C SRM CHAMBER                -11.327999 PSIA
<B47P2302C1>  RH PRESS C SRM CHAMBER                -11.327999 PSIA
<B58P1303C1>  LH PRESS HYDR FLUID SUPPLY 1           48.796676 PSIA
<B58P2303C1>  RH PRESS HYDR FLUID SUPPLY 1           27.883811 PSIA
<B58P1304C1>  LH PRESS HYDR FLUID SUPPLY 2           27.883811 PSIA
<B58P2304C1>  RH PRESS HYDR FLUID SUPPLY 2           6.9709529 PSIA
<B46P1305C1>  LH PRESS N2H4/GN2 BOTTLE OUT SYS A     389.57678 PSIA
<B46P2305C1>  RH PRESS N2H4/GN2 BOTTLE OUT SYS A     125.47717 PSIA
<B46P1306C1>  LH PRESS N2H4/GN2 BOTTLE OUT SYS B     381.21154 PSIA
<B46P2306C1>  RH PRESS N2H4/GN2 BOTTLE OUT SYS B     127.86721 PSIA

                                       PFK11 REFRESH
                                       PFK15 TERMINATE
```

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