JSC-25276

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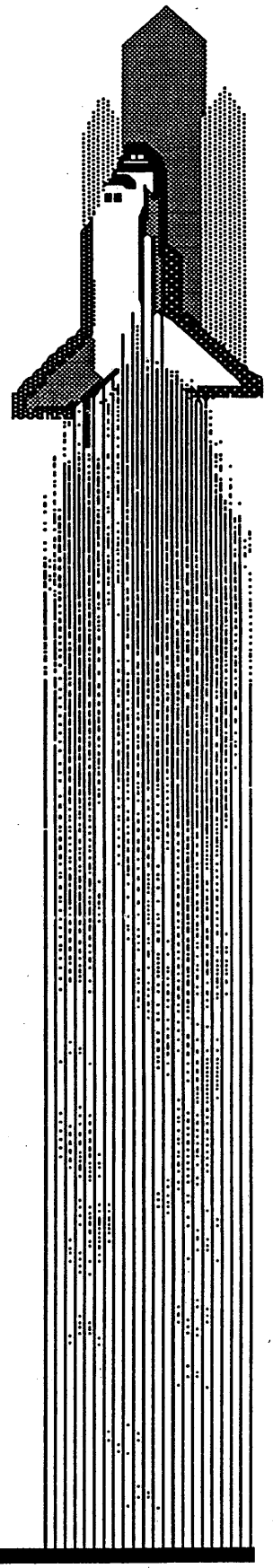

Space Shuttle

Photographic and Television Analysis Project

STS-43 Final Report

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National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

Space Shuttle Photographic and Television Analysis Project

STS-43 Final Report

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1.0 OV-104 STS-43 Film/Video Screening and Timing Summary

1.1 Screening Activities

All films and videos screened by project analysts are summarized in Tables 1 and 2. Screening information has been tabulated and is presented in Appendix A. Although no major anomalies were detected, significant events were noted during screening and are explained in Section 2.0 of this report.

1.1.1 Pre-Launch - ET Hydrogen Tanking and Screening Analysis *(Cameras OTV-009, OTV-054, OTV-063, OTV-064)*

MER engineering views were screened real-time during the tanking of the ET commencing approximately 8 hours prior to launch.

The usual vapors and water drops were noted during the tanking. Probable ice was noted to form on the baggie material at the ET/orbiter disconnect. No anomalies were detected. See Task #8 in Appendix D for details and for notes on the two previous screenings of STS-43 scrubbed tankings.

1.1.2 Launch

The STS-43 launch of Atlantis occurred at 15 hours 01 minute 59.994 seconds UTC on August 2, 1991 (day 214) as seen on camera E-10. SRB separation occurred at approximately 15 hours 04 minutes 05.605 seconds UTC as seen on ET-207.

On launch day, 25 videos of 25 expected were screened. Two significant events were observed. A discoloration was noted in the SSME #2 plume mach diamond at engine startup on cameras OTV-070 and OTV-071. A large piece of debris was seen falling aft of the vertical stabilizer at approximately 43 seconds MET on several of the long range tracking video cameras. Also worth mentioning was the holddown bolt hang-up at Holddown Post M-7. Results of the screening each day were presented to the Mission Management Team and a written status report was submitted each morning to the Mission Evaluation Room (MER), Level II, to other NASA centers and Rockwell/Downey.

The astronauts took seventeen handheld 70mm Hasselblad pictures of the external tank (ET) after it had separated from the Orbiter. Five of the views are very good and image the left side of the ET. No anomalies or damage to the external tank TPS were seen. There were no umbilical well cameras on board the STS-43 flight. Thus, for this mission, DTO-0312 was partially accomplished with usable handheld photographs.

Seventy-one of seventy-three expected launch films were reviewed.

No castglance film of the SRB recovery was taken.

1.1.3 Landing

Landing of STS-43 occurred on runway 15 at the Kennedy Space Center. Right main gear touchdown was at 12 hours 23 minutes 24.902 seconds UTC on August 11, 1991 (day 223) as seen from KTV-33L. Nose gear touchdown occurred at 12 hours 23 minutes 35.947 seconds UTC as seen from KTV-33L. Wheel stop was at approximately 12 hours 24 minutes 23.297 seconds UTC as seen on KTV-11L. Eight videos plus NASA Select were screened. No major anomalies were detected.

Video and Film List
STS-43
Launch Film & Video

Item Number	Expected	Received	Screened	Personnel
EX1	08/07/91	08/07/91	08/07/91	JH,MS,LR,RB
EX2	08/07/91	08/07/91	08/07/91	JH,MS,LR,RB
EX3	08/07/91	08/07/91	08/07/91	JH,MS,LR,RB
EX4	08/07/91	08/07/91	08/07/91	JH,MS,LR,RB
E1	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E2	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E3	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E4	08/03/91	08/03/91	08/04/91	JD,BG,SI,JV
E5	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E6	08/04/91	08/04/91	08/04/91	JH,MS,LR,RB,JV
E7	08/04/91	08/04/91	08/04/91	CD,JH,MS,LR,RB,JV
E8	08/04/91	08/04/91	08/04/91	CD,JH,MS,LR,RB,JV
E9	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E10	08/05/91	08/04/91	08/05/91	JD,SI,BG,JV
E11	08/05/91	08/04/91	08/05/91	JD,SI,BG,JV
E12	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E13	08/04/91	08/04/91	08/04/91	CD,JH,MS,LR,RB,JV
E14	08/04/91	08/04/91	08/04/91	CD,JH,MS,LR,RB,JV
E15	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E16	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E17	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E18	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E19	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E20	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E21	08/02/91	08/07/91	08/07/91	JH,MS,LR,RB
E22	08/02/91	08/07/91	08/07/91	JH,MS,LR,RB
E23	08/04/91	08/04/91	08/04/91	CD,JH,MS,LR,RB,JV
E24	08/04/91	08/04/91	08/04/91	CD,JH,MS,LR,RB,JV
E25	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E26	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E27	08/07/91	08/07/91	08/07/91	JH,MS,LR,RB
E28	08/07/91	08/07/91	08/07/91	JH,MS,LR,RB
E30	08/04/91	08/04/91	08/04/91	CD,JH,MS,LR,RB,JV
E31	08/05/91	08/04/91	08/05/91	JD,SI,BG,JV
E33	08/05/91	08/04/91	08/05/91	JD,SI,BG,JV
E34	08/03/91	08/03/91	08/03/91	JH,MS,RB,LR,JV
E35	08/03/91	08/03/91	08/04/91	JD,SI,BG,JV
E36	08/03/91	08/03/91	08/04/91	JD,SI,BG,JV
E40	08/03/91	08/03/91	08/04/91	JD,SI,BG,JV
E41	08/05/91	08/04/91	08/05/91	JD,SI,BG,JV
E42	08/05/91	08/04/91	08/05/91	JD,SI,BG,JV
E44	08/05/91	08/04/91	08/05/91	JD,SI,BG,JV
E50	08/05/91	08/04/91	08/05/91	JD,SI,BG,JV
E52	08/07/91	08/07/91	08/07/91	JH,MS,LR,RB
E53	08/07/91	08/07/91	08/07/91	JH,MS,LR,RB
E54	08/04/91	08/04/91	08/04/91	JH,MS,LR,RB,JV
E57	08/07/91	08/07/91	08/08/91	JD,BG,SI

Table 1

Video and Film List
STS-43
Launch Film & Video

Item Number	Expected	Received	Screened	Personnel
E58	08/07/91	08/07/91	08/08/91	JD,BG,SI
E59	08/04/91	08/04/91	08/04/91	JH,MS,LR,RB,JV
E60	08/04/91	08/04/91	08/04/91	JH,MS,LR,RB,JV,RP
E61	08/04/91	08/04/91	08/04/91	JH,MS,LR,RB,JV,RP
E62	08/04/91	/ /	/ /	No run
E63	08/04/91	08/04/91	08/04/91	JH,MS,LR,RB,JV,RP
E64	08/04/91	08/04/91	08/04/91	JH,MS,LR,RB,JV,RP
E65	08/03/91	08/03/91	08/04/91	JD,SI,BG,JV
E76	08/04/91	08/05/91	08/05/91	JH,MS,LR,RB,JV
E77	08/07/91	08/07/91	08/07/91	JH,MS,LR,RB
E78	08/04/91	08/04/91	08/05/91	JD,SI,BG,JV
E79	08/05/91	08/04/91	08/05/91	JD,SI,BG,JV
E150	08/08/91	/ /	/ /	Not received
E204	08/05/91	08/05/91	08/05/91	CD,JH,MS,LR,RB,JV,JDV
E205	08/05/91	08/05/91	08/05/91	CD,JH,MS,LR,RB,JV,JDV
E206	08/05/91	08/05/91	08/05/91	JH,MS,LR,RB,JV,JDV,RP
E207	08/04/91	08/04/91	08/04/91	JH,MS,LR,RB,JV
E208	08/05/91	08/05/91	08/05/91	JH,MS,LR,RB,JV,JDV
E211	08/07/91	08/07/91	08/08/91	JD,SI,BG
E212	08/05/91	08/05/91	08/05/91	CD,JH,MS,LR,RB,JV,JDV
E213	08/05/91	08/05/91	08/05/91	JH,MS,LR,RB,JV,JDV
E218	08/05/91	08/05/91	08/05/91	JH,MS,LR,RB,JV
E220	08/05/91	08/05/91	08/05/91	JH,MS,LR,RB,JV
E221	08/04/91	/ /	/ /	Not received
E222	08/05/91	08/05/91	08/05/91	CD,JH,MS,LR,RB,JV,JDV
E223	08/04/91	08/04/91	08/04/91	JH,MS,LR,RB,JV
E224	08/05/91	08/05/91	08/05/91	JH,MS,LR,RB,JV
ET204	08/02/91	08/02/91	08/02/91	JH,MS,RB,LR
ET206	08/02/91	08/02/91	08/02/91	JH,MS,RB,LR,CD
ET207	08/02/91	08/02/91	08/02/91	JH,MS,RB,LR,CD
ET208	08/02/91	08/02/91	08/02/91	JH,MS,RB,LR,CD
ET212	08/02/91	08/02/91	08/02/91	JH,MS,RB,LR,CD
ET213	08/02/91	08/02/91	08/02/91	JH,MS,RB,LR,CD
KTV2	08/02/91	08/02/91	08/02/91	SI,JD,MS,BG
KTV5	08/02/91	08/02/91	08/02/91	JD,SI,BG,MS,RB,JH
KTV11	08/02/91	08/02/91	08/02/91	JD,SI,MS,BG,RB,JH
KTV13	08/02/91	08/02/91	08/02/91	SI,JD,MS,BG,RB,JH
KTV18	08/02/91	08/02/91	08/02/91	SI,JD,BG,MS,RB,JH
KTV4A	08/02/91	08/02/91	08/02/91	JD,SI,MS,RB
KTV7A	08/02/91	08/02/91	08/02/91	SI,RB,JH,JD,BG,MS
KTV21A	08/02/91	08/02/91	08/02/91	SI,MS,BG,CD,JD,JH,RB
OTV009	08/02/91	08/02/91	08/02/91	JD,MS,SI,RB,JH,BG
OTV041	08/02/91	08/02/91	08/02/91	SI,JD,CD,BG
OTV048	08/02/91	08/02/91	08/02/91	SI,JD,BG,MS,RB,JH,CD
OTV049	08/02/91	08/02/91	08/02/91	SI,JD,BG,CD
OTV051	08/02/91	08/02/91	08/02/91	SI,JD,BG,CD

Table 1 - cont.

Video and Film List
STS-43
Launch Film & Video

Item Number	Expected	Received	Screened	Personnel
OTV054	08/02/91	08/02/91	08/02/91	CD,JD,SI,BG
OTV060	08/02/91	08/02/91	08/02/91	SI,JD,BG,CD
OTV061	08/02/91	08/02/91	08/02/91	SI,JD,BG,CD
OTV063	08/02/91	08/02/91	08/02/91	SI,JD,CD,BG
OTV070	08/02/91	08/02/91	08/02/91	BG,SI,JD,CD
OTV071	08/02/91	08/02/91	08/02/91	CD,JD,BG,SI,MS

Table 1 - cont.

Video and Film List
STS-43
Landing Film & Video

Item Number	Expected	Received	Screened	Personnel
E802	08/15/91	08/20/91	08/20/91	JD,BG
E803	08/15/91	08/20/91	08/20/91	JD,BG
E806	08/15/91	08/20/91	08/20/91	JD,BG
E807	08/14/91	08/16/91	08/16/91	JD,BG
E808	08/14/91	08/16/91	08/16/91	JD,BG
E809	08/15/91	08/20/91	08/20/91	JD,BG
E810	08/15/91	/ /	/ /	Not received
E812	08/14/91	08/16/91	08/16/91	JD,BG
E813	08/14/91	08/16/91	08/16/91	JD,BG
E816	08/15/91	08/20/91	08/20/91	JD,BG
E820	08/14/91	08/16/91	08/16/91	MS,BG
E821	08/14/91	08/16/91	08/16/91	MS,BG
E822	08/14/91	/ /	/ /	Not received
E823	08/14/91	08/16/91	08/16/91	MS,BG
E830	08/14/91	08/16/91	08/16/91	JD,BG
E831	08/14/91	08/16/91	08/16/91	MS,BG
E832	08/15/91	08/20/91	08/20/91	JD,BG
E833	08/14/91	08/16/91	08/16/91	MS,BG
E834	08/15/91	08/20/91	08/20/91	JD,BG
E835	08/14/91	08/16/91	08/16/91	MS,BG
E836	08/15/91	08/20/91	08/20/91	JD,BG
E837	08/14/91	08/16/91	08/16/91	MS,BG
E845	08/15/91	08/20/91	08/20/91	JD,BG
E846	08/15/91	/ /	/ /	Not received
KTV5L	08/11/91	08/11/91	08/11/91	JD,SI,BG,CD
KTV6L	08/11/91	08/11/91	08/11/91	JD,SI,BG,CD
KTV11L	08/11/91	08/11/91	08/11/91	JD,SI,BG
KTV15L	08/11/91	08/11/91	08/11/91	JD,SI,BG,CD,DP
KTV33L	08/11/91	08/11/91	08/11/91	JD,SI,BG,CD
KTV2L	08/11/91	08/11/91	08/11/91	JD,SI,BG,CD,DP
KTV13L	08/11/91	08/11/91	08/11/91	CD,JD,SI,BG
KTV14L	08/11/91	08/11/91	08/11/91	CD,JD,SI,BG
NASA SEL	08/11/91	08/11/91	08/11/91	JD,SI,BG,CD,DP

Table 2

1.0 OV-104 STS-43 Film/Video Screening and Timing Summary

Several events worth mentioning are: A white vapor appeared aft of the vehicle at 12 hours 18 minutes 40.003 seconds UTC on the NASA Select view of the descent, a piece of loose material was noted at the 7 o'clock position on the SSME #2 beta blanket after touchdown from KTV-33L, a white spot was noted on the base heat shield between SSME #2 and SSME #3 after touchdown, a U-shaped metal object was found underneath one of the umbilicals after wheel stop, and the left inboard main gear tire had a worn strip.

Twenty-one of twenty-four expected landing films were reviewed and no major anomalies were detected.

1.1.4 On Orbit

At approximately 23:00 MET, a down-link of the TDRS deploy contained about 22 seconds of video of a piece of curved debris to the right of the left OMS pod (to the left of the Orbiter). See section 2.13.1 and Task #10 in Appendix D for more details.

1.2 Timing Activities

Film from cameras E-4, E-8, E-204, E-212, and E-223 were used to time events of interest for the STS-43 mission. Film timing was determined from encoded film edge timing marks except on the cameras which had in-frame Light Emitting Diode (LED) numbers available which were E-9, E-12, E-61, and E-222.

Appendix C contains a detailed listing of the 19 items of interest that were timed. Several of these events were timed to determine if the same event was being seen on more than one camera.

Also summarized in Appendix C are the operations of 3 film cameras relative to the timing encoded, total frames exposed, camera offsets used in timing, actual determined frame rates and problems encountered.

2.0 Summary of Significant Events Analysis

2.1 Debris

2.1.1 Debris Near The Time of Ignition

2.1.1.1 Ice Debris From Umbilical Areas
(Cameras OTV-054, OTV-009, OTV-063, E-4, E-5, E-6, E-15, E-17, E-23, E-25, E-26, E-30, E-31, E-35, and E-79)

Several pieces of white debris, probably ice originating from the LH2 ET/Orbiter umbilical area, were seen falling aft at liftoff. See Figure 2.1.1.1 (A). A large piece of ice appeared to strike the TPS (OTV-054) but no damage was noted. ET/Orbiter umbilical ice debris has been seen on most shuttle launches.

Numerous pieces of ice debris were also noted falling from the LO2 carrier assembly prior to disconnect possibly due to a LO2 leak in the TSM area. See Figure 2.1.1.1 (B). None of this debris appeared to strike the vehicle.

2.1.1.2 Debris From Holddown Post M-5
(Camera E-12)

A small piece of white debris, that originated from the DCS area of the LSRB holddown post M-5, was seen moving to the left after PIC firing. See Figure 2.1.1.2. The piece of debris did not appear to strike the vehicle.

2.1.1.3 Debris From Holddown Post M-7
(Camera E-28)

Four pieces of dark debris, probably shim material 3 by 5 inches in size or smaller, were seen in the view of the LSRB holddown post M-7. (Holddown post M-7 had the bolt hang up.) See Figure 2.1.1.3. The debris were seen originating from the side of the shoe facing the SRB. Three additional small pieces of dark debris were noted coming from the M-7 DCS area after PIC firing. None of the debris was seen to strike the vehicle.

2.1.1.4 Flame Trough Debris
(Cameras E-7, E-14)

The trajectories of four fast moving pieces of debris were digitized on a Film Motion Analyzer. The particles exit the flame duct area after SRB ignition and as the SRB clears the MLP. The velocities of these particles were calculated. The peak velocity of these particles was determined to be over 115 feet per second. None of the observed debris appeared to strike the orbiter.

Multiple cameras were reviewed to determine if an individual particle could be seen by more than one camera. A single particle was not found on two cameras which would have satisfied the restrictions of the phototheodolite solution. See Task #7 in Appendix D for more details and charts of debris velocities.

2.1.2 Debris After Liftoff

2.1.2.1 Debris Between Liftoff and 42 Seconds
(Cameras E-26, E-36, E-40, E-52, E-53, E-59, E-65, E-207, E-222, E-223)

None of the debris mentioned in this section appeared to strike the vehicle.

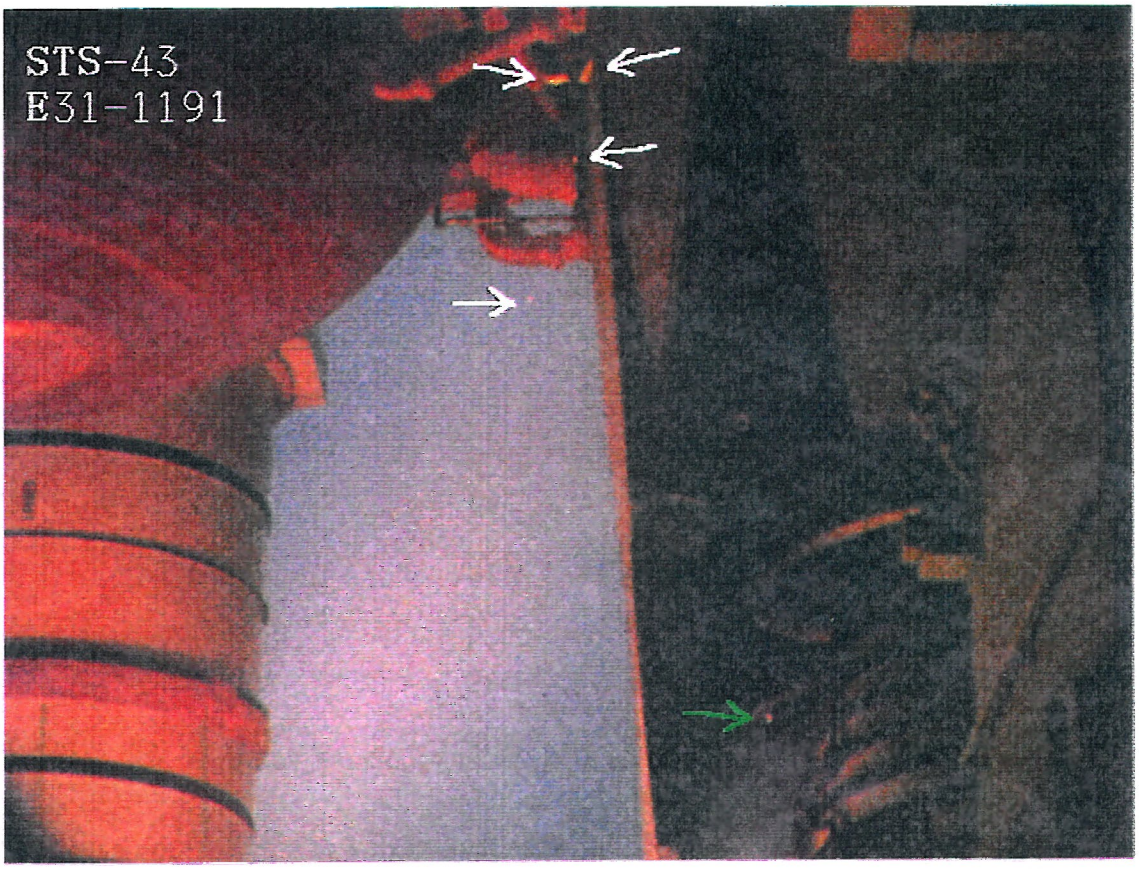

Figure 2.1.1.1 (A) **Ice Debris from LH2 Umbilical Areas**

Several pieces of ice debris fall from the LH2 ET/Orbiter umbilical at ignition and continue after liftoff. Also noted was a small piece of white debris originating between SSME #2 and the body flap after liftoff (green arrow). *(Camera E-31 Frame 1191)*

Figure 2.1.1.1 (B) **Ice Debris from LO2 TSM Umbilical Area**

Numerous large pieces of ice were noted falling from the LO2 TSM umbilical disconnect area at liftoff. Excessive ice in the LO2 TSM could be due to a possible LO2 leak in the TSM area. *(Camera E-17 Frame 3273)*

Figure 2.1.1.2 **White Debris from Holddown Post M-5**

A small piece of white debris was seen originating from the DCS area of holddown post M-5 at PIC firing. *(Camera E-12 Frame 3867)*

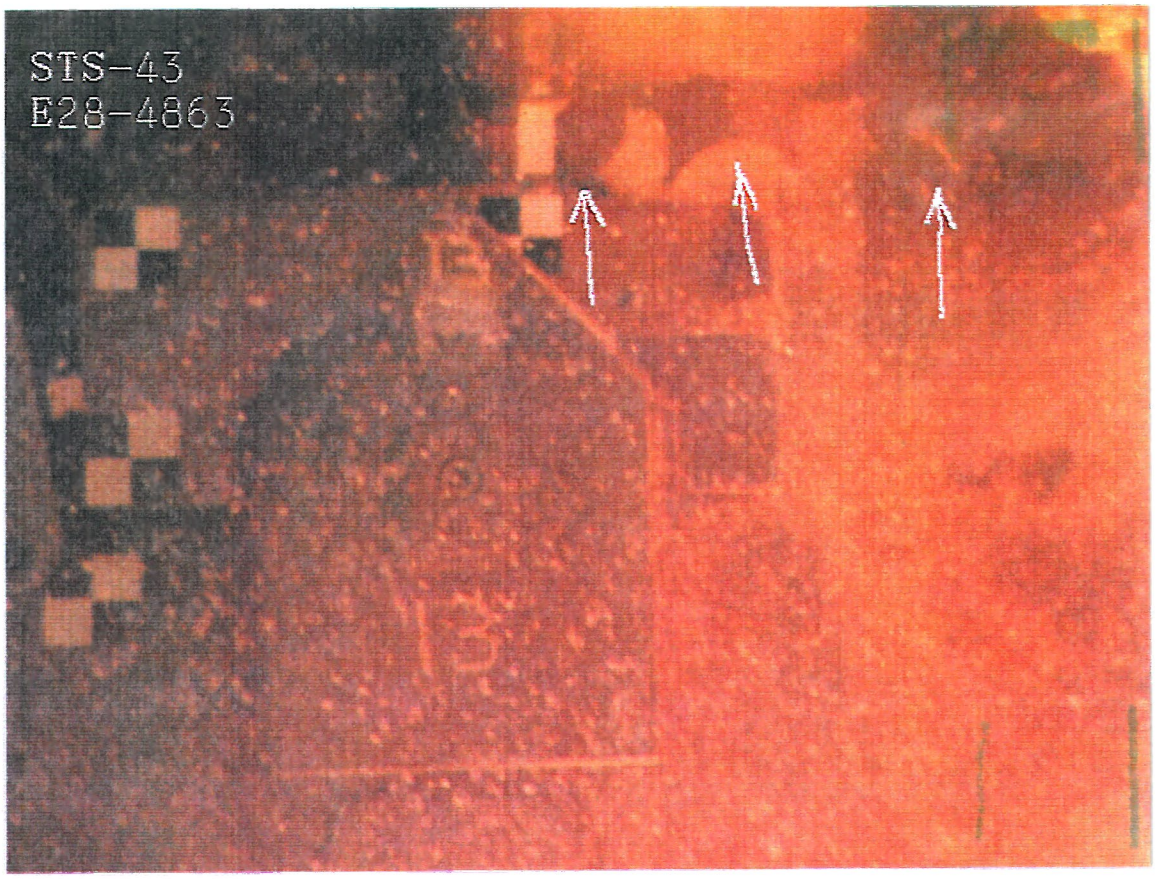

Figure 2.1.1.3 **Large Dark Debris at Holddown Post M-7**

Several pieces of large dark debris were noted in the shoe area of holddown post M-7 at liftoff. This is the same holddown post that had the bolt hang up. *(Camera E-28 Frame 4863)*

On camera E-36, several small pieces of debris passed through the camera's field of view right to left (north to south) during liftoff.

On camera E-26, a single piece of white debris that appeared to originate near the ring (beta blanket) at the base of SSME #2 was seen to fall aft of the SLV after liftoff. See Figure 2.1.2.1 (A).

On camera E-65, three pieces of white debris (probably ice) were seen moving aft along the body flap after liftoff. See Figure 2.1.2.1 (B).

On camera E-40, numerous pieces of debris were seen in the exhaust plume after liftoff.

On cameras E-52 and E-53, a large piece of light colored debris was seen to originate between SSME #1 and SSME #2 and fall aft of the vehicle at approximately 10 seconds MET. A possible source of this debris may be the debonded SSME beta blanket discussed in Section 2.3.

On camera E-59, a medium sized light colored piece of debris was noted falling aft along the underside of the left outboard elevon prior to the roll maneuver.

On camera E-53, a small piece of white debris was seen to originate from the left elevon area and fall aft of the launch vehicle during roll maneuver.

On camera E-222, several large pieces of light colored debris were noted falling aft of the vehicle after the roll maneuver. See Figure 2.1.2.1 (C). Orange debris (probably baggy material) fell from behind the Orbiter (near the SRB's) at 23 seconds MET. See Figure 2.1.2.1 (D). On cameras E-54 and E-223, several small light pieces of debris were seen aft of the vertical stabilizer and in the SRB plume after the roll maneuver.

On camera E-207, a small piece of debris was seen falling aft of the vertical stabilizer after the condensation collar formation.

2.1.2.2 Debris Aft of SLV at 43 Seconds MET
(Cameras ET-204, ET-208, ET-212, E-204, E-208, E-212, E-218, E-220)

A large, light colored piece of debris appeared to originate from above the SSME #2 and was seen to travel around the left RCS stinger, along the SSME nozzle and fall aft of the vehicle. See Figure 2.1.2.2. The event was seen at approximately 43 seconds MET. The piece of debris appeared to be trapezoidal in shape and white in color. It also appeared to be rotating as it travelled through the FOV. The size of the debris was estimated to be between 22.72 sq. in. (min) and 33.28 sq. in. (max). The average taken over four measurements was 28.15 sq. in. KSC has theorized that the debris seen at 43 seconds may be the missing layers of closeout material from the SSME #2 beta blanket noted on the post landing debris assessment walkdown. See Task #11 in Appendix D for more details.

2.2 Discoloration of SSME #2 Plume
(Cameras OTV-070, OTV-071, E-2, E-3, E-63, E-77, E-222)

Eight discolorations in the SSME #2 plume mach diamond were noted prior to liftoff. The color of the plume appeared to change from a blue to an orange tint. See Figure 2.2. The discoloration was recorded at 15:01:59.629 UTC on OTV-070. A possible cause of the discolorations could be due to impurities present in the engine. The event was reported to the MER manager and to the JSC Mission Management Team. A similar event was noted during the SLV ascent on mission STS-32. See Task #13 in Appendix D for more details.

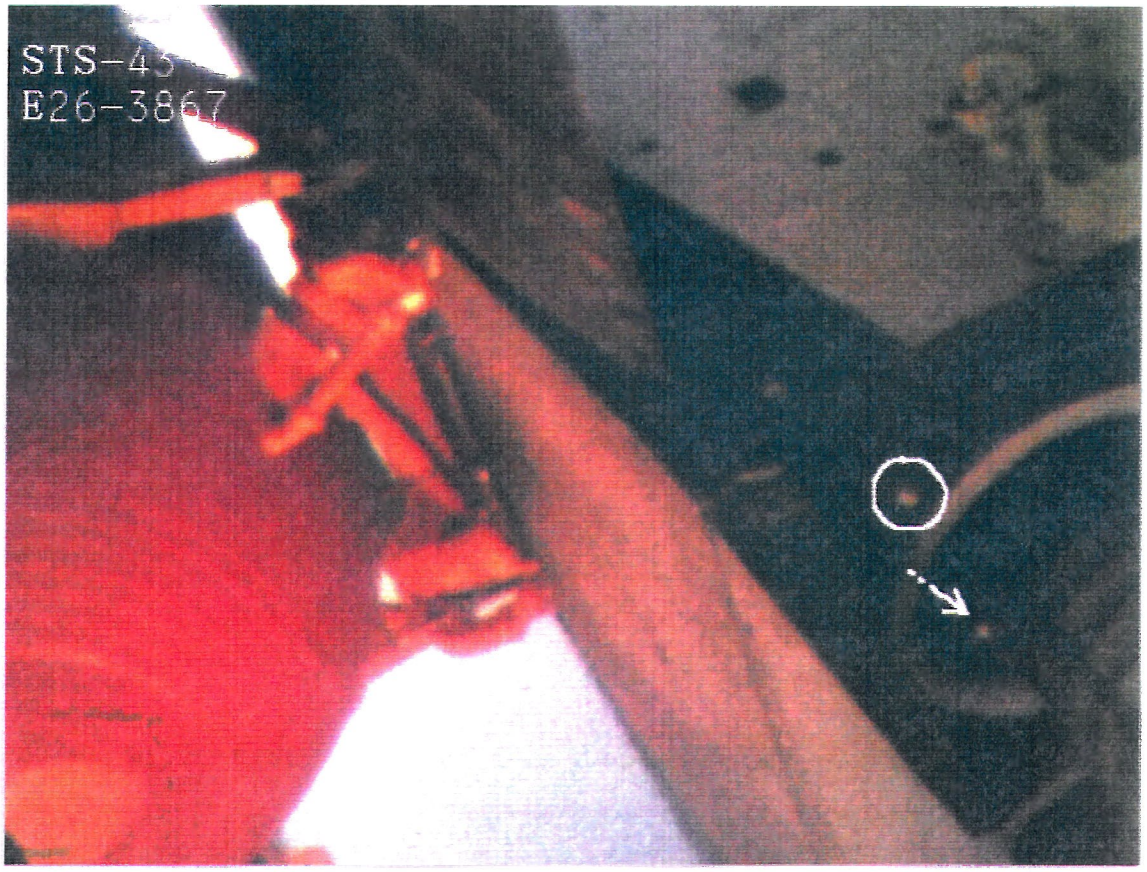

Figure 2.1.2.1 (A) **Light Debris from SSME #2 Beta Blanket**

A small piece of white debris was noted to originate near the ring (beta blanket) at the base of SSME #2 and then fall aft of the SLV. An area of possible tile erosion was also noted in this frame near SSME #2 beta blanket. *(Camera E-26 Frame 3867)*

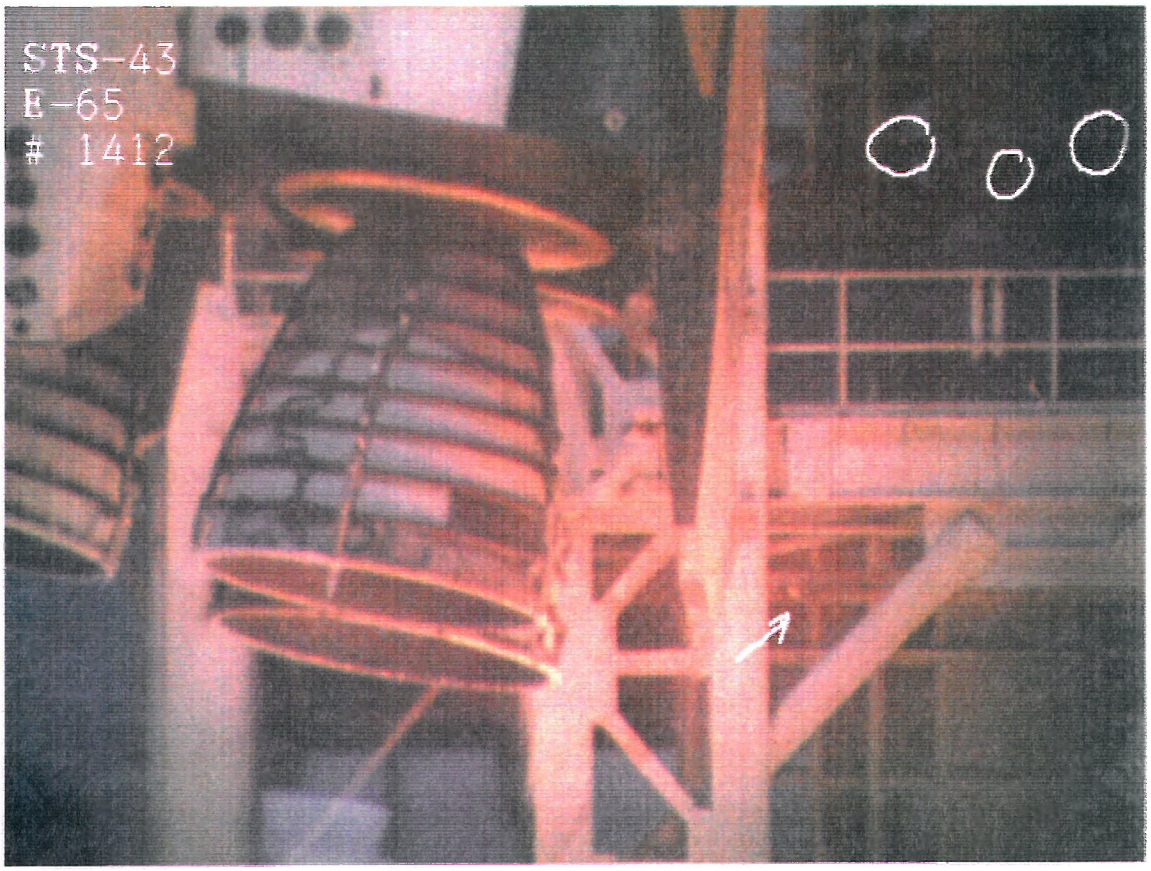

Figure 2.1.2.1 (B) **Light Colored Debris Falls Along Body Flap**

Several pieces of light debris, possibly ice from ET/Orbiter umbilicals, were noted falling along the body flap after liftoff. *(Camera E-65 Frame 1412)*

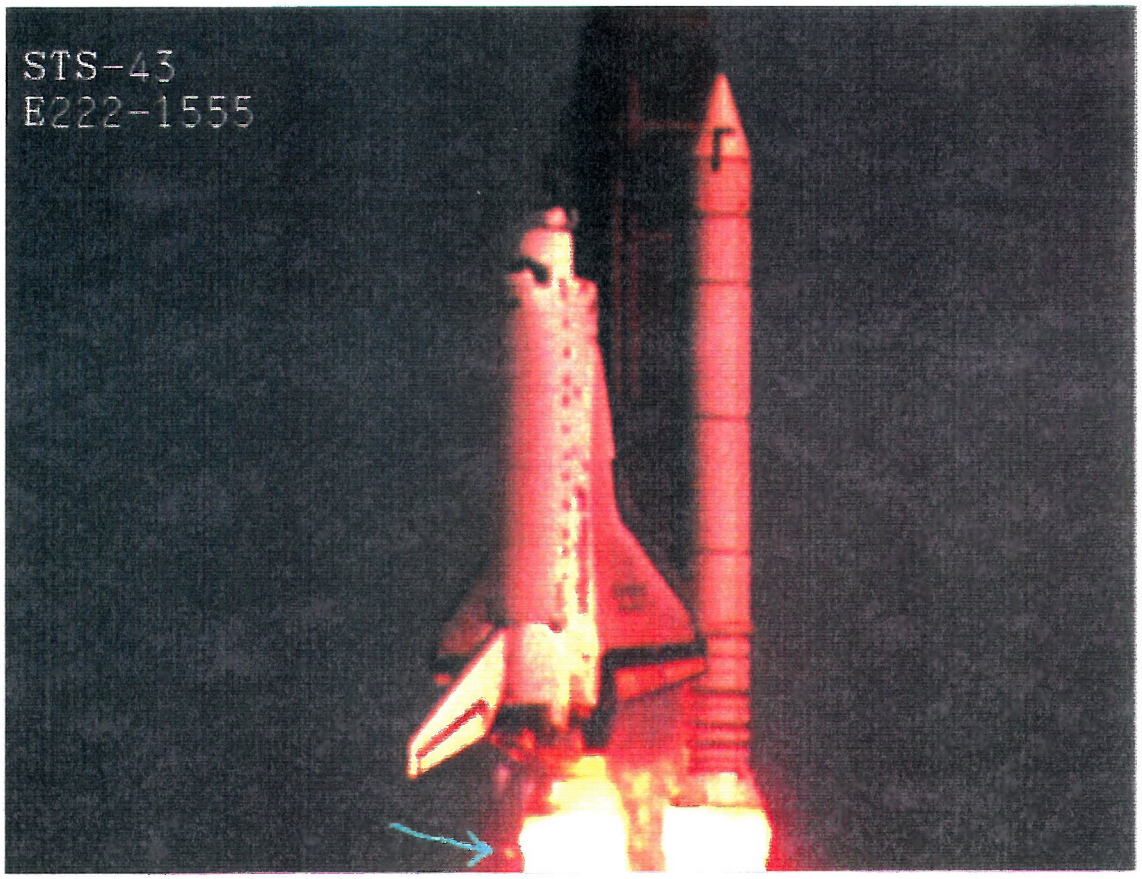

Figure 2.1.2.1 (C) **Large Debris Falls Aft of Vehicle**

A large piece of light colored debris appears to originate from the left side of the SSME area and falls aft of the vehicle after roll maneuver. *(Camera E-222 Frame 1555)*

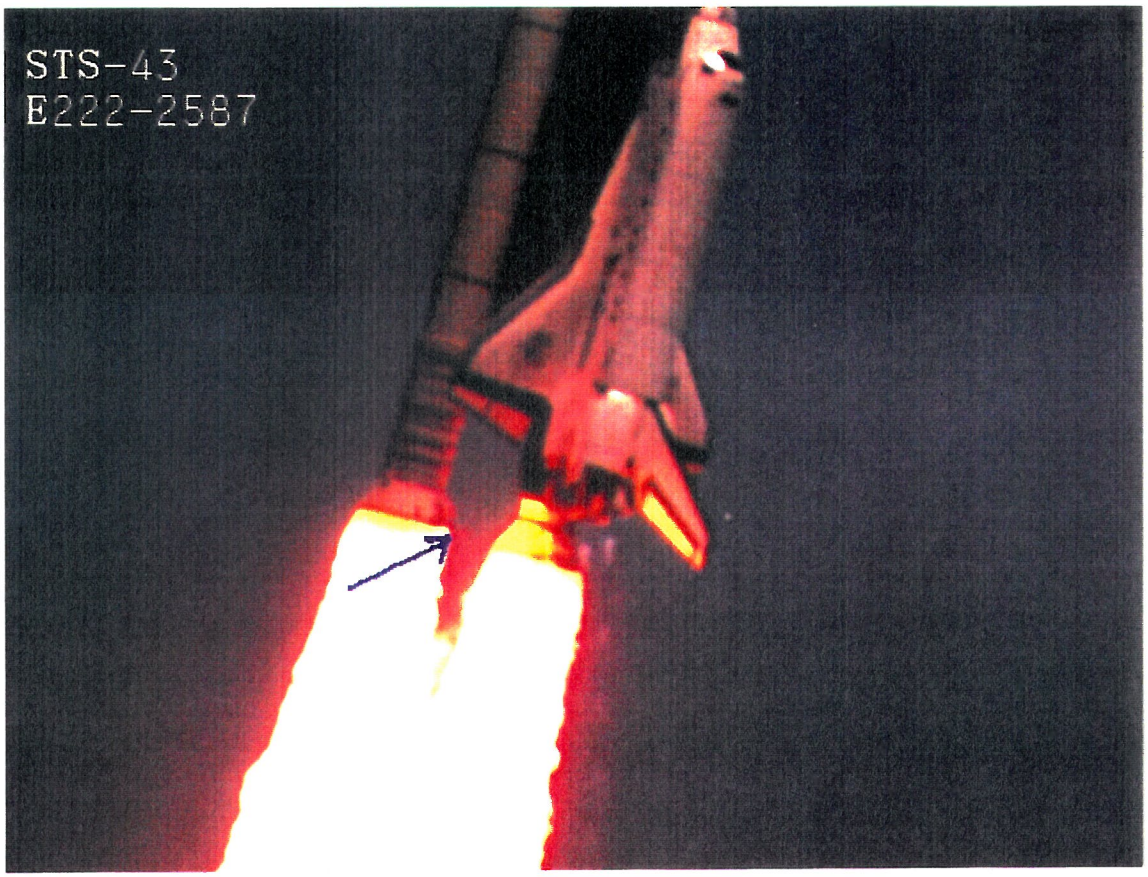

Figure 2.1.2.1 (D) **Orange Debris between SRB's**

An orange colored piece of debris (possibly baggie material) noted here near the LSRB, falls from behind the Orbiter near the SRB plume. *(Camera E-222 Frame 2587)*

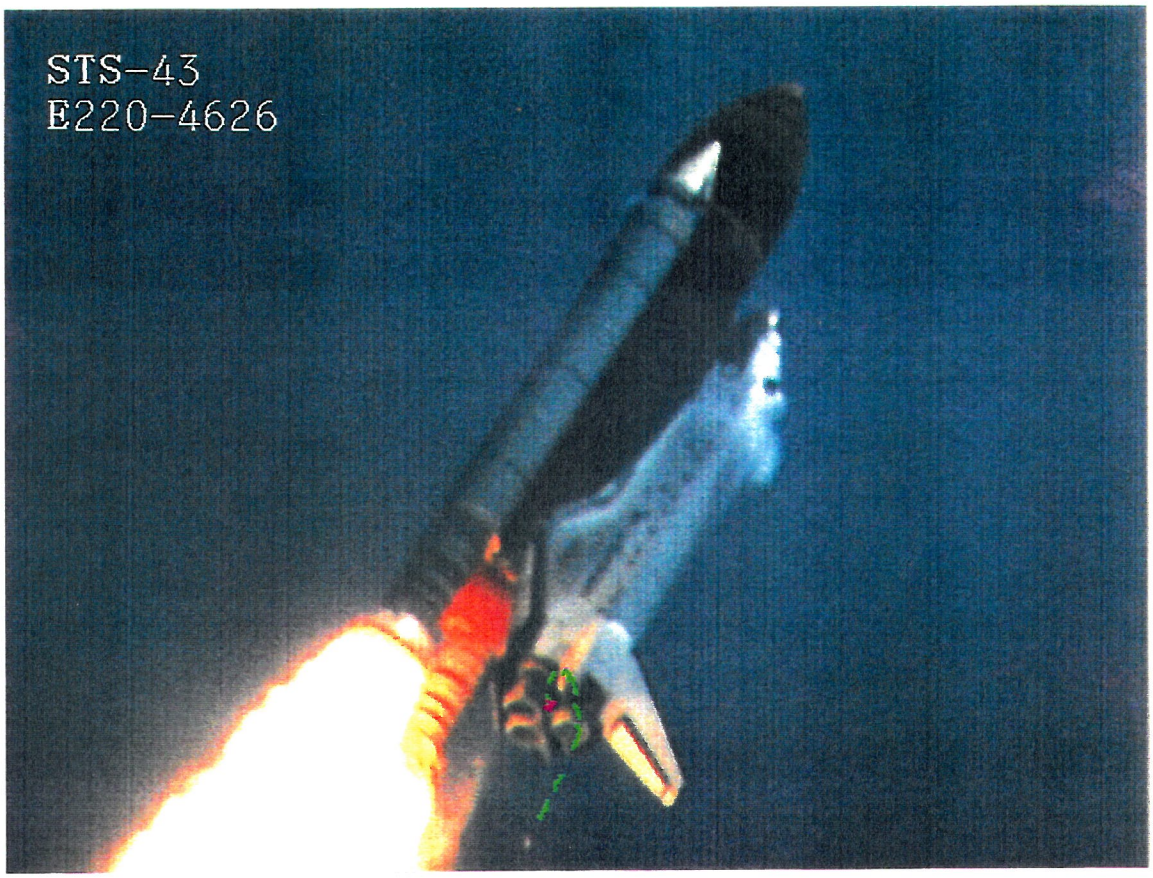

Figure 2.1.2.2 **Debris Aft of SLV at 43 Seconds MET**

A large light colored piece of debris appeared to originate from above SSME #2 and was noted to travel around the left RCS stinger, along the SSME #1 nozzle and fall aft of vehicle. *(Camera E-220 Frame 4626)*

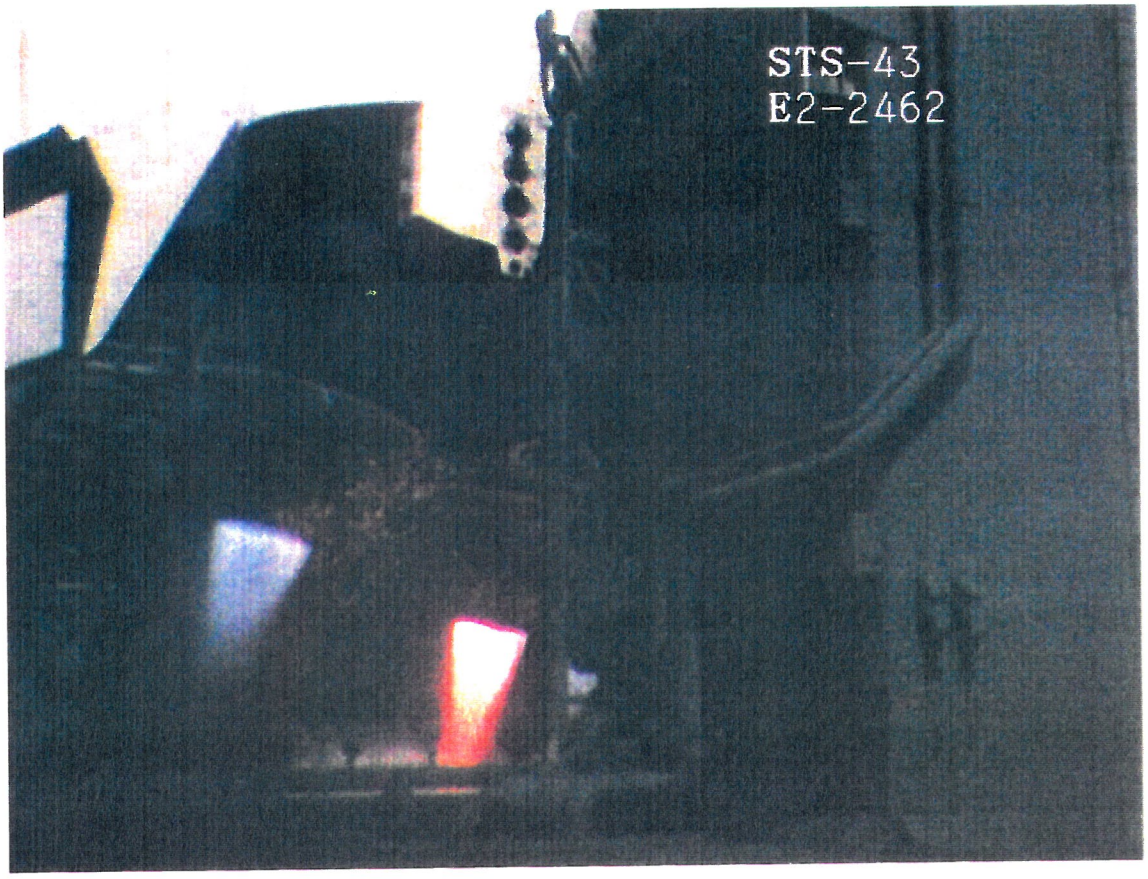

Figure 2.2 **Discolorations of the SSME #2 Plume**

Eight discolorations (from blue to bright orange) of the SSME #2 mach diamond were noted prior to liftoff. *(Camera E-2 Frame 2462)*

2.3 Debonding of the SSME #2 Thermal (Beta) Blanket
(Camera E-24, E-26)

A debonding of the SSME #2 thermal blanket was noted on camera E-24 during the SSME engine start up. See Figure 2.3. Measurements were made from the film to determine the size of the detached area. The beta blanket was detached approximately 10.85 inches circumferentially and 1.81 inches in depth. The blanket was seen to oscillate forward and aft during the ignition sequence. At no time did the thermal protection material appear to fail or tear. The detached area was not seen on any of the other launch camera films. After the landing, KSC reported that the outer layer of the SSME #2 closeout blanket was frayed along a 12 inch length at the 8 o'clock position. See Task #12 in Appendix D for more details.

2.4 Bolt Hang-up at Holddown Post M-7
(Cameras E-11, E-28)

A holddown bolt hang-up was noted at liftoff at holddown post M-7 (LSRB). See Figure 2.4. Rockwell/Downey engineers had previously reported the possibility that one of the holddown bolts had hung up based on the accelerometer data prior to the receipt of the films at JSC. The event was reported to the MER manager and the JSC Mission Management Team.

2.5 Base Heat Shield Erosion
(Camera E-18, E-23, E-26)

On camera E-23, slight heat shield erosion was noted at the base of the right OMS nozzle prior to liftoff. Base heat shield erosion was also noted between the SSME #2 nozzle and the RCS on camera E-18 and E-26 films. See Figure 2.5. Heat shield erosion has been noted on previous missions.

2.6 RCS Paper Discoloration
(Camera E-24)

The RCS paper on the left RCS stinger (L4U) cover was observed to be discolored. See Figure 2.6. The exact reason for the discoloration is yet unknown. This event was reported to the JSC Mission Management Team and the MER manager.

2.7 Flares and Flashes in the SLV Exhaust Plume
(Cameras E-52, E-53, E-204, E-208, E-212, E-213, E-218, E-220, E-222, E-223)

Several orange colored flares were seen in the SSME plume after the roll maneuver. At least three flares were noted in the SSME plume prior to the condensation collar formation (E-223). Flares have been seen on previous missions. See Appendix C for details about specific times of flares.

On cameras E-52 and E-53, white flashes were noted in both the SRB and the SSME exhaust plumes after the roll maneuver.

2.8 Orange Tint in the SRB Exhaust Plume
(Cameras KTV-4A, KTV-5)

An apparent orange discoloration was noted in the SRB exhaust plume from approximately 81 seconds to 103 seconds MET. The orange tint in the SRB plume may have been due to the sun angle. The KTV-4A view was compared to the same view on STS-34, also a day time launch. The orange hue was not present on the STS-34 view. Rockwell stated in the L+48 hour ascent flight report that STS-43 was the second flight with the Wecco SRB propellant. JSC propulsion

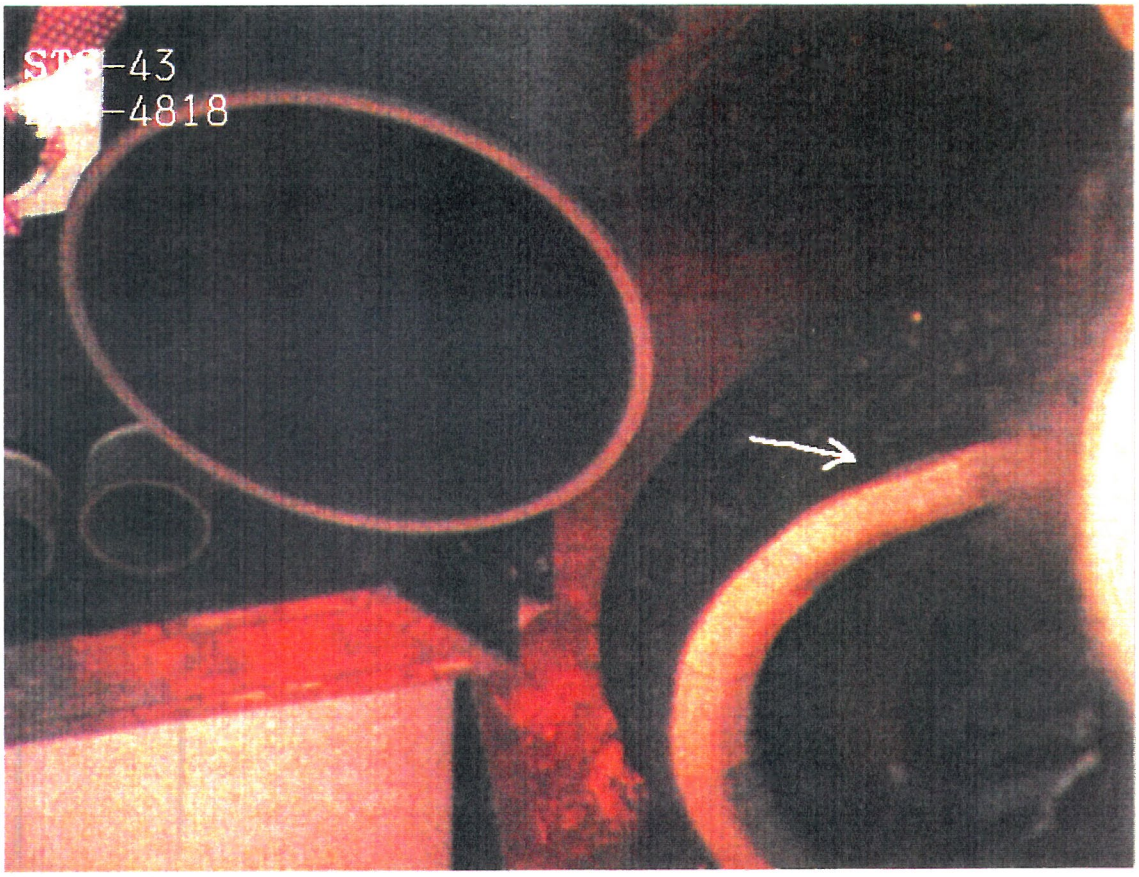

Figure 2.3 **Debonding of SSME #2 Thermal (Beta) Blanket**

A slight debonding of the SSME #2 thermal (beta) blanket was noted during SSME ignition. *(Camera E-24 Frame 4818)*

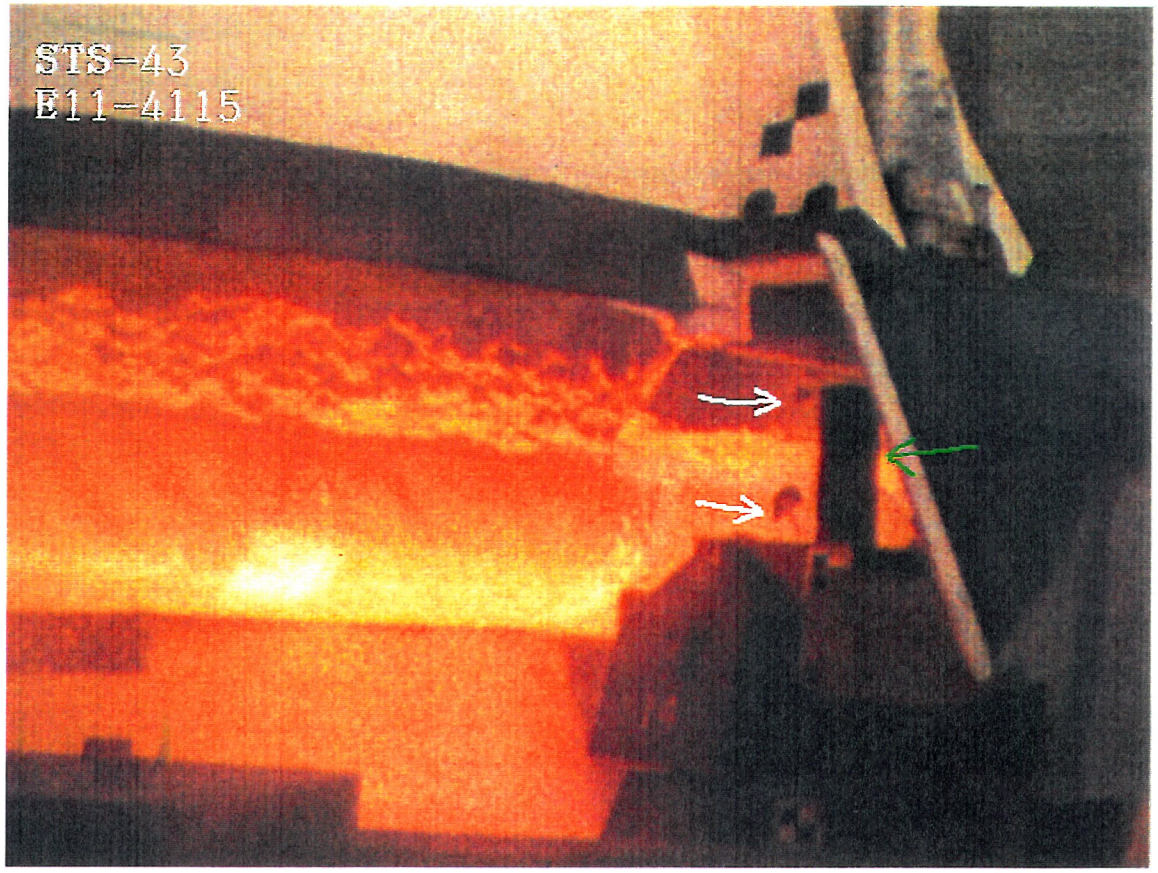

Figure 2.4 **Bolt Hang-up and Debris at Holddown Post M-7**

The bolt from holddown post M-7 remained attached to the LSRB momentarily and fell back down after liftoff. Several pieces of large dark debris associated with this event are also noted in this picture. *(Camera E-11 Frame 4115)*

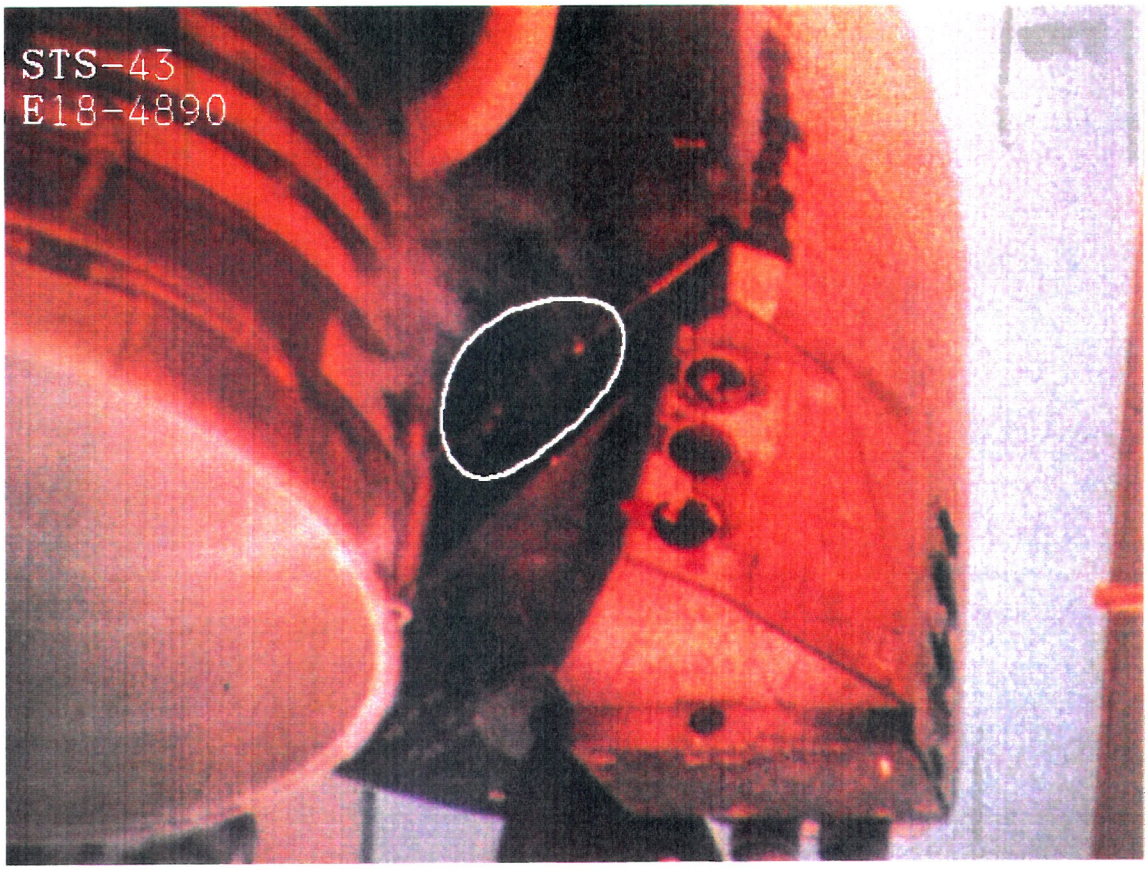

Figure 2.5 **Base Heat Shield Erosion**

Slight base heat shield erosion was noted between SSME #2 and the left OMS pod prior to liftoff. *(Camera E-18 Frame 4890)*

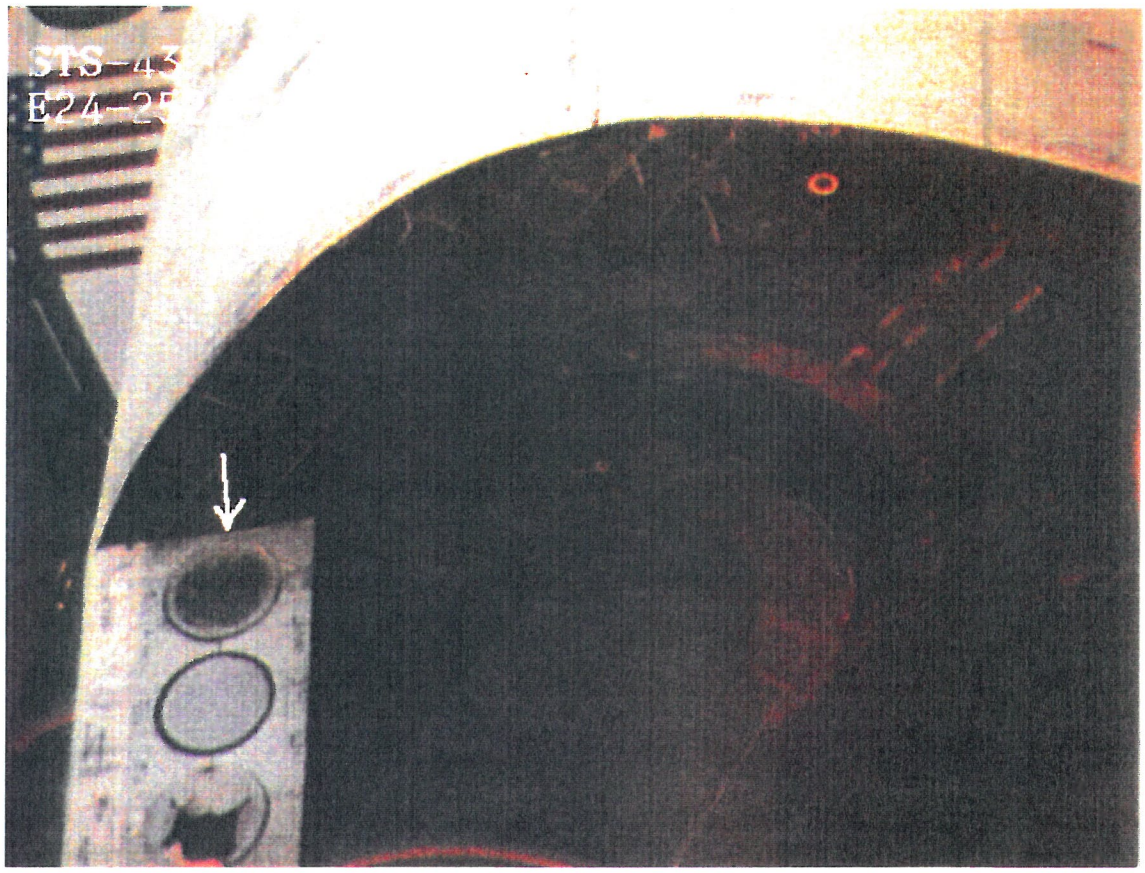

Figure 2.6 **RCS Paper Discoloration**

The paper on the upper left (L4U) RCS of the RCS stinger was noted to be discolored. *(Camera E-24 Frame 2524)*

engineers are investigating to determine if a change in propellant could be related to the apparent increase in the orange color of the plume.

2.9 Linear Optical Distortion of the SLV
(Camera E-212, E-218)

A linear optical effect was seen moving along the vehicle after the formation of the condensation collar. See Figure 2.9.

2.10 Slight Body Flap Motion
(Camera E-220)

Compared to previous missions, body flap motion on this mission was minimal. Given that body flap motion in past missions was greater and yet still difficult to measure, the slight amount of motion seen in this mission did not warrant a detailed measurement.

2.11 Condensation Around SLV
(Cameras ET-204, ET-206, ET-207, ET-212, ET-213, E-204, E-205, E-206, E-207, E-208, E-211, E-212, E-213, E-218, E-220, E-222, E-223, E-224, KTV-4A, KTV-5, KTV-13, KTV-21A)

Condensation was noted around the forward bipod, fuselage, vertical stabilizer, crew cabin and OMS pods. Atmospheric condensation around the SLV had been seen on several of the previous mission's photography and videos. The condensation is believed to be caused by the rapid motion of the SLV through a moist atmospheric layer.

2.12 Recirculation
(Cameras ET-204, ET-206, E-204, E-206, E-208, E-212, KTV-13)

Recirculation was observed on the long range camera films between 94 and 110 seconds MET. The recirculation or expansion of burning gases at the aft end of the SLV prior to SRB separation has been seen on most of the previous missions. A table showing start and stop times for the recirculation on STS-43 is shown below. A table showing recirculation on previous missions is included in Task #1 in Appendix D.

CAMERA	START (Seconds MET)	STOP (Seconds MET)
ET-204	96	105
ET-206	95	110
E-204	95	110
E-206	---	---
E-208	---	---
E-212	---	---
KTV-13	94	105

NOTE: Intermittent cloud cover prevented acquisition of specific start and stop times for cameras E-206, E-208 and E-212.

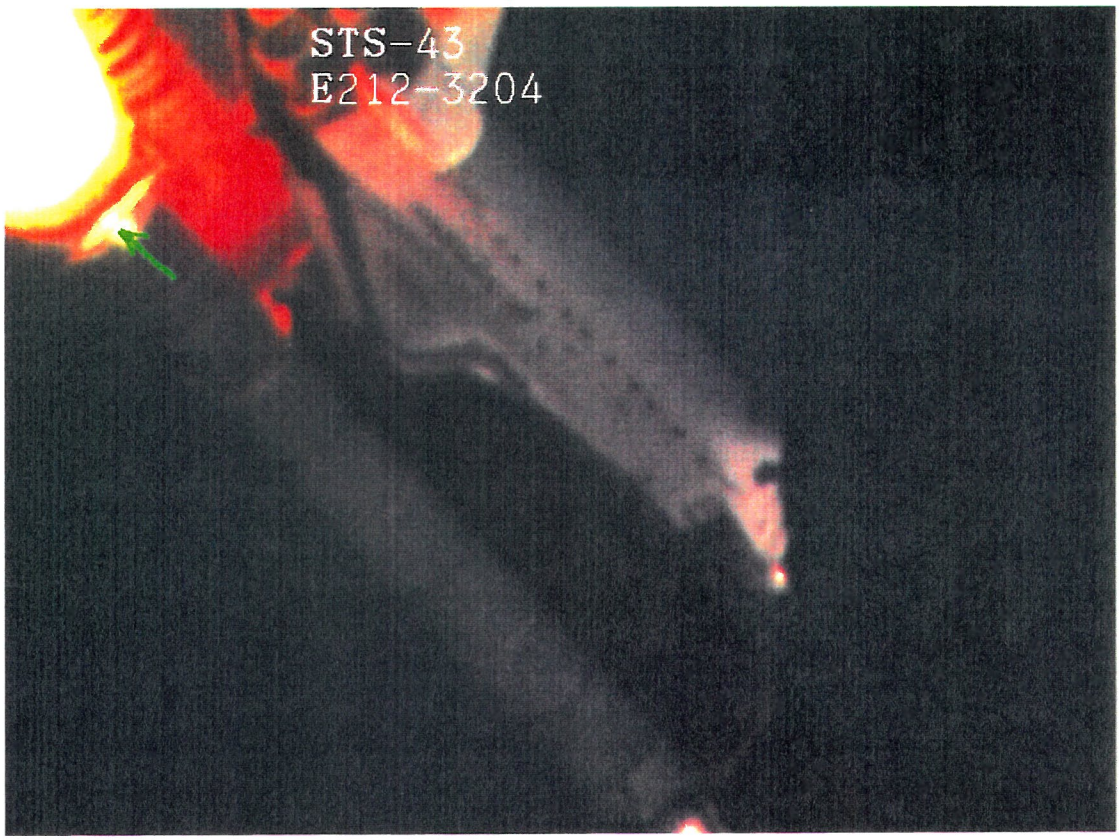

Figure 2.9 **Linear Optical Distortion of the SLV**

A linear optical effect was noted moving along the vehicle. *(Camera E-212 Frame 3204)*

2.13 On-Orbit

2.13.1 Crescent Shaped Debris
(Camcorder and on-board 16mm film camera)

At approximately 23:00 MET, a down-link replay of the TRDS deploy contained about 22 seconds of video of a piece of curved debris to the right of the left OMS pod (to the left of the Orbiter). See Figure 2.13.1 (A).

From the video screening, the piece was characterized as curved, having a thin dimension along the curve and a wider dimension perpendicular to the curve. The piece was much longer than it was wide. The piece tumbled in the field of view. During the tumbling, the object appeared to change from light (white) to dark (grey to black). The dark and light appearance of the piece was most likely due to shadows rather than a real color difference. The convex side of the piece had a roughness to the surface. The concave side appeared smoother. See Figure 2.13.1 (B).

This debris has many characteristics that are similar to debris seen on STS-41 and STS-35. On these missions, the debris was determined to be ice which came from the SSME bell.

The object subtends approximately 30 degrees of an arc. Due to a lack of information, there are no true linear measurements which can be derived, but relative (unit-less) measurements were as follows: the broader face of the object has an average width of 1, the narrower face has a width of 0.75, and the length of the object is 14. Due to the resolution in the video, these measurements could be off by +/- 0.37.

A short video of three sequences of enhancement to the down linked video was compiled. Sequences 1 and 2 showed registered images of the debris. The third sequence is a zoomed version of 200 frames of the debris.

A copy of this material regarding the on-orbit crescent shaped debris as seen on STS-43, STS-41, and STS-35 were reviewed with engineers from the Propulsion and Power Division. The material consisted of video from STS-43 and STS-41, as well as still photographs from STS-41 and STS-35. The engineers are convinced that the debris from each mission was from the same source, and that it was solidified oxygen which had formed on the SSME bells during the oxygen dump just after MECO. Sixteen millimeter film also imaged this debris. See Task # 10 in Appendix D for more details.

2.13.2 ET Onboard Hasselblad Photographic Analysis - DTO-0312
(Photographs 43-71-01 through 17)

Seventeen 70-mm Hasselblad photographs of the ET were taken on STS-43. The exposure and focus for the first 5 photographs were excellent. The data back was turned on and timing information was available. The LSRB BSM burn scar on the O-give of the ET is visible. See Figure 2.13.2. Frames 6 through 17 are backlit and dark, hindering analysis of burn scars or divots on the ET.

All the measurements were taken with an analog Shadowgraph. The Shadowgraph operates similar to a monocomparator and can measure objects to 1000th of an inch. The distance to the ET ranged from approximately 1240 meters on photograph 43-71-01 to 1830 meters on photograph 43-71-17. The burn scar on the left side of the O-give measured approximately 3.29 meters along its major axis. No debris was seen near the ET in these photographs. No divots in the insulation were noted. See Task #6 in Appendix D for more details and notes from the debriefing of the astronauts.

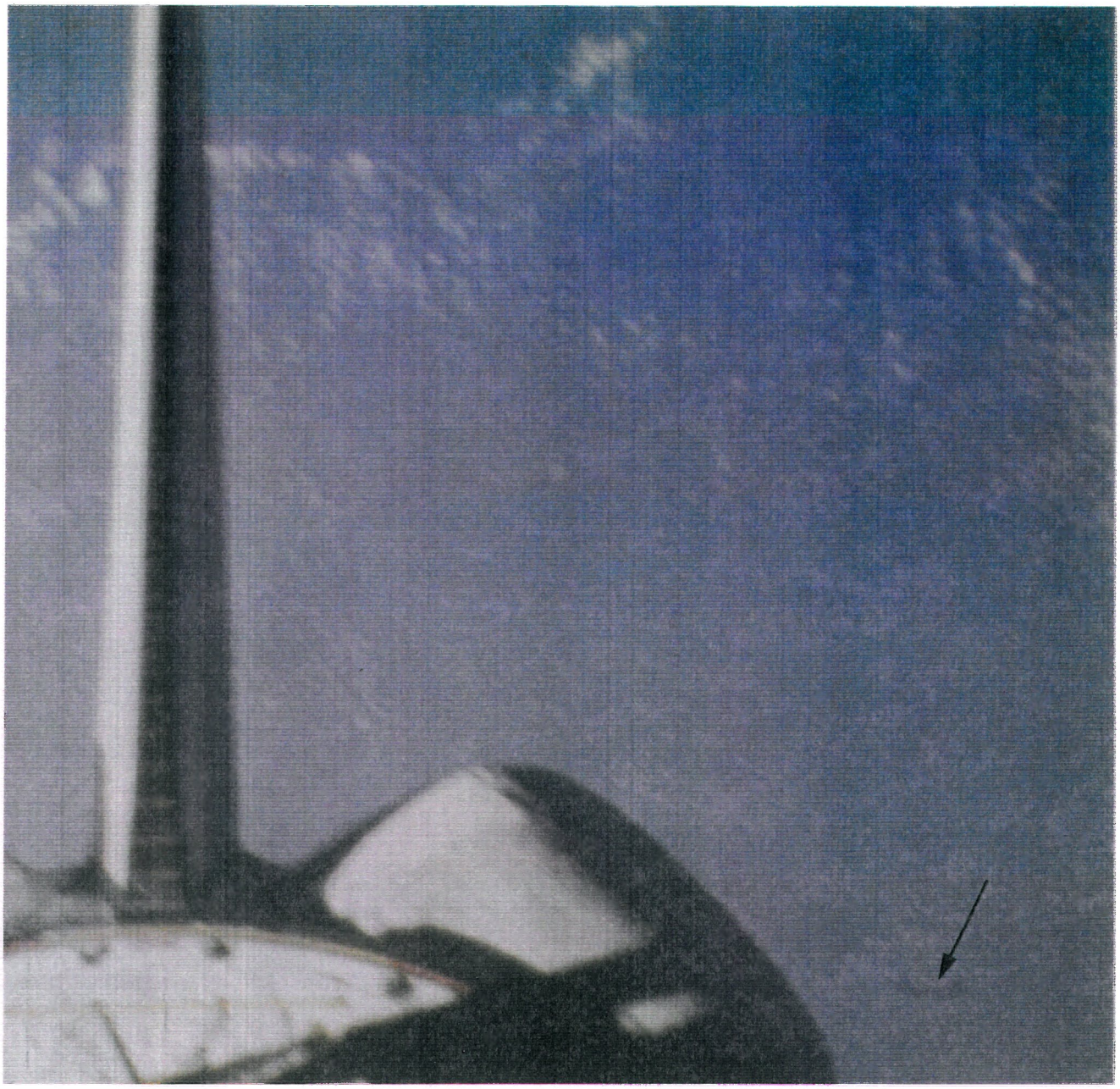

Figure 2.13.1 (A) **Crescent Shaped Debris near Orbiter**

The crescent shaped debris was first noted near the left OMS pod shortly after the TDRS deploy. *(Camera F-258 (onboard 16mm) Frame 10788)*

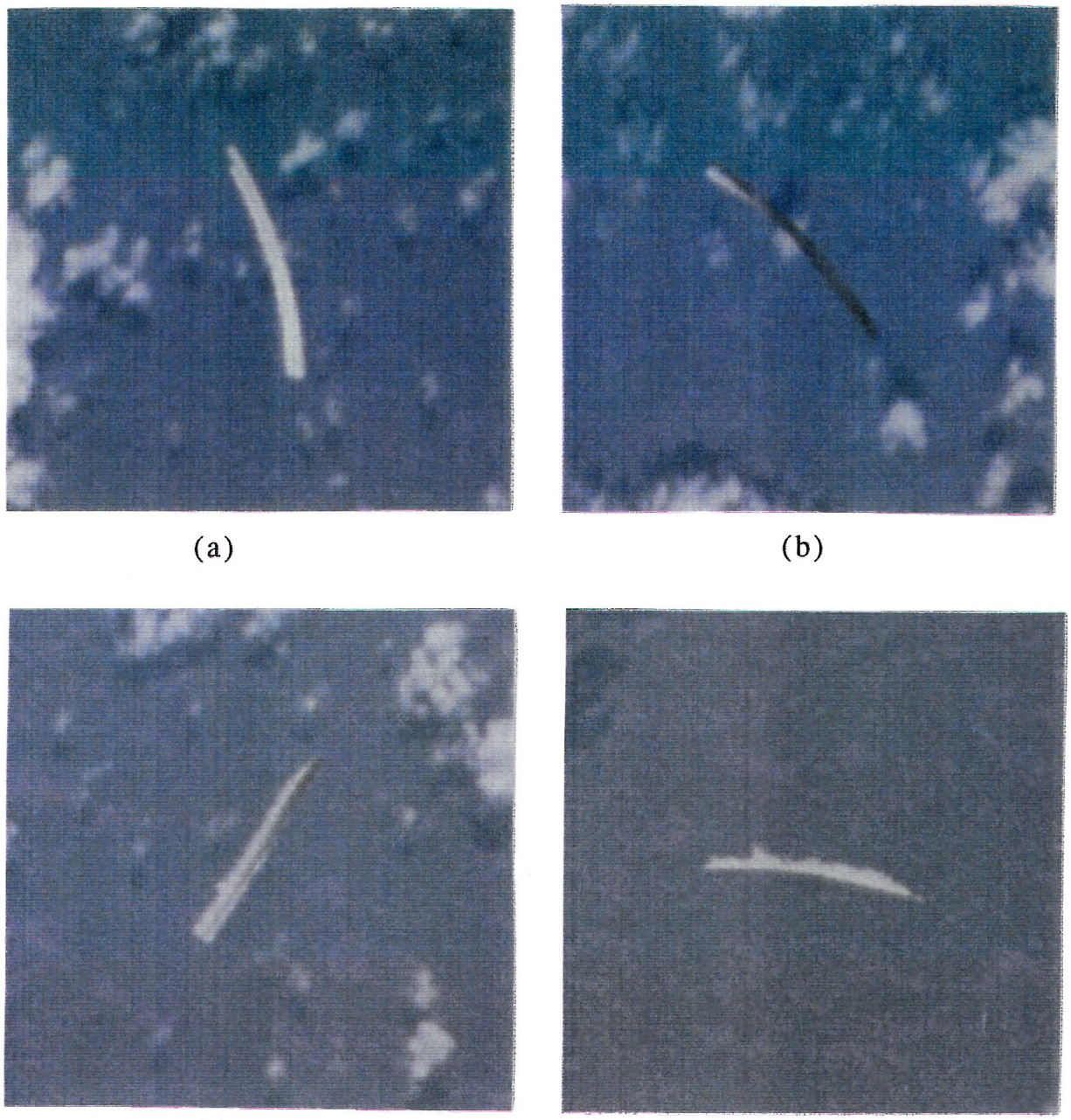

Figure 2.13.1 (B) **Four Views of the Crescent Shaped Debris**

Shown here are four different aspects of the debris. Besides the overall curved shape, several other characteristics are visible. In (a), the debris has what appears to be a ledge or ridge, (b) shows that while the object is tumbling shadows fall across it making it appear dark, and (c) and (d) show that one side of the object has a rough jagged appearance. (Camera F-258 (16mm onboard) mag. 168, Frames (a) 11257, (b) 11177, (c) 11388, (d) 11795)

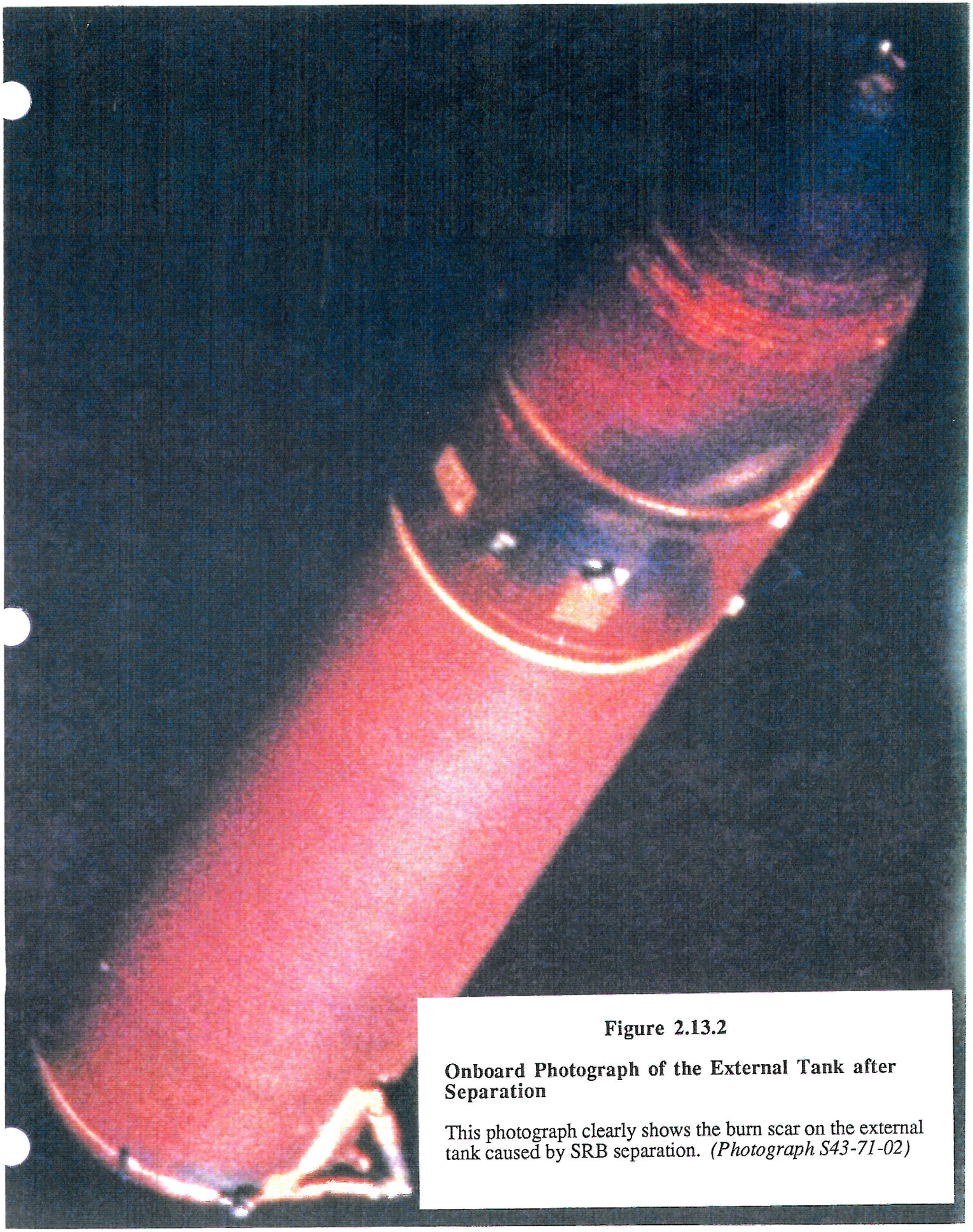

Figure 2.13.2

Onboard Photograph of the External Tank after Separation

This photograph clearly shows the burn scar on the external tank caused by SRB separation. *(Photograph S43-71-02)*

2.14 Landing

2.14.1 Vapor at Landing
(Camera E-845 and NASA Select)

A white vapor, seeming to emanate from the orbiter, was noted during landing at 223:12:18.40 (approximately 4 minutes and 45 seconds before main gear touchdown). See Figure 2.14.1. After speaking with engineers and using data available at this time, it is thought that the white cloud was due to the firing of the two left rear RCS jets. See Task #15 in Appendix D for more details.

2.14.2 Sink Rate Analysis

2.14.2.1 Landing Sink Rate Using Video

Sink rate analysis using film is considered to be more reliable than that of video due to the more precise resolution of the data. Since several unobstructed views of landing were available on film, no video sink rate was determined for STS-43. The quantization error inherent in the use of the video makes analysis using video insufficient to meet the .1 ft/sec precision required by the OMSRB.RCN500002DV51.P.001.

2.14.2.2 Landing Sink Rate Using Film
(Camera E-806, E-833)

Camera E-806 film was used to determine the sink rate of both the main gear and the nose gear and camera E-833 was used to verify main gear sink rate results. The vertical stabilizer was used as a scale reference. Three points per frame over 48 frames were digitized. The points used were the top of the right and left main gear and the edge of the runway with the same X coordinate. The vertical difference between the points was taken and a least squares regression was calculated on the vertical distance vs. time data to determine the actual sink rate. This rate was determined to be 2.2 ft/sec.

Nose gear touchdown occurred at 10.045 seconds after right main gear touchdown. Four points on every other frame over a period of 96 frames were digitized. These points consisted of the top of the right nose gear wheel, the top and bottom of the vertical stabilizer (as a scaling reference) and a point on the runway immediately below the wheel. A least squares regression was performed on the vertical distance vs. time data. The slope of this line was used as the sink rate of the nose gear and was found to be 2.5 ft/sec. See Task #3 in Appendix D for more details and plots of the above data.

2.14.3 Height Measurement of Vehicle Above Threshold
(Photographs KSC-391C-5165.09, .23, and .35)

Three photographs of the vehicle approaching touchdown at the Kennedy Space Center were analyzed to determine the height of the vehicle above the runway threshold. The exposure was good and the focus was sharp. No ancillary timing information was provided with the photographs. The orbiter occupies only a small area of the original photographs. However, enlargements of frame KSC-391C-5165.23 provided significant detail for analysis. See Figure 2.14.3. See Task #14 in Appendix D for detailed measurements.

Figure 2.14.1 **Vapor at Landing**

A white vapor, seeming to emanate from the Orbiter, was noted during landing at approximately 4 minutes and 45 seconds prior to main gear touchdown. *(Camera E-845 Frame 3262)*

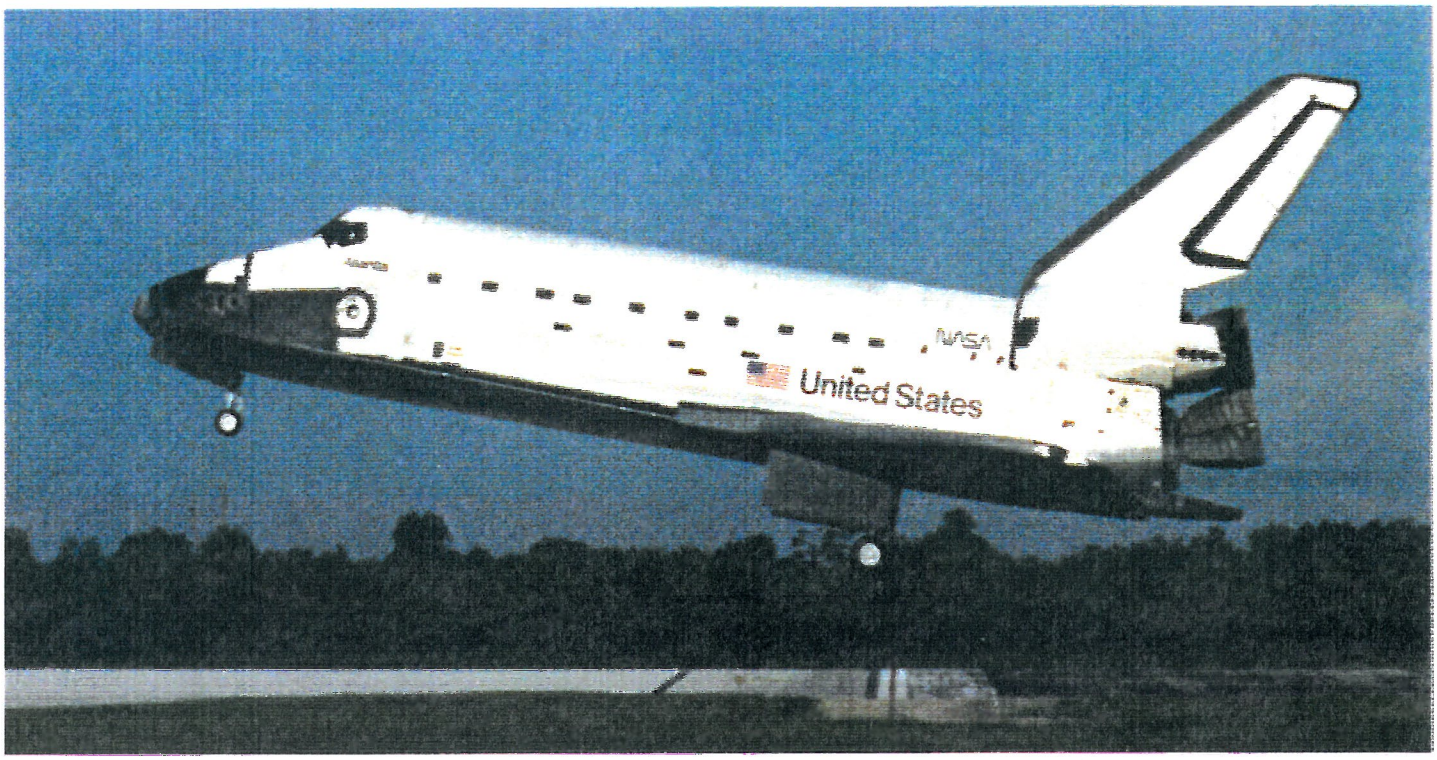

Figure 2.14.3 **Height Measurement of Vehicle Above Threshold**

The height of the vehicle above the threshold was calculated using this photograph and two others.
(Photograph KSC-391C-5165.23)

All the measurements were taken from a photograph with an analog caliper. The caliper had a least count of 1000th of an inch and range of motion of 6.000 inches. The orbiter was found to be 113.95 ± 4.00 inches above the threshold. This distance was determined by scaling distances from the photograph to actual sizes.

$$\frac{\text{distance of the orbiter on the photograph}}{\text{actual length of the orbiter}} = \frac{\text{height of vehicle above threshold}}{\text{actual height of vehicle}}$$

2.14.4 Other Landing Events and Debris After Landing
(Camera KTV-33L, handheld video - post landing)

A piece of loose material was noted at the 7 o'clock position on the SSME #2 beta blanket after touchdown from KTV-33L. A white spot was noted on the base heat shield between SSME #2 and SSME #3 after touchdown. See Figure 2.14.4 (A).

The following items were noted during the screening of the post landing handheld video views:

A liquid was seen dripping on the ground underneath one of the umbilicals, liquid was seen in the oxygen umbilical well, and on the ground under the left main landing gear. KSC reported the liquid to be water due to the atmospheric condensation present on the orbiter after landing.

A U-shaped metal object was seen on the ground underneath one of the umbilicals. KSC reported the object to be a yoke from the umbilical separation bolt head (#V072-565471-001, orbiter side).

A red stain (possibly from hydraulic fluid) was seen on the left main landing gear. KSC reported that they had seen no sign of a hydraulic leak on the post landing inspection.

The left inboard main gear tire had a worn strip on the tread. See Figure 2.14.4 (B).

2.15 Ground Equipment Events
(Cameras E-7, E-8, E-9, E-13, E-16, E-21)

On camera E-9, a slight shoe hangup was noted at the RSRB holddown post M-1 at liftoff. See Figure 2.15 (A).

On camera E-7, a slight rebound was noted of the blast deflector shield at holddown post M-4 of the RSRB at liftoff.

On cameras E-8 and E-13, the GN2 purge line was seen venting beneath both of the SRB's after liftoff.

On cameras E-7, E-11 and E-16, a water leak from an MLP J-pipe was noted. See Figure 2.15 (B).

On camera E-21, a vapor (possibly a leak) was seen coming from the TSM LO2 carrier lines. A loose piece of tape was seen on the backside of the carrier plate in the same view. The vapor coming from the LO2 carrier line was reported to the MER manager.

2.16 Other Normal Events

Other events seen on the STS-43 launch views that have been seen many times before on previous shuttle flights include: SRB throat plug debris, debris in the exhaust cloud after liftoff, slag debris at SRB separation, ET aft dome outgassing, vapors off the SRB stiffener rings at liftoff, ice and RCS paper debris at SSME ignition, and birds and bugs in view at liftoff.

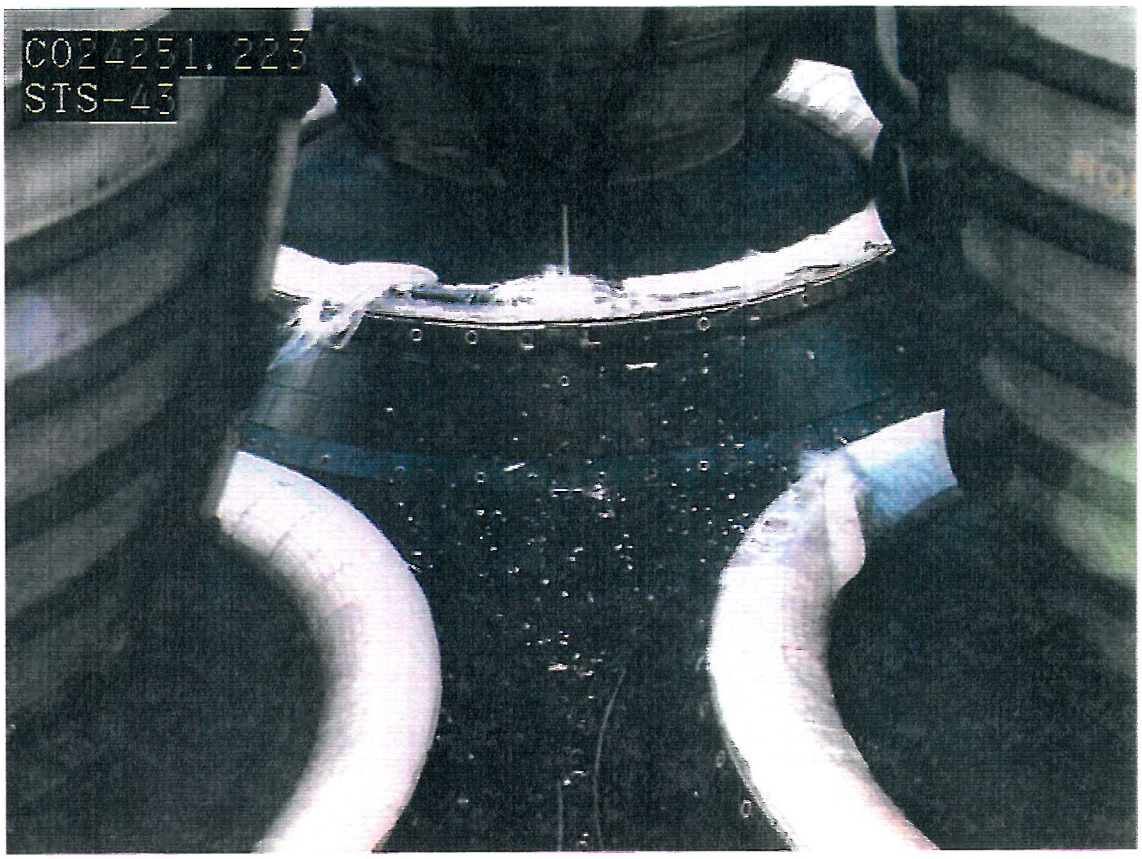

Figure 2.14.4 (A) **Torn Beta Blanket**

This post landing photograph shows the torn thermal (beta) blankets noted during launch and landing film screenings. Base heat shield erosion is also evident between the SSME's in this photograph. *(Photograph C024251.223)*

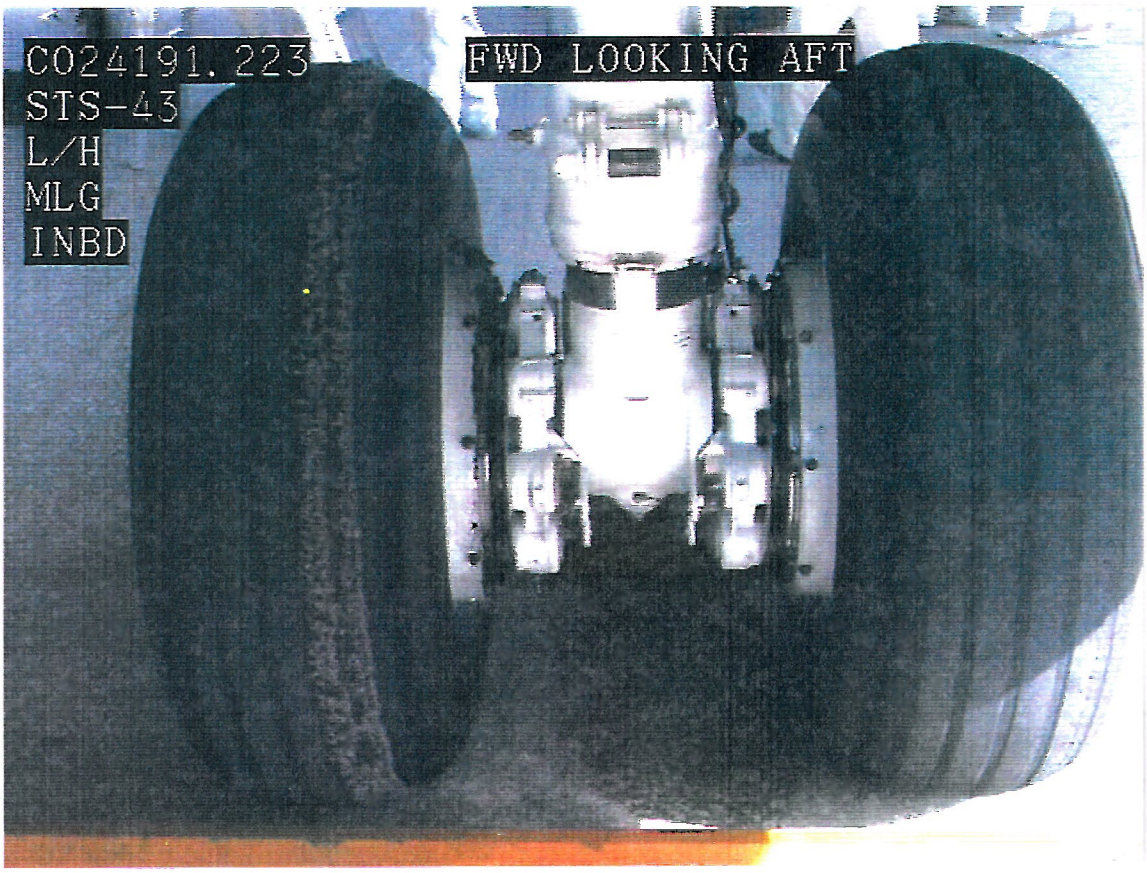

Figure 2.14.4 (B) **Torn Tire Tread**

A strip of worn tread was noted on the left inboard tire of the main gear during the post landing inspection. *(Photograph C024191.223)*

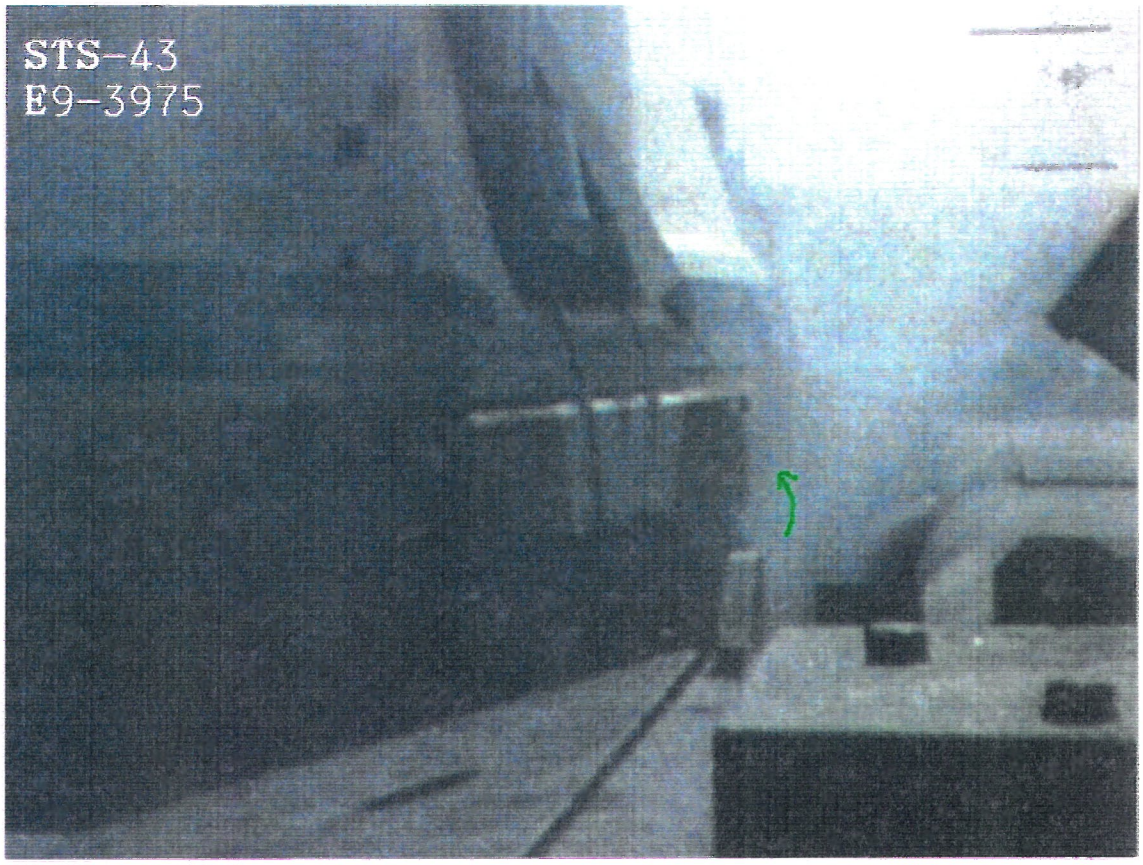

Figure 2.15 (A) **Shoe Rotation at Holddown Post M-1**

A slight shoe rotation at holddown post M-1 was noted at liftoff. (Camera E-9 Frame 3975)

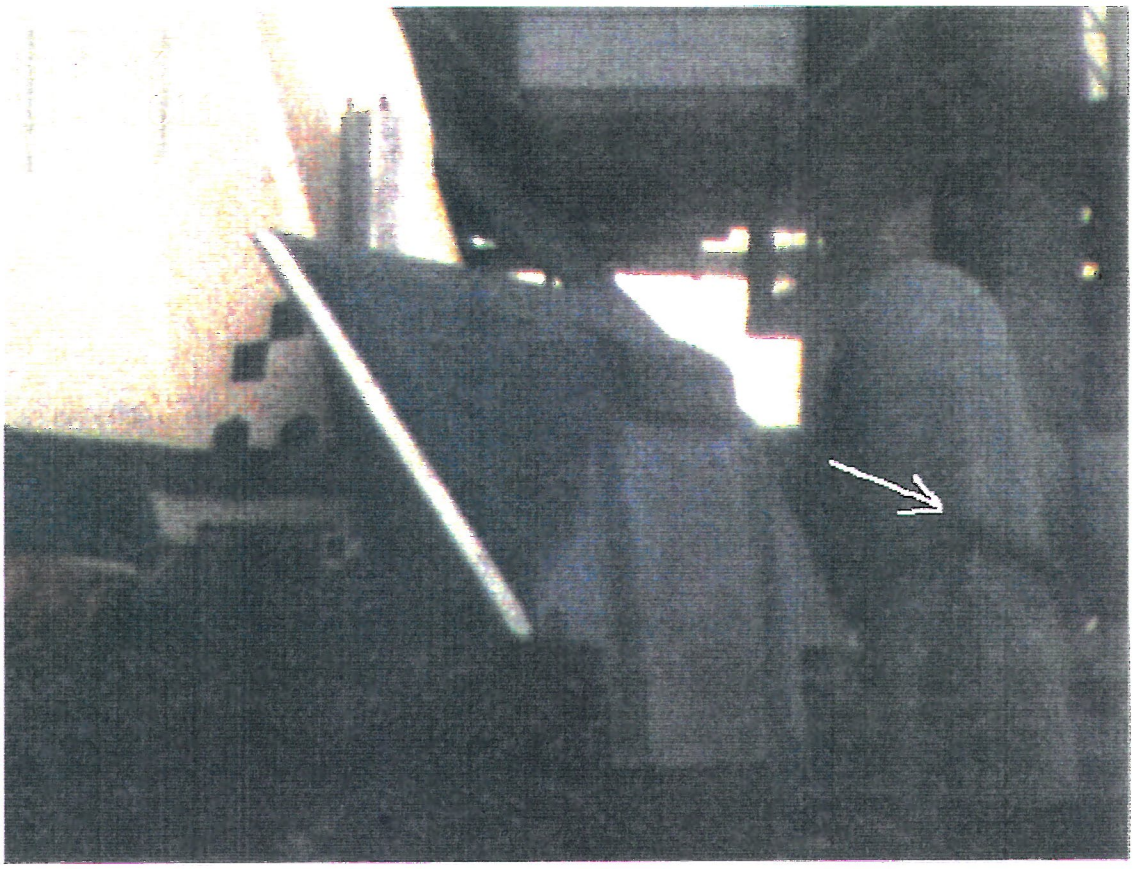

Figure 2.15 (B) **J-Pipe Water Leak**

A water leak from an MLP J-pipe located near holddown post M-7 was noted prior to liftoff. (Camera E-11 Frame 3611)

3.0 General Product Evaluation

3.1 Launch Video

Twenty-five launch videos were received out of the twenty-five expected. The videos were received at approximately 30 minutes after launch for the first replays and at approximately 6.5 hours after launch for the second replays. Timing was received with all videos. Timing discrepancies were noted on many of the videos. These discrepancies were short intervals of incorrect timing in an otherwise good time signal.

A detailed assessment of the video quality by camera follows:
Note that unless stated otherwise, focus and exposure were good and cameras not included had no problems.

OTV-041: The exposure after liftoff was dark. Camera internal reflection was noted.

OTV-048: A timing discrepancy was noted. Lens flares were noted. The exposure was variable.

OTV-049: A timing discrepancy was noted in the minutes field.

OTV-051: There is horizontal banding in the video at SSME ignition and at liftoff which interfered with analysis. Water was noted on lens at liftoff.

OTV-054: There is horizontal banding in the video at SSME ignition and at liftoff which interfered with analysis. A timing discrepancy was noted.

OTV-060: Water spots were noted on the lens after liftoff.

OTV-061: A timing discrepancy was noted. Video drop out in the upper left of the FOV was noted. Dirt was noted on the lens prior to liftoff.

OTV-063: The umbilical area was in shadow.

OTV-071: A timing discrepancy was noted.

KTV-2: A timing discrepancy was noted. A minor intermittent video noise was noted.

KTV-4A: A timing discrepancy was noted. Ghost images were visible after liftoff.

KTV-5: The exposure appears variable. A timing discrepancy was noted. Ghost images were visible after liftoff. Camera vibration was noted.

KTV-4A: A timing discrepancy was noted.

KTV-13: An apparent change in the field of view occurs at 214:15:03:31.324 and 214:15:03:41.234 possible due to a change in focal length. A timing discrepancy was noted. The focus was soft and the exposure was light.

KTV-18: The Shuttle appears low in the FOV. The focus was soft and the exposure was dark. A timing discrepancy was noted.

KTV-21A: A timing discrepancy was noted. Camera vibration was noted. A change in exposure occurred at 214:15:03:29.281. An apparent change in the FOV occurred at 214:15:01:52.417.

ET-204: The focus was soft. The vehicle is lost intermittently due to irregular tracking.

ET-206: The focus is soft. The vehicle was intermittently lost in the clouds. The video had a yellowish tint.

ET-207: A possible internal reflection occurred at 214:15:02:49.562. The exposure was variable.

ET-208: The focus was soft.

ET-212: A timing discrepancy was noted. The video signal appeared saturated. The focus and exposure were variable.

ET-213: Focus and exposure were variable. The color balance was poor. A temporary loss of signal occurred before SRB separation. Dirt was noticed on the camera lens.

3.2 Launch Film

Seventy-one launch films arrived out of seventy-three expected. Films from cameras E-62 and E-221 were not received.

Cameras E-205 and E-224 had no timing.

The following is a detailed assessment of the film quality:
(Note: If not otherwise mentioned, the focus, timing, and exposures were good.)

E-2, E-3, E-12, E-19, E-20, E-24, E-36: These cameras had camera vibration.

E-16, E-50, E-204, E-205, E-206, E-207, E-208, E-212, E-223: These cameras had soft or variable focus.

E-205, E-206, E-207, E-208, E-213, E-223: These cameras had light or variable exposures.

E-26, E-50: These cameras had dark exposures.

E-34: This camera had faint timing marks.

E-12, E-15: These cameras had the view intermittently obscured by smoke.

E-4: This camera was not centered in the camera housing.

E-19: This camera had slight image smear at SSME ignition.

E-22: This camera needed to be pointed more to the right.

E-61: This camera had multiple pieces of dark debris on the film (probably in the camera box).

E-65, E-213: These cameras had digs in the film.

E-79: This camera appeared to be aimed high.

E-204, E-218: These cameras had erratic tracking.

E-204, E-206: These cameras acquired the vehicle after liftoff.

E-205, E-212, E-218: These cameras acquired the vehicle after roll maneuver.

E-205, E-206, E-213: These cameras had a haze present which hampered analysis.

E-206, E-207: These cameras had intermittent loss of vehicle due to clouds.

E-222: This camera was a GREAT view this mission!

E-223: This camera had sun glare on the film.

3.3 Landing Video

Nine landing videos were received out of the nine expected. The videos were received at approximately 2 hours after launch. Timing was received with all videos.

All views received had good exposures and good focus except KTV-33L which had a soft focus.

3.4 Landing Film

Twenty one films of the STS-43 Orbiter landing at the Kennedy Space Center were screened on August 20, 1991 (9 days after landing).

A detailed assessment of the film quality follows:

E-802, E-803, E-806, E-809, E-832, E-834, E-836, E-845: These cameras had no first frame identifier.

E-802, E-803, E-806, E-807, E-808, E-809, E-812, E-813, E-820, E-821, E-823, E-830, E-831, E-833, E-835, and E-845: These cameras had no timing.

E-803: This camera had a short film run.

E-816: The lights on the left margin bleed into the frame and the timing marks on the right margin were blurred.

E-823, E-832, E-845: These cameras had erratic tracking.

E-832, E-834: These cameras had a timing discrepancies (days and hours appear to be incorrect).

E-816: This camera had light exposure.

E-845: This camera had the view reversed.

4.0 Process Evaluation

The screening of the STS-43 films and videos was completed on schedule.

Data base improvements, including the formation of the new Significant Events Data Base, was found to be useful in working tasks and compiling this final report.

The launch films designated to arrive at L+1, 2, 3, and 5 days were shipped to JSC via a direct flight from Orlando International Airport to Houston Intercontinental Airport. The films were then picked up by JSC transportation and delivered to the JSC Photographic Branch in Building 8. All deliveries were on schedule.

The 35mm projector was again inoperable the first day the 35mm films were screened. The films were quick screened using the Tokiwa projector in Building 8 and then thoroughly reviewed on the film motion analyzers in Building 31. The projector was fixed for the second screening and beyond. Hopefully, the projector problems will be resolved by the next mission since the film motion analyzers offer little viewing room and a much smaller viewing screen.

5.0 References

a. TGS Technology, Inc., Photographic Acquisition Disposition Document: Space Shuttle Launch and RTLS Complex 39-A. TGS Doc. 91-031; June 25, 1991.

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c. Martin Marietta Manned Space Systems (Michould Division), Space Shuttle External Tank (lightweight Model) Layout Drawings. Volume II, April 1983.

d. Johnson Space Center Space Shuttle Photographic and Television Analysis Project, STS-31R Final Report, May 25, 1990, LESC-28304, JSC-24404

e. Johnson Space Center Space Shuttle Photographic and Television Analysis Project, STS-41R Final Report, November 9, 1990, LESC-28862, JSC-24743

f. Johnson Space Center Space Shuttle Photographic and Television Analysis Project, STS-38 Final Report, December 21, 1990, LESC-24799, JSC-28951

g. Johnson Space Center Space Shuttle Photographic and Television Analysis Project, STS-35 Final Report, January 18, 1991, LESC-29022, JSC-24825

h. Johnson Space Center Space Shuttle Photographic and Television Analysis Project, STS-37 Final Report, May 10, 1991, LESC-29388, JSC-25042

i. Johnson Space Center Space Shuttle Photographic and Television Analysis Project, STS-39 Final Report, June 14, 1991, LESC-29453, JSC-25111

j. Johnson Space Center Space Shuttle Photographic and Television Analysis Project, STS-40 Final Report, August 9, 1991, LESC-29577, JSC-25162

k. Rockwell International, Space Transportation Systems Division, Operational Aerodynamic Data Book, Vol. 1, September 1985, STS85-0118, Volume 1.

l. Engineering Photographic Analysis Summary Report STS-35, Rockwell International; 91MA1688, May 10, 1991.

m. National Space Transportation System, Program Launch and Landing Photographic Engineering Evaluation, NSTS 08244, Lyndon B. Johnson Space Center Houston, Texas. October 14, 1988.

Engineering Photographic Screening Disposition Forms

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number EX1

		Film Quality	
Location:	MLP B13	Focus:	GOOD
Camera Type:	16 DBM5	FOV:	
Film:	ECD 200'	Exposure:	GOOD
Lens Focal Length:	50mm	Timing:	YES
FPS:	400	Date Received:	08/07/91
Timing:	A	Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Orientation
View of Holddown Shoe on Holddown M-1 to show shoe movement during period starting at SSME ignition thru liftoff.

Comments
Deluge water and usual pad debris noted
Frame 4827 - Instafoam debris noted from RSRB at liftoff
Frame 4910 - Small piece of dark debris enters from top of FOV, strikes M-1 shoe and falls into flame trough after liftoff
No anomalies detected

Film Quality Description

Item Number EX2

		Film Quality	
Location:	MLP B14	Focus:	GOOD
Camera Type:	16 DBM4	FOV:	
Film:	ECD 200'	Exposure:	GOOD
Lens Focal Length:	25mm	Timing:	YES
FPS:	400	Date Received:	08/07/91
Timing:	A	Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Orientation
View of right SRB Heater Umbilical during ignition and liftoff. To show disconnect. Camera looking east.

Comments
Usual pad debris noted
Deluge water noted
Frame 4162 - Heater umbilical separation noted
Several small pieces of instafoam break away at liftoff
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number EX3

Location:	MLP B15	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	25mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/07/91
		Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Orientation

View of LEFT SRB Heater Umbilical during ignition and liftoff. To show disconnect. Camera looking west.

Comments

Usual pad debris noted
Frame 4302 - Heater umbilical separation noted
Frame 4358 - Large white piece of debris comes from the right side of the heater umbilical (flame trench area) and travels to the left across FOV, does not appear to strike vehicle
Frame 4592 - Several pieces of dark debris fly up into FOV from flame trench area after liftoff
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number EX4

Location:	MLP B16	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	50mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/07/91
		Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Orientation

View of Holddown Shoe on Holddown M-5 to show shoe movement during period starting at SSME ignition thru liftoff.

Comments

Usual pad debris noted
Deluge water noted
Frame 4094 - ~PIC firing noted
Frame 4276 - Small piece of white debris comes from right side of FOV and bounces around in M-5 shoe
Frame 4299 - Several small dark pieces of debris noted inside shoe area after liftoff
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E1

Location:	MLP,NE L1	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10MM	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,MS,LR,RB,JV

Orientation

Bottom 1/4 of launch vehicle with launch deck in extreme bottom of frame, during ignition and liftoff. To view for structural anomalies, thermal insulation failures, water patterns and possible debris.

Comments

MLP deluge water noted after liftoff
Frame 4878 - Several pieces of white debris fall from the LH2 Orbiter/ET umbilical area after liftoff
ET aft dome outgassing noted
Vapor off SRB stiffener rings noted
Frame 5574 - LOV
Debris noted in exhaust plume after LOV
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E2

Location:	MLP/SE L4	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10MM	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,MS,LR,RB,JV

Orientation
Bottom 1/4 of launch vehicle with launch deck in extreme bottom of frame, during ignition and liftoff. To view for structural anomalies, thermal insulation failures, water patterns and possible debris.

Comments
Frame 2642 (20 frames in length), 2934, 2981, 3061, 3124, 3429 - Discoloration of SSME #2 plume (M). During discoloration the plume changes color from blue to orange.
Ice and RCS paper debris noted at SSME ignition and liftoff
Vapor off SRB stiffener rings noted
Frame 4912 - LOV

Film Quality Description
Camera vibration

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E3

Location:	MLP,SW L5	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10MM	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,LR,MS,RB,JV

Orientation
Bottom 1/4 of launch vehicle with launch deck in extreme bottom of frame, during ignition and liftoff. To view for structural anomalies, thermal insulation failures, water patterns and possible debris.

Comments
Ice and RCS paper debris noted at SSME ignition
Frame 2591, 2924 - Discoloration of the SSME #2 plume noted
Minor rebound of the LO2 TSM door noted (one bounce)
Vapor off LSRB stiffener rings noted
Frame 4570 - LOV

Film Quality Description
Camera vibration

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E4

Location:	MLP, NW L6	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/04/91
		Screened By:	JD,BG,SI,JV

Orientation

Bottom 1/4 of launch vehicle with launch deck in extreme bottom of frame, during ignition and liftoff. To view for structural anomalies, thermal insulation failures, water patterns and possible debris.

Comments

Rofi start noted
Frame 2529 - Small white piece of debris falls aft along body flap. Does not appear to strike the vehicle.
Frame 3822 - Small white cloud aft edge of body flap noted prior to SRB ignition
FSS deluge water noted
Frame 4225 - ~Liftoff
Frame 4686 - Small white debris falls aft along right TSM (LOX)
MLP deluge system activated after liftoff
Small dark pieces of debris in exhaust cloud noted after liftoff
Frame 5413- LOV
No anomalies detected

Film Quality Description

Camera not centered in housing

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E5

Location:	MLP L2	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10MM	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,LR,MS,RB,JV

Orientation

View underside of ORB to show URSI on Body Flap and surrounding area. Show entire Body Flap, but include as much other insulation surface as possible. View for possible tile fallout.

Comments

Frame 1362 - Flame curls around rim of SSME #3 at startup
RCS paper debris noted around SSME nozzles
Multiple pieces of white debris fall from Orbiter/ET umbilical areas along the body flap, but do not appear to strike the vehicle
Vapor noted from the LO2 TSM disconnect area after liftoff
Vapor off RSRB stiffener rings noted
Frame 4179 - Bird travels from left to right in the FOV
Frame 4433 - LOV
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E6

Location:	MLP L3	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	25MM	Exposure:	GOOD/DARK
FPS:	200	Timing:	YES
Timing:	A	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	JH,MS,LR,RB,JV

Orientation

View ORB/ET LO2 fluid and electrical umbilical (EO-5) and lower portion of LO2 antigeyser line during ignition and liftoff. To view icing, leakage, insulation and structural failure.

Comments

Frame 1228 - Small piece of white debris (probably ice) falls from Orbiter/ET LO2 umbilical
Frame 1965 - Three small pieces of light colored debris are noted falling from top of FOV between Orbiter and ET before liftoff
Slight motion of the right outboard elevon noted
Frame 2444 - Several pieces of ice noted falling from Orbiter/ET LH2 umbilical after liftoff
Frame 2660 - LOV
No anomalies detected
-1 frame

Film Quality Description

Faint timing marks

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E7

Location:	MLP B2	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10MM	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	CD,JH,MS,LR,RB,JV

Orientation

View SRB holddown post M-4 during ignition and liftoff to show release and SRM nozzle clearance.

Comments

Venting from HPU noted
Frame 4714 - Leak from J-pipe noted
Frame 5034 - ~PIC firing noted
Frame 5107 - Flame duct debris noted (M)
Frame 5386 - Numerous pieces of flame duct debris noted
Frame 5401 - Numerous pieces of black and orange flame duct debris noted
Frame 5447 - Minor rebound of the blast deflection shield noted
Frame 5520 - LOV
No anomalies detected

Film Quality Description

Timing marks are very faint

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E8

Location:	MLP B3	Focus:	GOOD
Camera Type:	16 DBM4	FOV:	
Film:	ECD 200'	Exposure:	GOOD
Lens Focal Length:	10MM	Timing:	YES
FPS:	400	Date Received:	08/04/91
Timing:	A	Date Screened:	08/04/91
		Screened By:	CD,JH,MS,LR,RB,JV

Film Quality

Orientation

View SRB holddown post M-2 during ignition and liftoff to show release and SRM nozzle clearance.

Comments

Frame 4241 - PIC firing noted (T)
Shoe rock noted at liftoff
Frame 4503 - Flame duct debris noted to strike instafoam
Frame 4574 - Debris comes from aft skirt area to the right of the DCS (origin unknown), debris strikes the shoe
Instafoam debris noted
Venting seen from GN2 purge line from underneath the RSRB noted after liftoff
Frame 4818 - LOV
Flame duct debris noted after liftoff
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E9

Location:	MLP B4	**Film Quality**	
Camera Type:	16 PS	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	B	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,LR,MS,LV,RB

Orientation

View SRB holddown post M-1 during ignition and liftoff to show release and SRM nozzle clearance.

Comments

MLP deluge water noted
Usual pad debris and bird noted. The debris and bird do not appear to strike the vehicle
Frame 3830 - PIC firing noted
Frame 3975 - Shoe appears skewed at liftoff
Frame 4373 - LOV
No anomalies detected

Film Quality Description

Camera vibration at liftoff
Smoke intermittently obscures the view
Faint digital timing

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E10

Location:	MLP B5	**Film Quality**	
Camera Type:	16 PS	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10mm	Exposure:	GOOD
FPS:	400	Timing:	YES*
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/06/91
		Screened By:	JD,SI,BG,JV

Orientation
View SRB holddown post M-3 during ignition and liftoff to show release and SRM nozzle clearance.

Comments
15:01:59.994 (Frame 309) - Pic firing
15:02:00.224 (Frame 3902) - Several small dark pieces of debris coming from flame trench.
15:02:00.410 (Frame 3977) - Small dark piece of flame trench debris moves upward and adhears to right SRB aft skirt during liftoff. No damage noted. (M)
15:02:01.068 (Frame 4243) - LOV
No anomalies detected

Film Quality Description
* Inframe timing

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E11

Location:	MLP/ B7	**Film Quality**	
Camera Type:	16 PS	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10mm	Exposure:	GOOD
FPS:	400	Timing:	YES*
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/06/91
		Screened By:	JD,SI,BG,JV

Orientation
View SRB holddown post M-7 during ignition and liftoff to show release and SRM nozzle clearance.

Comments
15:01:59.360 (Frame 3611) Small water leak in MLP J-pipe noted throughout film sequence. (M)
Pic firing could not be determined
Small dark pieces of flame trench debris noted at liftoff
15:02:00.596 (Frame 4115) - Bolt hang-up on left SRB holddown post #M-7 during liftoff. Several pieces of epon shim material seen near the bolt hang-up. (M)
15:02:00.930 (Frame 4251) - LOV

Film Quality Description
* Inframe timing

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E12

Location:	MLP B8	**Film Quality**	
Camera Type:	16 PS	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	B	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,LR,MS,RB,LV

Orientation
View SRB Holddown post M-5 during ignition and liftoff to show release and SRM nozzle clearance.

Comments
Usual pad debris noted
Ice debris strikes MLP on left side of view and does not appear to strike vehicle
214:15:01.55.371 (Frame 1965) - Small piece of dark debris moves from right to left on the left side of view, origin unknown
214:15:01:59.995 (Frame 3859) - PIC firing noted
214:15:02:00.015 (Frame 3867) - White piece of debris comes from the DCS area at PIC firing
214:15:02:00.623 (Frame 4116) - Medium size piece of instafoam debris noted
214:15:02:01.417 - LOV
No anomalies detected

Film Quality Description
Camera vibration
Smoke intermittently obscures view
Digital timing

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Item Number E13

Location:	MLP B9	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10MM	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	CD,JH,MS,LR,RB,JV

Orientation

View SRB holddown post M-6 during ignition and Liftoff to show release and SRM nozzle clearance.

Comments

Frame 4237 - PIC firing noted
Frame 4268 - Multiple pieces of black debris noted behind the DCS area after PIC firing (M)
Small piece of debris noted from aft skirt area and falls into flame duct after liftoff
Frame 4792 - LOV
No anomalies detected

Film Quality Description

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Item Number E14

Location:	MLP B10	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10MM	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	CD,JH,MS,LR,RB,JV

Orientation

View SRB holddown post M-8 during ignition and liftoff to show release and SRM nozzle clearance.

Comments

PIC firing not discernible
Frame 5471 - Dark thin piece of debris seen between blast deflector shield and holddown post #M-8 shoe at liftoff (M)
Frame 5411 - Dark piece of flame duct debris noted
Frame 5568 - LOV
No anomalies detected

Film Quality Description

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Item Number E15

Location:	MLP B1	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	15MM	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,LR,MS,RB,JV

Orientation

SRM Nozzle on east SRB to show nozzle motion, Holdown post clearance, gimble position and heat shield integrity.

Comments

SSME venting noted
Ice falls from umbilicals at SSME ignition
Frame 2409 - Ice falls from vent nozzle of SSME #3
Frame 3137,3286 - Small pieces of dark debris appear to fall from between the body flap and SSMEs after SSME startup, do not appear to strike the vehicle
Frame 3665, 4428 - Small pieces of dark debris noted between the RSRB and SSME #3, does not appear to strike vehicle
Frame 4639 - Medium size piece of debris (origin unknown) travels to the left out of the FOV
Frame 4935 - Medium size piece of debris comes from left side of view and falls into flame trench at liftoff (possibly same debris as noted above-Frame 4639)
Small pieces of debris noted after liftoff
Frame 5041 - LOV
No anomalies detected

Film Quality Description

View of vehicle obscured by smoke and water vapor at liftoff

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Item Number E16

Location:	MLP B6	Focus:	VARIABLE
Camera Type:	16 DBM4	FOV:	
Film:	ECD 200'	Exposure:	GOOD
Lens Focal Length:	15MM	Timing:	YES
FPS:	400	Date Received:	08/03/91
Timing:	A	Date Screened:	08/03/91
		Screened By:	JH,MS,LR,JV,RB

Film Quality

Orientation
SRM Nozzle on east SRB to show nozzle motion, holddown post clearance, gimble position and heat shield integrity.

Comments
SSME venting noted
Frame 2067 - Leak from J-pipe noted
Frame 3217 - Light/dark piece of debris originates at upper center of the FOV on the LSRB and falls away from the vehicle
Frame 3841 - Multiple pieces of light debris fall along the body flap RCS paper debris noted near SSME #2
Frame 4423 - PIC firing noted
Frame 4710 - Several pieces of small white debris come from flame trench area at SRB ignition and falls back, does not appear to strike the vehicle
Frame 4766 - A dark piece of debris comes from the top of the FOV and travels to the left, origin unknown, and does not appear to strike the vehicle
Frame 4978 - Bird travels from right to left through the FOV after liftoff, does not appear to strike the vehicle
Several pieces of flame trench debris noted after liftoff
Frame 5176 - LOV
No anomalies detected

Film Quality Description

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Item Number E17

Location:	MLP 01	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10MM	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,LR,MS,RB,JV

Orientation

TSM carrier disconnect and withdrawal during ignition and liftoff. View to include all visible portions of LO2 line for possble anomalies.

Comments

Vapor from SSME venting obscures view prior to liftoff
Frame 3273 - Minor body flap and elevon motion noted
RCS paper noted at SSME ignition
Frame 3273 - Numerous pieces of ice (small to large) fall from the LO2 carrier assembly prior to disconnect (M)
Frame 4485 - LO2 umbilical disconnect noted
Frame 4532 - Medium size piece of light colored debris comes from top of frame and moves to the right of the FOV in front of the body flap, does not appear to strike the vehicle (M)
Vapor from the LO2 noted after umbilical disconnect
Frame 5373 - LOV
No anomalies detected

Film Quality Description

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Item Number E18

Location:	MLP 04	Focus:	GOOD
Camera Type:	16 DBM4	FOV:	
Film:	ECD 200'	Exposure:	GOOD
Lens Focal Length:	10MM	Timing:	YES
FPS:	400	Date Received:	08/03/91
Timing:	A	Date Screened:	08/03/91
		Screened By:	JH,MS,LR,JV,RB

Film Quality

Orientation

Views of OMS engine nozzle during ignition and liftoff. To record nozzle structural integrity. Power and timing with E19.

Comments

Vapor from SSME venting obscures view prior to liftoff
Minor body flap and elevon motion noted
Numerous pieces of ice debris fall from the LH2 carrier plate
Frame 3039 - Base heat shield erosion noted near SSME #2
Several loose pieces of tape noted on the LH2 carrier lines
Frame 3674 - Several medium sized pieces of white debris fall from top of frame in front of body flap, debris does not appear to strike the vehicle (M)
Frame 4530 - LH2 umbilical disconnect noted
Vapor from the LH2 umbilical noted after disconnect
RCS paper debris noted
Frame 4890 - Base heat shield erosion noted near SSME #2 (M)
Frame 5411 - LOV
No anomalies detected

Film Quality Description

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Item Number E19

Location:	MLP 02	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10MM	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,MS,LR,JV,RB

Orientation
View inside of SSME nozzles #1 and #3 and surrounding heat-shield during ignition and liftoff. For engine ignition evaluation and leakage surveillance.

Comments
Frame 636 - Rofi start noted
Ice build-up on SSME nozzles
Ice and RCS paper debris noted
Frame 4488 - T-0 LO2 disconnect noted
Vapor from LOX TSM noted at liftoff
Frame 5301 - Several medium sized pieces of light debris fall away
Orbiter/ET disconnects at liftoff
Frame 5846 - LOV
No anomalies detected

Film Quality Description
Camera vibration/image smear at SSME ignition

Photo/TV Analysis Group Evaluation Report
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Item Number E20

Location:	MLP 03	Focus:	GOOD
Camera Type:	16 DBM4	FOV:	
Film:	ECD 200'	Exposure:	GOOD
Lens Focal Length:	10MM	Timing:	YES
FPS:	400	Date Received:	08/03/91
Timing:	A	Date Screened:	08/03/91
		Screened By:	JH,MS,LR,RB,JV

Film Quality

Orientation
View inside of SSME nozzles #1 and #2 and surrounding heat-shield during ignition and liftoff.

Comments
Frame 642 - Rofi start noted
Ice build-up on SSME nozzles
Frame 2988 - Ice and RCS paper debris noted
Ringing of SSME bells noted
Frame 4508 - LH2 TSM umbilical disconnect noted
Vapor from LH2 TSM disconnect noted
Frame 4838 - Light colored debris noted between Orbiter and right TSM (possibly ice from LO2 TSM)
Frame 4892 - LO2 TSM door closed - minor rebound of the door noted (one bounce)
Frame 5738 - LOV
No anomalies detected

Film Quality Description
Camera vibration

Photo/TV Analysis Group Evaluation Report
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Item Number E21

Location:	LO2 TSM* T1	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	15mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/07/91
		Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Orientation

View of fixed target mounted on TSM structure and target on carrier plate to measure deflection in X and Z planes. Locate carrier plate at south side of frame.
*East TSM
Manually advance film approximately 20 frames after final installation to obtain suitable orientation exposure.

Comments

Vapor off the LO2 carrier lines noted (Large amount of vapor noted in middle of FOV, on the end of the TSM carrier plate, side facing the camera) - possible leak
Frame 4525 - Start of retraction of the LO2 carrier plate
Loose piece of tape on backside of carrier plate noted
Minor rebound of door noted
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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Item Number E22

Location:	LH2 TSM* T2	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	15mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/07/91
		Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Orientation

View of foxed target mounted on TSM structure and target on carrier plate to measure deflection in X and Z planes. Locate carrier plate at south side of frame.
*West TSM
MANUALLY ADVANCE FILM APPROXIMATELY 20 FRAMES AFTER FINAL INSTALLATION TO OBTAIN SUITABLE ORIENTATION EXPOSURE.

Comments

Slight vapor noted around LH2 TSM carrier plate
Slight gap on left side of door noted after closure
Frame 4377 - Start of retraction of the LH2 carrier plate
No anomalies detected

Film Quality Description

TSM is too far to the right in FOV

Photo/TV Analysis Group Evaluation Report
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Item Number E23

Location:	MLP 02A	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	25mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	CD,JH,MS,LR,RB,JV

Orientation

Views of OMS engine nozzle during ignition and liftoff. To record nozzle structural integrity. Power and timing with E19.

Comments

Frame 1439 - Winged creature flutters through FOV from top to bottom, does not appear to strike vehicle
Deluge water noted
RCS paper debris noted
Vapor noted coming from behind the right OMS nozzle, probably from SSMEs
Frame 3379 - Base heat shield erosion noted at the base of the right OMS nozzle (M)
Small pieces of white debris noted between body flap and SSME after liftoff
Vapor and ice noted from LO2 T-0 umbilical disconnect
Frame 5610 - LOV
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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Item Number E24

		Film Quality	
Location:	MLP/ 03A	Focus:	GOOD
Camera Type:	16 DBM4	FOV:	GOOD
Film:	200' ECD	Exposure:	YES
Lens Focal Length:	25mm	Timing:	08/04/91
FPS:	400	Date Received:	08/04/91
Timing:	A	Date Screened:	CD,JH,MS,LR,RB,JV
		Screened By:	

Orientation
View of OMS engine nozzle during ignition and liftoff. To record nozzle structural integrity. Power and timing with E20.

Comments
Frame 2524 - L4U RCS paper cover was discolored (M)
Frame 2978 - Closeout (beta) blanket around SSME#2 appears to tear along the outer rim at SSME startup. This event was first reported by KSC.(Frame 4818) (M)
Frame 4280 - Base heat shield erosion noted near left OMS nozzle prior to liftoff (three areas) (M)
Frame 5273 - Large pieces of white debris (probably ice) fall aft of vehicle (probably from umbilical area) at liftoff
Frame 5679 - LOV
No anomalies detected
-1 Frame

Film Quality Description
Camera vibration

Photo/TV Analysis Group Evaluation Report
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Item Number E25

Location:	MLP B11*	**Film Quality**	
Camera Type:	16 DBM4	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	5.9mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,MS,LR,RB,JV

Orientation
View between ORB and ET/SRB during liftoff to show possible debris.

*East Side

Comments
Frame 3207 - Two pieces of debris first noted near underside of Orbiter above the umbilical/Orbiter disconnect area fall away from Orbiter, debris does not appear to strike the vehicle
Frame 3535 - A light colored piece of debris first noted in the middle of the ET, falls away from the ET
Frame 3535 - LO2 TSM umbilical disconnect noted
Vapor noted from the LO2 TSM disconnect after liftoff
Vapor from RSRB stiffener rings noted
Frame 4120 - Multiple pieces of white debris from the Orbiter/ET umbilical areas noted, debris does not appear to strike the vehicle.
Frame 4372 - Bird travels from right to left in the FOV
Frame 4603 - LOV
No anomalies detected
-1 frame

Film Quality Description

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Item Number E26

Location:	MLP B12*	Focus:	GOOD
Camera Type:	16 DBM4	FOV:	
Film:	ECD 200'	Exposure:	DARK
Lens Focal Length:	5.9mm	Timing:	YES
FPS:	400	Date Received:	08/03/91
Timing:	A	Date Screened:	08/03/91
		Screened By:	JH,MS,LR,RB,JV

Film Quality

Orientation
View between ORB and ET/SRB during liftoff to show possible debris.

*West Side

Comments
FSS deluge water noted
Frame 3874 - White piece of debris appears to originate on the white ring on the base heat shield around the SSME #2 after liftoff (M)
Frame 3874 - Possible erosion noted on base heat shield near SSME #2 after liftoff (M)
ET aft dome outgassing noted
Vapor off LSRB stiffener rings noted
Frame 3973 - Multiple pieces (small to large) of ice debris fall from the Orbiter/ET disconnect areas, debris does not appear to strike the vehicle
GH2 vent arm retraction appeared normal
Frame 4460 - LOV
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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Item Number E27

Location:	MLP/B2A	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	200' ECD	FOV:	
Lens Focal Length:	100mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/07/91
		Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Orientation

View holddown shoe on holddown M-3 to show shoe movement during period starting at SSME ignition thru liftoff. This item has start and timing paralleled with item E7.

Comments

Frame 2937 - Small dark piece of debris originating from area above the RSRB aft skirt interface and falls down behind the holddown post M-3 shoe (probably insect)
Frame 4325 - PIC firing noted
Shoe rocks to the right after liftoff and rights itself when blast deflection shield closes
Usual debris noted at liftoff
No anomalies detected

Film Quality Description

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Item Number E28

Location:	MLP B10A	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	100mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/07/91
		Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Orientation

View of holddown shoe on holddown M-7 to show shoe movement during period starting at SSME ignition thru liftoff. This item has start and timing paralleled with item E14.

Comments

Deluge water noted
Frame 3164 - One small piece of dark debris noted from DCS area before PIC firing
Frame 4618 - PIC firing noted
Frame 4676 - Three small pieces of dark debris noted from DCS area after PIC firing
Frame 4863 - Four pieces of black debris (probably shim material) (the two larger pieces being, one approximately 5 inches by 3 inches, the other 3 inches by 2 inches) appear to fall from the backside of M-7 holddown foot (SRB side) (M)
Frame 4901 - Bolt hang-up noted at holddown post M-7 (M)
Usual pad debris noted
One anomaly noted
-1 frame

Film Quality Description

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Item Number E30

Location:	FSS-195' /19C	Focus:	GOOD
Camera Type:	16 DBM5	FOV:	
Film:	200' ECD	Exposure:	GOOD
Lens Focal Length:	15/16	Timing:	YES
FPS:	400	Date Received:	08/04/91
Timing:	A	Date Screened:	08/04/91
		Screened By:	CD,JH,MS,LR,RB,JV

Film Quality

Orientation

View SRB secondary holes on MLP to show water bag reaction during ignition and liftoff.

Comments

Frame 2657 - At least three large pieces (probably ice) fall below body flap
Frame 4130 - Ice debris falls from Orbiter/ET LH2 umbilical area
MLP deluge water noted after liftoff
Frame 4583 - LOV
No anomalies detected

Film Quality Description

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Item Number E31

Location:	FSS-95' 9	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	25mm	Exposure:	GOOD
FPS:	100	Timing:	YES
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/06/91
		Screened By:	JD,SI,BG,JV

Orientation

View ORB/ET LH2 fluid and electrical umbilicial (EO-4), LH2 feedline and tank pierce point during ignition and liftoff. To view icing, leakage, insulation and structual failure. Adjust ASA Dial on AEC to agree with actual exposure meter reading at time of setup. Set slew rate at approx. 2 f/stops per second.

Comments

Frame 1114 - Vapor near the LH2 umbilical disconnect visible
ET aft dome outgassing noted.
Slight left elevon motion noted after SSME ignition
Frame 1191 - Several small pieces of white debris (probably ice) is seen falling from the hydrogen umbilical disconnect after liftoff. A single small piece of white debris was seen originating between SSME #2 and the body flap after liftoff. None of the pieces of debris appear to strike the vehicle. (M)
Frame 1261-1262 - A small rectangular piece of debris seen to fall from SSME #2 area into SSME #2 exhaust plume. (M)
Frame 1326 - LOV
No anomalies detected

Film Quality Description

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Item Number E33

Location:	FSS-235' /23	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	100mm*	Exposure:	GOOD
FPS:	200	Timing:	YES
Timing:	A	Date Received:	08/04/91
		Date Screened:	08/06/91
		Screened By:	JD,SI,JV

Orientation
View ET GH2 umbilical vent line carrier and interface during ignition and liftoff. (Disconnect) View for icing and possible disconnect anomalies. *Must use Schneider Lens.

Comments
Ice debris and vapor noted prior to and during GUCP retraction
Frame 1735 - GUCP retraction noted
No anomalies detected

Film Quality Description

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Item Number E34

Location:	FSS-255' 25	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	15mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/03/91
		Screened By:	JH,LR,MS,RB,JV

Orientation
View ORB tiled surface, (HRSI) on upper portion of orbiter bottom. Include cockpit windows at bottom edge of frame. View during ignition and liftoff to show possible tile falloff and debris.

Comments
Twang noted
Frame 3460 - GH2 vent carrier arm disconnect noted
Small pieces of ice debris from the umbilical areas noted
Small piece of RCS paper noted near left RCS stinger
ET aft dome outgassing
Frame 5211 - LOV
No anomalies detected

Film Quality Description
Faint timing marks

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E35

Location:	FSS-255' /25A	Focus:	GOOD
Camera Type:	16 DBM5	FOV:	
Film:	ECD 200'	Exposure:	GOOD
Lens Focal Length:	15mm	Timing:	YES
FPS:	400	Date Received:	08/03/91
Timing:	A	Date Screened:	08/04/91
		Screened By:	JD,SI,BG,JV

Film Quality

Orientation
View ORB tiled surfaces,(HRSI) on midportion of orbiter bottom. Include cockpit windows at top edge of frame. View during ignition and liftoff to show possible tile falloff and debris.

Comments
Rofi start noted
Frame 1471 - Large piece of dark debris falls aft from LH2 umbilical prior to liftoff. Does not appear to strike the vehicle.
Frame 1719 - Large piece of dark debris falls aft from LH2 umbilical prior to liftoff. Does not appear to strkie the vehicle. (M)
Frame 2715 - ~Liftoff
Frame 4118 - LOV
Numerous small pieces of debris in exhaust cloud after liftoff
No anomalies detected

Film Quality Description

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Item Number E36

Location:	FSS-255' 25E	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	15mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/04/91
		Screened By:	JD,SI,BG,JV

Orientation
View ORB tiled surface (HRSI) on lower portion of Orbiter bottom. Include left (west) wing-tip at bottom edge of frame. View during ignition and liftoff to show possible tile falloff and debris.

Comments
Frame 63 - Small piece of dark debris (possible bird) seen originating from top right side of view and moves across vehicle to left side of view. Does not appear to strike the vehicle. (M)
Frame 2334 - Large piece of dark debris falls aft from LH2 umbilical area prior to liftoff. Does not appear to strike the vehicle.
Frame 3223 - -Liftoff
Frames 3516-3721 - Long dark piece of debris originates from top of view (above LH2 umbilical) and falls aft along left SRB towards MLP. Does not appear to strike the vehicle. (M)
Frame 3766-3967- Long dark piece of thin debris originates from lower right of view (near FSS) and falls aft along lower surface of left wing. Does not appear to strike the vehicle. (M)
GUCP line retraction noted
Frame 4020-4161 - Long dark piece of debris (possible bat or bird) originates on right side of view, crosses LH2 TSM and into flame trench. Does not appear to strike the vehicle. (M)
Frame 4544 - LOV
No anomalies detected

Film Quality Description
Slight camera vibration after liftoff

Photo/TV Analysis Group Evaluation Report
STS-43
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Item Number E40

Location:	FSS-275' 27C	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10mm	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/03/91
		Date Screened:	08/04/91
		Screened By:	JD,BG,SI,JV

Orientation

Tip of ET in center of frame. (horiz. and vert.) to show tiled surfaces of orbiter passing through frame, and any possible falling debris.

Comments

Twang noted
Frame 4188 - Long thin dark piece of debris originating from upper left and falling aft of vehicle. Does not appear to strike the vehicle. (M)
ET aft dome outgassing noted
Vapor off both SRB stiffener rings noted
Frame 4659 and 4790 - Numerous small pieces of debris seen falling aft of SLV after liftoff. (M)
Frame 4879 - LOV
No anomalies detected

Film Quality Description

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Item Number E41

Location:	FSS-255' 25D**	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	10mm*	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/04/91
		Date Screened:	08/06/91
		Screened By:	JD,SI,BG,JV

Orientation

View of GH2 Vent Line during rotation. Place Vent Line in top of frame and include bottom level of Vent Line structure in bottom of frame. To show clearance between structure and SRB aft skirt.
* Lens with F/ in top position. ** Raised platform, E. side.

Comments

FSS deluge water noted
Frame 2868 - -GUCP retraction noted. Retraction and latch back appeared normal
Frame 3283 - MLP deluge water activated after liftoff
Frame 4458- LOV
Debris in exhaust cloud after tower clear noted
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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Item Number E42

Location:	FSS-185' 18	Focus:	GOOD
Camera Type:	16 DBM5	FOV:	
Film:	ECD 200'	Exposure:	GOOD
Lens Focal Length:	25mm	Timing:	YES
FPS:	400	Date Received:	08/04/91
Timing:	A	Date Screened:	08/06/91
		Screened By:	JD,SI,BG,JV

Film Quality

Orientation

View of GH2 Vent Line during rotation. Place Vent Line in top of frame and include bottom level of Vent Line structure in bottom of frame. To show clearance between structure and SRB aft skirt.
* Lens with f/ in top position. ** Raised platform, E. side.

Comments

FSS deluge water noted
Frame 4073 - GUCP latch back noted
GUCP retraction and latch back appeared normal
Numerous pieces of debris in exhaust cloud after liftoff
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E44

Film Quality

Location:	FSS-155' 15	Focus:	GOOD
Camera Type:	16 DBM5	FOV:	
Film:	ECD 200'	Exposure:	GOOD
Lens Focal Length:	25mm	Timing:	YES
FPS:	400	Date Received:	08/04/91
Timing:	A	Date Screened:	08/06/91
		Screened By:	JD,SI,BG,JV

Orientation
View of left OMS Pod leading edge during ignition and liftoff to show possible tile damage.

Comments
Frame 4851 - Tile surface erosion noted on the lower aft corner of the left speed brake as the SLV clears the TSM. (M)
Frame 5056 - LOV
No anomalies detected

+1 frame

Film Quality Description

Item Number E50

Film Quality

Location:	39-1 17	Focus:	SOFT
Camera Type:	16 DBM5	FOV:	
Film:	ECD 200'	Exposure:	DARK
Lens Focal Length:	8"	Timing:	YES
FPS:	400	Date Received:	08/04/91
Timing:	B	Date Screened:	08/06/91
		Screened By:	JD,SI,BG,JV

Orientation
Overall view of GH2 vent line including hinge and ET interface during ignition and liftoff. (Rotation) To view for possible anomalies duing rotation and latchback.

Comments
No anomalies detected

Film Quality Description
Film too dark for analysis

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E52

Location:	39-2 T1	Focus:	GOOD
Camera Type:	35mm Mit	FOV:	
Film:	ECD 400'	Exposure:	GOOD
Lens Focal Length:	152mm	Timing:	YES
FPS:	96	Date Received:	08/07/91
Timing:	B	Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Film Quality

Orientation

Remote tracking coverage of lower one-third of launch vehicle including MLP deck. Interval of coverage from ignition to 1200'. View to record vehicle motion, Structural integrity and engine operation during early flight.

Comments

FSS and MLP deluge water noted
Frame 886 - Ice noted from umbilicals after liftoff
ET aft dome outgassing noted
Vapor off SRB stiffener rings noted
Frame 1187-Frame 2218 - Debris noted falling from SSME/body flap area after liftoff
Frame 1472 - Large orange colored piece of debris travels from left to right through FOV aft of vehicle before roll maneuver, does not strike vehicle
Frame 1683 - Large piece of light colored debris originating between SSME #1 and #2 falls aft of the vehicle
Frame 1916-Frame 2281 - Flashes noted in SSME and SRB plumes
Frame 3178 - Large piece of debris (possible bird) moves from right to left through FOV below vehicle after roll maneuver
Frame 3208 - LOV
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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Item Number E53

Location:	39-2 T2	Focus:	GOOD
Camera Type:	35 PS*	FOV:	
Film:	ECD 400'	Exposure:	GOOD
Lens Focal Length:	150mm	Timing:	YES
FPS:	100	Date Received:	08/07/91
Timing:	B	Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Film Quality

Orientation

Remote tracking coverage of center one-third of launch vehicle. Interval of coverage from ignition to 1200'. View to record vehicle motion, structural integrity and engine operation during early flight. Boresite video camera to this item.

*Use range type ML4.

Comments

FSS deluge water noted
GH2 vent arm retraction noted
Vapor off SRB stiffener rings noted
ET aft dome outgassing noted
215:15:02:05.336 (Frame 1433)-215:15:02:15.036 (Frame 2382) - Numerous pieces of white debris noted from SSME/body flap areas after liftoff
Roll maneuver noted
215:15:02:06.072 (Frame 1505) - Flare noted in SSME #1 plume
215:15:02:08.127 (Frame 1706) - Large piece of light colored debris (fast moving) travels from left to right below the vehicle, does not strike the vehicle
215:15:02:10.682 (Frame 1956) - Large white piece of debris comes from left side of SSME #2 and falls aft of vehicle during roll maneuver
215:15:02:11.367 (Frame 2023) - Small white piece of debris noted falling from the left elevon area aft of the vehicle during roll maneuver
215:15:02:13.646 (Frame 2246)-215:15:02:18.930 (Frame 2763) - Flashes in SSME and SRB plumes noted
214:15:02:26.625 (Frame 3516) - LOV
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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Item Number E54

Location:	39-2 T4	Focus:	GOOD
Camera Type:	35mm MIT	FOV:	
Film:	ECD 400'	Exposure:	GOOD
Lens Focal Length:	152mm	Timing:	YES
FPS:	96	Date Received:	08/04/91
Timing:	B	Date Screened:	08/04/91
		Screened By:	JH,MS,LR,RB,JV

Film Quality

Orientation
Remote tracking coverage to upper one-third of launch vehicle. Interval of coverage from ignition to 1200'. View to record vehicle motion, structural integrity and engine operation during early flight. Also to show possible ET debris.

Comments
FSS deluge water noted
Twang noted
Frame 713 - ~Liftoff
ET aft dome outgassing
Vapor off SRB stiffener rings noted
Frame 1416 - White debris falls aft along body flap from umbilical area
Frame 1395-2006 - Numerous small light colored pieces of debris seen falling aft of SSME's.
Roll maneuver noted
Frame 2069-2191 - Numerous small light colored pieces of debris seen falling aft of SLV from right elevon area after roll maneuver
Debris noted in SRB plume
Frame 3231 - LOV due to tracking

Film Quality Description
Viewed on Tokiwa projector

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E57

Location:	39-6 T1	**Film Quality**	
Camera Type:	35mm Mit	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	152mm	Exposure:	GOOD
FPS:	96	Timing:	YES
Timing:	B	Date Received:	08/07/91
		Date Screened:	08/08/91
		Screened By:	JD,SI,BG

Orientation

Remote tracking coverage of lower one-third of launch vehicle including MLP deck. Interval of coverage from ignition to 1200'. View to record vehicle motion, structural integrity and engine operation during early flight.

Comments

FSS deluge water noted
Frame 662 - -Liftoff
ET aft dome outgassing and vapors off SRB stiffener rings seen after liftoff.
Frame 1149 - Small white debris seen coming from behind vertical stabilizer and falls aft near SSME plume.
Frame 1297 - White debris seen forward of crew access door, falls aft along left wing leading edge, and under wing into SRB plume. Did not appear to strike the vehicle. (Probably RCS paper). Frame 1352 (M)
Frame 2490 - LOV
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E58

Location:	39-6 T2	**Film Quality**	
Camera Type:	35 PS*	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	150mm	Exposure:	GOOD
FPS:	100	Timing:	YES
Timing:	B	Date Received:	08/07/91
		Date Screened:	08/08/91
		Screened By:	JD,SI,BG

Orientation

Remote tracking coverage of center one-third of launch vehicle. Interval of coverage from ignition to 1200'. View to record vehicle motion, structural integrity and engine operation during early flight. Boresite video camera to this item.

* Use Range type ML4.

Comments

FSS deluge water noted
Frame 936 - ~Liftoff
ET aft dome outgassing and vapors off SRB stiffener rings noted after liftoff.
Frame 1113 - Small white debris seen falling aft along SSME #2. This debris was not seen to strike the vehicle.
Frame 1452 - Small white debris seen falling from left RCS stinger area. Probably RCS paper. Did not appear to strike the vehicle.
Frame 1606 - Debris seen on E-57 that originated by the crew access door and fell aft by left wing leading edge and under wing into SRB plume seen again. Probably RCS paper.
Frame 2871 - LOV
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E59

Location:	39-6 T4	**Film Quality**	
Camera Type:	35mm Mit	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	152mm	Exposure:	GOOD
FPS:	96	Timing:	YES
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	JH,MS,LR,RB,JV

Orientation
Remote tracking coverage of upper one-third of launch vehicle. Interval of coverage from ignition to 1200'. View to record vehicle motion, structural integrity and engine operation during early flight. Also to show possible ET debris.

Comments
Frame 677 - ~Liftoff
FSS deluge water noted at liftoff
ET aft dome outgassing noted
Frames 1368-1396 - Piece of light colored debris noted along underside of left outboard elevon prior to roll maneuver
Frame 1463-1497 - Small light colored debris falls aft from mid point of RSRB, across the ET to aft end of LSRB prior to roll maneuver.
Roll maneuver noted
Frame 2533 - View obscured by plume after roll maneuver
No anomalies detected

Film Quality Description
Viewed on Tokiwa projector

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E60

Location:	39-1 11	**Film Quality**	
Camera Type:	35mm Mit	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	100mm	Exposure:	GOOD
FPS:	96	Timing:	YES
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	JH,MS,LR,RB,JV,RP

Orientation
View of entire launch vehicle during ignition and liftoff. View for structural surveillance and starting sequence.

Comments
FSS deluge water noted
Frame 902 - ~Liftoff
ET aft dome outgassing noted
Frame 1063 - Debris noted falling in front of the body flap after liftoff
Vapor off SRB stiffener rings noted
Frame 2322 - Debris in exhaust plume after liftoff
No anomalies detected

Film Quality Description
Viewed on Tokiwa projector

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E61

Location:	39-2 8	**Film Quality**	
Camera Type:	35 PS	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	105mm	Exposure:	GOOD
FPS:	100	Timing:	YES
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	JH,MS,LR,RB,JV,RP

Orientation
View of entire launch vehicle, FSS and MLP, during ignition and liftoff. View for structural surveillance and starting sequence.

Comments
FSS deluge water noted
Twang noted
ET aft dome outgassing noted
Vapor off SRB stiffener rings
No anomalies detected

Film Quality Description
Multiple pieces of dark debris on film (probably in camera box)
Digital timing
Viewed on Tokiwa projector

Item Number E62

Location:	39-3 9	**Film Quality**	
Camera Type:	35 PS	Focus:	
Film:	ECD 400'	FOV:	
Lens Focal Length:	105mm	Exposure:	
FPS:	100	Timing:	
Timing:	B	Date Received:	/ /
		Date Screened:	08/04/91
		Screened By:	

Orientation
View of entire launch vehicle during ignition and liftoff. View for structural surveillance and starting sequence.

Comments
No run

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E63

Location:	39-4 9	**Film Quality**	
Camera Type:	35mm Mit	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	100mm	Exposure:	GOOD
FPS:	96	Timing:	YES
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	JH,MS,LR,RB,JV,RP

Orientation
View of entire launch vehicle,during ignition and liftoff. View for structural surveillance and starting sequence.

Comments
FSS deluge water noted
Twang noted
Frame 825 - White debris noted falling from the LO2 TSM before liftoff.
Frames 853, 927, 1052 - Discoloration in noted SSME #2 cone prior to liftoff
Frame 1143 - ~Liftoff
Frame 1154 - White debris noted falling from the LH2 TSM before liftoff
Frame 1305 - Debris fell from behind the elevon/Orbiter after liftoff
Vapor off SRB stiffener rings noted
No anomalies detected

Film Quality Description
Viewed on Tokiwa projector

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E64

Location:	39-6 10	**Film Quality**	
Camera Type:	35mm Mit	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	100mm	Exposure:	GOOD
FPS:	96	Timing:	YES
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	JH,MS,LR,RB,JV,RP

Orientation
View of entire launch vehicle during ignition and liftoff. View for structural surveillance and starting sequence.

Comments
FSS deluge water noted
Twang noted
MLP deluge water noted
ET aft dome outgassing noted
Vapor off SRB stiffener rings noted
No anomalies detected

Film Quality Description
Viewed on Tokiwa projector

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E65

Location:	39-2 4	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	20"	Exposure:	GOOD
FPS:	100	Timing:	YES
Timing:	B	Date Received:	08/03/91
		Date Screened:	08/04/91
		Screened By:	JD,SI,BG,JV

Orientation
View of LO2 Feedline at entrance to ET Intertank area. Include last sliding support prior to lines entering the intertank area. (Ignition and lift-off.) View to record TPS/Feedline Assembly.
Committed for daylight launches only.

Comments
Twang noted
ET aft dome outgassing noted
Frame 1412 - Several small pieces of white debris seen falling aft along body flap. Does not appear to strike the vehicle. (M)
Frame 1432 - LOV
No anomalies detected

Film Quality Description
Digs in film

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E76

Location:	39-3 3	**Film Quality**	
Camera Type:	35 Mit	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	20"	Exposure:	GOOD
FPS:	96	Timing:	YES
Timing:	B	Date Received:	08/05/91
		Date Screened:	08/05/91
		Screened By:	JH,MS,LR,RB,JV

Orientation

View of AFT End of ORB and SSME's with MLP in bottom of frame. To show possible propulsion problems and free Hydrogen Burnoff Systems.

Comments

Ice build-up noted on SSME vents
Ice and paper debris noted at startup
Frame 791-977 - Discolorations noted in SSME #2
Ice debris noted after liftoff
Frame 1300 - LOV
No anomalies detected
+1 frame

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E77

Location:	39-4 2	**Film Quality**	
Camera Type:	35 Mit	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	20"	Exposure:	GOOD
FPS:	96	Timing:	YES
Timing:	B	Date Received:	08/07/91
		Date Screened:	08/07/91
		Screened By:	JH,MS,LR,RB

Orientation

View of AFT End of ORB and SSME's with MLP in bottom of frame. To show possible propulsion problems and free Hydrogen Burnoff System.

Comments

Ice build-up noted on SSME vent nozzles
Normal RCS paper debris noted
Frames 489, 508, 557, 586, 600, 671 - Discolorations in SSME #2 plume
Ice and vapor noted from the LH2 TSM area
Frame 847 - Orange piece of debris noted from LH2 TSM area, moves in front of body flap and behind SSME #2
Frame 909 - Several small pieces of white debris fall from behind the body flap after liftoff, does not appear to strike vehicle
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E78

Location:	39-3 4	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	20"	Exposure:	GOOD
FPS:	400	Timing:	YES
Timing:	A	Date Received:	08/04/91
		Date Screened:	08/06/91
		Screened By:	JD,SI,BG,JV

Orientation
View of RIGHT OMS Pod leading edge during ignition and liftoff toshow possible tile damage. Top edge of OMS Pod near bottom edge of frame to allow max. travel during liftoff.

Comments
Venting from oxygen TSM noted at liftoff
Frame 4169 - White piece of debris falling aft of SLV after liftoff
Frame 4325 - LOV
No anomalies detected

Film Quality Description

Item Number E79

Location:	39-2 3	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	40"	Exposure:	GOOD
FPS:	100	Timing:	YES
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/06/91
		Screened By:	JD,SI,BG,JV

Orientation
View of tip of ET in center of frame with FSS in background to show +Y ET GO2 Vent Louver icing condition and +Y Ogive TPS configuration at time of launch. Also to record quantity of ice being lost from ET LO2 Tank Ogive and LO2 feedline areas during liftoff. Include black and white target on FSS at top edge of frame. Committed for daylight launches only.

Comments
Twang noted
Ice debris from ET umbilicals noted at liftoff
ET aft dome outgassing noted
Frame 1214 - LOV
No anomalies detected

Film Quality Description
Camera appears to be aimed high

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E150

Location:	EAFB/DFRS WSSH	**Film Quality**	
Camera Type:	35mm	Focus:	
Film:	2 rls	FOV:	
Lens Focal Length:	A/R	Exposure:	
FPS:	N/A	Timing:	
Timing:	-	Date Received:	/ /
		Date Screened:	08/01/91
		Screened By:	

Orientation

FILM PROCESSING ONLY

Two rolls of exposed 35mm color coverage of ORB Post Landing Debris Inspection will be provided by the requester.
Tech. Contact: G. Katnik, TV-MSD-22, 867-0806

NOTE: CAPTIONS WILL BE PROVIDED BY THE REQUESTER.

Comments

Not received

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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Item Number E204

Location:	IGOR PAFB	Focus:	SOFT
Camera Type:	35 MIT	FOV:	
Film:	ECD 1000'	Exposure:	GOOD
Lens Focal Length:	360"	Timing:	YES
FPS:	72	Date Received:	08/05/91
Timing:	B	Date Screened:	08/05/91
		Screened By:	CD,JH,MS,LR,RB,JV,J

Film Quality

Orientation

Track to view overall Launch Vehicle from acquisition to LOV. Continue track of ORB/ET during and after SRB separation. DO NO TRACK SEPARATED SRB'S. Operational at 0-390 Mins. Perform Pad checks at 0-375 Mins. and 0-25 Mins. Committed for Range Safety from T-0 to T+50 Secs. Film run from AOV to LOV. FIDUCIALS REQUIRED.

Comments

Roll maneuver noted
Frame 2364, 2397 - Flares noted in SSME plume (T)
Frame 2772-3687 - Condensation collar noted off crew cabin window, SRB frustum, and the vertical stabilizer
Frame 2873 - White debris noted aft of the vertical stabilizer as seen on video (M) (T)
Frame 6485-7588 - Recirculation noted
SRB plume brightening noted
Frame 8711 - SRB separation noted
No anomalies detected

Film Quality Description

Vehicle acquired after liftoff
Erratic tracking after SRB separation

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E205

Location:	SHILOH IFLOT	**Film Quality**	
Camera Type:	35 Mit	Focus:	SOFT
Film:	ECD 1000'	FOV:	
Lens Focal Length:	200"	Exposure:	LIGHT
FPS:	72	Timing:	NO
Timing:	B	Date Received:	08/05/91
		Date Screened:	08/05/91
		Screened By:	CD,JH,MS,LR,RB,JV,J

Orientation

Track to view overall Launch Vehicle from acquisition to LOV. Continue track of ORB/ET during and after SRB separation. DO NO TRACK SEPARATED SRB's. View to record vehicle structural integrity. Focus on hyperfocal distance. Period of focus: T+25 sec. to inf. FIDUCIALS REQUIRED

Comments

Condensation collar noted
Linear optical effect noted
SRB plume brightening noted
Frame 6980 - SRB separation noted
No anomalies detected

Film Quality Description

Vehicle acquired after roll maneuver
Haze hampers analysis

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E206

Location:	ROTI Mel.	**Film Quality**	
Camera Type:	35 Mit	Focus:	SOFT
Film:	ECD 1000'	FOV:	
Lens Focal Length:	400"	Exposure:	LIGHT
FPS:	72	Timing:	YES
Timing:	B	Date Received:	08/05/91
		Date Screened:	08/05/91
		Screened By:	JH,MS,LR,RB,JV,J,RP

Orientation

Track to view overall Launch Vehicle from acquisition to SRB separation. Upon separation, continue track of ORB/ET. Do not track separated SRB's. PROVIDE ON-TRACK DATA TO MOTHER COMPUTER. Not committed for Range Safety. FIDUCIALS REQUIRED.

Comments

Condensation collar noted
Recirculation noted
SRB plume brightening noted
Frame 8036 - SRB separation noted
Slag noted from both SRBs
No anomalies detected

Film Quality Description

Vehicle acquired after launch
Haze hampers analysis
Intermittent LOV due to clouds

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E207

Location:	MIGOR/ UCS 10	**Film Quality**	
Camera Type:	35 Mit	Focus:	SOFT
Film:	1000' ECD	FOV:	
Lens Focal Length:	180"	Exposure:	LIGHT
FPS:	96	Timing:	YES
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	JH,MS,LR,RB,JV

Orientation

Track to view Launch Vehicle from acquisition to SRB separation. At separation, camera will continue track of ORB/ET. PROVIDE ON-TRACK DATA TO MOTHER COMPUTER. Primary FOV is SRB Nozzles. Film committed from T+20 secs. to T+40 secs. FIDUCIALS REQUIRED.

Comments

ET aft dome outgassing
Frame 1340 - LOV due to clouds after roll maneuver
Frame 1477 - AOV
Frame 2353 - AOV - Condensation at forward end of SLV noted.
Condensation around SLV (collar) continues until frame 4811.
Frame 11539 - SRB separation noted
No anomalies detected

Film Quality Description

Intermittent LOV due to clouds
Viewed on the Tokiwa projector

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E208

Location:	DOAMS Cocoa B	**Film Quality**	
Camera Type:	35 Mit	Focus:	SOFT/GOOD
Film:	ECD 1000'	FOV:	
Lens Focal Length:	200"	Exposure:	VARIABLE
FPS:	48	Timing:	YES
Timing:	B	Date Received:	08/05/91
		Date Screened:	08/05/91
		Screened By:	JH,MS,LR,RB,JV,J

Orientation

Track to view overall Launch Vehicle from first acquisition thru SRB Separation. Upon separation continue track of ORB/ET. Do not track separated SRB's. PROVIDE ON-TRACK DATA TO MOTHER COMPUTER. Film run from first acquisition. FIDUCIALS REQUIRED. Not committed for Range Safety. Fixed focus on hyperfocal distance.

Comments

Frame 168 - Flare noted in SSME plume
Frame 528 - Large light colored piece of debris originates from the base of the vertical stabilizer/above SSME #1 area and falls aft (M) (possibly the 43 second debris)
Condensation collar noted
Recirculation noted
SRB plume brightening noted
Frame 4287 - SRB separation noted
Slag noted from both SRBs
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E211

Location:	IFLOT UCS 13	Focus:	GOOD
Camera Type:	35 MIT	FOV:	
Film:	ECD 1000'	Exposure:	GOOD
Lens Focal Length:	80"	Timing:	YES
FPS:	96	Date Received:	08/07/91
Timing:	B	Date Screened:	08/08/91
		Screened By:	JD,BG

Film Quality

Orientation

Tracking: View of entire of Launch Vehicle from AOV to LOV. Focus on hyperfocal distance. Period of focus: T-0 to LOV.

Comments

Frame 1683 - AOV
Frame 1709 - LOV due to tracking
Frame 1788 - AOV
Frame 2271 - LOV due to clouds
Frame 2883 - AOV
Frame 3691 - Start of condensation around SLV
Frame 5759 - Condensation ends
Frame 5995 - Unidentified object enters view from top and moves aft (possible bird). Did not appear to strike the vehicle.
Frame 8585 - LOV due to view angle and SRB exhaust plume
Frame 12528 - Plume brightening noted
Frame 13104 - SRB separation
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E212

Location:	MIGOR UCS-23	Focus:	SOFT
Camera Type:	35 Mit	FOV:	
Film:	ECD 1000'	Exposure:	GOOD
Lens Focal Length:	360"	Timing:	YES
FPS:	64	Date Received:	08/05/91
Timing:	B	Date Screened:	08/05/91
		Screened By:	CD,JH,MS,LR,RB,JV,J

Film Quality

Orientation

Tracking: View of SRB Nozzles from T+20 sec. to T+40 secs. To record Vehicle motion, structural integrity, and possible debris Operational at 0-390 Mins. Perform pad checks at 0-375 Mins. and 0-25 Mins. Central computer will drive Theoretical Trajectories at 0-200 Mins and 0-130 Mins. Provide on-track data from 0-10 Mins. or termination of 0-25 Min. pad checks. Not committed for Range Safety.

Comments

Bright sun reflection noted on vehicle
Frame 1732, 1764, 1835, 1857, 1904, 1925 - Flares noted in SSME plume (T)
Frame 2939 - Condensation collar noted in this time frame
Frame 3204 (M) - Linear optical effect noted
Frame 5630 - Recirculation noted in this time frame
SRB plume brightening noted
Frame 7476 - SRB separation noted
Slag noted from both SRBs after separation
No anomalies detected

Film Quality Description

Vehicle acquired during roll maneuver

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E213

Location:	MOTS UCS-12	Focus:	GOOD
Camera Type:	35 Mit	FOV:	
Film:	ECD 400'	Exposure:	LIGHT
Lens Focal Length:	800mm*	Timing:	YES
FPS:	96	Date Received:	08/05/91
Timing:	B	Date Screened:	08/05/91
		Screened By:	JH,MS,LR,RB,JV,J

Film Quality

Orientation

Tracking: Forward portion of Launch Vehicle from acquisition to LOV. To record possible debris. *Nikkor lens Focus on hyperfocal distance. (1.6 mi.) As image size decreases, include entire vehicle in frame.

Comments

Frame 137 - ET aft dome outgassing noted
Vapor off SRB stiffener rings noted
Roll maneuver noted
Frame 3455 - Flare noted in SSME plume
Frame 3235-end of film - Condensation collar noted
Frame 5073 - LOV before SRB separation
No anomalies detected

Film Quality Description

Haze hampers anlaysis
Digs in film

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E218

Location:	IFLOT UCS-26	**Film Quality**	
Camera Type:	35 MIT	Focus:	GOOD
Film:	ECD 1000'	FOV:	
Lens Focal Length:	120"	Exposure:	GOOD
FPS:	96	Timing:	YES
Timing:	B	Date Received:	08/05/91
		Date Screened:	08/05/91
		Screened By:	JH,MS,LR,RB,JV

Orientation

Track entire Launch Vehicle from AOV to LOV. To record vehicle motion, structural integrity, engine operation and possible debris. Focus on hyperfocal distance.

Comments

Frame 3870-4552 - Flares noted in SSME plume (seven flares)
Condensation collar noted
Frame 4727 - Large light colored piece of debris originates from the base of the vertical stabilizer/above SSME #1 area and falls aft (M)
Linear optical effect noted
SRB plume brightening noted
LOV before separation
No anomalies detected

Film Quality Description

Vehicle acquired after roll maneuver
Erratic tracking early in film (AOV - 2200 frames)

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E220

		Film Quality	
Location:	IFLOT/U247 L116	Focus:	GOOD
Camera Type:	35 MIT	FOV:	
Film:	ECD 1000'	Exposure:	GOOD
Lens Focal Length:	120"	Timing:	YES
FPS:	96	Date Received:	08/05/91
Timing:	B	Date Screened:	08/05/91
		Screened By:	JH,MS,LR,RB,JV

Orientation

Track Forward portion of Launch Vehicle from AOV to LOV. To record possible debris. Focus on vehicle at Pad 39-B. 39B=7.74 st. mi.
Period of focus: T-O to T+35 sec.
As image size decreases, include entire vehicle.

Comments

Roll maneuver
Vapor off SRB stiffener rings noted
Slight body flap motion noted
Frame 4182-4665 - Flares noted in SSME plume
Condensation collar noted
Frame 4580-4626 - Large piece of light colored debris appears to originate above SSME #2, moves around left RCS stinger, travels along SSME #1 bell, and falls aft (M)
SRB plume brightening noted
Frame 12607 - SRB separation noted
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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Item Number E221

Location:	IFLOT UCS-3	**Film Quality**	
Camera Type:	35 MIT	Focus:	
Film:	ECD 1000'	FOV:	
Lens Focal Length:	80"	Exposure:	
FPS:	96	Timing:	
Timing:	B	Date Received:	/ /
		Date Screened:	08/04/91
		Screened By:	

Orientation
Track to view Launch Vehicle from acquisition to SRB separation. At separation, camera will continue track of ORB/ET. PROVIDE ON-TRACK DATA TO MOTHER COMPUTER. Primary FOV is SRB Nozzles. Film committed from T+20 secs. to T+40 secs. FIDUCIALS REQUIRED.

Deleted for STS-43

Comments
Not received

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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Item Number E222

Location:	N.IFLOT BEACH	Focus:	GOOD
Camera Type:	35 PS	FOV:	
Film:	400' ECD	Exposure:	GOOD
Lens Focal Length:	800 MM	Timing:	YES
FPS:	100	Date Received:	08/05/91
Timing:	B	Date Screened:	08/05/91
		Screened By:	CD,JH,MS,LR,RB,JV,J

Film Quality

Orientation

Tracking: rear potion of Launch Vehicle from AOV to LOV. to record possible debris. Focus on vehicle at Pad 39. (39A=2.46 st.mi., 39B=1.94 st.mi.) Period of focus: T-0 to T+50 sec.

Comments

15:01:57.206 (Frame 506) - Brightening in SSME #2
15:01:57.673 (Frame 552) - Orange discoloration in SSME #2 plume (M)
15:01:58.394 (Frame 623), 15:01:58.516 (Frame 635), 15:01:58.709 (Frame 654), 15:01:58.861 (Frame 669), 15:01:59.612 (Frame 743) - Orange discoloration in SSME #2 plume.
Vapor off SRB stiffener rings noted
15:02:07.861 (Frame 1555) - Large light colored piece of debris falls from the left side of the SSME area and falls aft of the vehicle (M)
15:02:14.584 (Frame 2218) - Several pieces of light colored debris noted aft of the vehicle to the right of the SRB plume
15:02:18.325 (Frame 2587) - Orange debris comes from behind the Orbiter (possibly baggy material) (M)
Glare off window noted
Several pieces of red debris fall from behind the Orbiter between the SRBs
15:02:23.312 (Frame 3079) - Orange debris comes from behind the Orbiter (possibly baggy material) another piece follows within a few frames
15:02:26.059 (Frame 3350)- Debris falls from behind the Orbiter and recirculates between SRBs and falls into plume (M)
Multiple pieces of debris noted around SSME plume
15:02:36.458 (Frame 4377), 15:02:37.877 (Frame 4517),15:02:41.607 (Frame 4885) - Flares in SSME plume noted
15:02:41.941 (Frame 4918) - Condensation collar noted
15:02:42.854 (Frame 5008) - Light feature around SSME #1 (M)
15:02:43.006 (Frame 5023) - Second light feature around SSME #1
15:02:43.290 (Frame 5051) - Debris seen to move from below SSME #1 behind SSME #3 - across aft skirt of right SRB, and into plume.
15:02:53.811 (Frame 6089) - End of film

Film Quality Description

Great view
Digital timing
IRIG B

Photo/TV Analysis Group Evaluation Report
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Item Number E223

Location:	IFLOT UCS-9	**Film Quality**	
Camera Type:	35 MIT	Focus:	SOFT
Film:	ECD 1000'	FOV:	
Lens Focal Length:	80"	Exposure:	VARIABLE
FPS:	96	Timing:	YES
Timing:	B	Date Received:	08/04/91
		Date Screened:	08/04/91
		Screened By:	JH,MS,LR,RB,JV

Orientation

Tracking : Rear portion of Launch Vehicle from AOV to LOV. To record possible debris. Focus on Launch Vehicle at Pad. (39A=4.35 st.mi., 39B=2.74 st.mi.) Period of focus : T-0 to T+50 sec. As image decreases, include entire vehicle.

Comments

Frame 404 - -Liftoff
ET aft dome outgassing
Vapor off SRB stiffener rings noted
Roll maneuver noted
Frame 7950-10796 - SRB exhaust plumes appear orange colored
Frames 1953 (M), 2208, 2215, 3579, 33785 - Several pieces of debris fall aft of the vertical stabilizer after roll maneuver
Frames 3899, 4056 (M) - Several flares noted in SSME plume prior to condensation collar
Frame 3940-6043 - Condensation collar noted
Frame 4852 - Relatively large piece of debris seen falling aft of SLV. Time was approximated to be 38 seconds MET. (M) (T)
Frame 8737 - Rainbow noted
Frame 13211 - SRB separation noted
No anomalies detected

Film Quality Description

Sun glare on film
Viewed on Tokiwa projector

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E224

Location:	IFLOT UCS-16	**Film Quality**	
Camera Type:	35 PS	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	800mm	Exposure:	GOOD
FPS:	100	Timing:	NO
Timing:	B	Date Received:	08/05/91
		Date Screened:	08/05/91
		Screened By:	JH,MS,LR,RB,JV

Orientation

Close-in tracking coverage of entire launch vehicle from AOV to LOV. Focus on launch vehicle at Pad. (39A=3.31 st.mi, 39B=3.20 st.mi.) View to record vehicle motion, structural integrity, and engine operation during early flight. **72 @ f/8.0 *B120

Comments

FSS deluge water noted
Twang noted
Vapor off SRB stiffener rings noted
ET aft dome outgassing noted
Frame 1584 - Small light colored piece of debris falls from the base of the SSME area and falls aft
Roll maneuver noted
Vehicle obscured by clouds after roll maneuver
Condensation collar noted
Film ends before end of condensation collar
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number ET204

Location:	PIGOR	Focus:	SOFT
Camera Type:	3000 TV	FOV:	
Film:	1/2"	Exposure:	GOOD
Lens Focal Length:	120"	Timing:	YES
FPS:	N/A	Date Received:	08/02/91
Timing:	B12	Date Screened:	08/02/91
		Screened By:	JH,MS,RB,LR

Film Quality

Orientation

Video track of launch vehicle from acquisition to LOV. This item utilizes the acquisition lens. Continue track of ORB/ET during and after SRB separation. Do not track separation of SRB's. Local record on 1/2" MII. MII requires IRIG B Mod. (B-120) on audio track #2.

Comments

214:15:02:06.845 - AOV
Roll maneuver noted
214:15:02:42.247-214:15:02:49.654 - Condensation collar noted
214:15:02:43.248 - A white piece of debris falls aft from the vertical stabilizer
214:15:03:35.999-214:15:03:44.876 - Recirculation noted
SRB plume brightening noted
214:15:04:05.597 - SRB separation noted
214:15:04:10.368 - LOV
214:15:04:20.979 - AOV
No anomalies detected

Film Quality Description

Erratic tracking immediately after SRB separation

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number ET206

Location:	ROTI, M.B.	Focus:	SOFT
Camera Type:	750 TV	FOV:	
Film:	1/2" -	Exposure:	VARIABLE
Lens Focal Length:	120"	Timing:	YES
FPS:	-	Date Received:	08/02/91
Timing:	B12	Date Screened:	08/02/91
		Screened By:	JH,MS,RB,LR,CD

Film Quality

Orientation

Tracking : Forward portion of Launch Vehicle from AOV to LOV. To record possible debris. Focus on Launch Vehicle at Pad. (39A=7676 yds., 39B=4824 yds.) Period of focus : T-0 to T+50 sec. As image decreases, include entire vehicle.

Comments

214:15:02:07.659 - AOV
214:15:02:42.895-214:15:02:56.608 - Condensation collar noted
214:15:03:34.980-214:15:03:50.395 - Recirculation noted
214:15:03:53 - SRB plume brightening noted
214:15:04:05.610 - SRB separation noted
214:15:04:13.185 - LOV
No anomalies detected

Film Quality Description

Intermittent LOV due to clouds
Yellowish tint to video

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number ET207

Location:	MIGOR UCS-10	Focus:	GOOD
Camera Type:	3000 TV	FOV:	
Film:	1/2" -	Exposure:	VARIABLE
Lens Focal Length:	52"	Timing:	YES
FPS:	N/A	Date Received:	08/02/91
Timing:	B	Date Screened:	08/02/91
		Screened By:	JH,MS,RB,LR,CD

Film Quality

Orientation

Video track of Launch Vehicle from acquisition to LOV. This item utilizes the acquisition lens. After separation, camera will continue to track ORB/ET. Local Record on 1/2" MII. MII requires IRIG B Mod. (B-120) on audio track #2.

Comments

Roll maneuver noted
214:15:02:13.826-214:15:02:14.227 - Large white piece of debris falls vertically through FOV. Does not appear to strike vehicle.
214:15:02:18.798 - LOV due to clouds
214:15:02:43.488 - AOV
-214:15:02:43.488-214:15:02:54.667 - Condensation collar noted
214:15:03:55.161 - SRB plume brightening noted
214:15:04:05.605 - SRB separation noted
No anomalies detected

Film Quality Description

214:15:02:49.562 - Possible internal reflection

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number ET208

Location:	C.B. DOAMS	Focus:	SOFT
Camera Type:	750 TV	FOV:	
Film:	1/2"	Exposure:	GOOD
Lens Focal Length:	240"	Timing:	YES
FPS:	-	Date Received:	08/02/91
Timing:	B	Date Screened:	08/02/91
		Screened By:	JH,MS,RB,LR,CD

Film Quality

Orientation
TV System to provide real time video signal for transmission to JSC via BRRS. Track from first acquisition to LOV. Local Record on 1/2" MII. Requires IRIG B Mod. (B-120) on audio track #2.

Comments
214:15:02:43.186 - Large light piece of debris falls aft of the vertical stabilizer
See KTV13 for other events

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number ET212

Location:	MIGOR UCS-23	**Film Quality**	
Camera Type:	3000 TV	Focus:	VARIABLE
Film:	1/2"	FOV:	
Lens Focal Length:	52"	Exposure:	VARIABLE
FPS:	N/A	Timing:	YES*
Timing:	B	Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	JH,MS,RB,LR,CD

Orientation

Video track of Launch Vehicle from acquisition to LOV. This item utilizes the acquisition lens. After separation, camera will continue to track ORB/ET. Local record on 1/2" MII. MII requires IRIG B Mod. (B-120) on audio track #2. Provide real-time for video signal for transmission to LC-39 Press Site.

Comments

214:15:02:09.674 - AOV
Roll maneuver noted
214:15:02:35.466-214:15:02:54.952 - Condensation collar noted
A white piece of debris falls aft of the vertical stabilizer
214:15:03:34.892 - LOV due to clouds
214:15:03:45.036 - AOV
214:15:04:05.589 - SRB separation noted
214:15:04:10.027 - Reflection off the LSRB
No anomalies detected

Film Quality Description

Saturation of video signal
*Timing discrepancy in the minutes column

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number ET213

Location:	MOTS UCS 12	Focus:	VARIABLE
Camera Type:	101/102 TV	FOV:	
Film:	1/2"	Exposure:	VARIABLE
Lens Focal Length:	ZOOM	Timing:	YES
FPS:	-	Date Received:	08/02/91
Timing:	B	Date Screened:	08/02/91
		Screened By:	JH,MS,RB,LR,CD

Film Quality

Orientation

Manual Video track of entire Launch Vehicle from liftoff to T+50 seconds or LOV, whichever first occurs. Committed for Range Safety. Remote tracker control from VAB. Provide video signal for transmission to RSDS. Local record on 1/2" MII. Requires IRIG B Mod. (B120) on audio track #2.

Comments

214:15:02:00.470 - Liftoff
Vapor off LO2 TSM noted
Vapor off SRB stiffener rings noted
Roll maneuver noted
Condensation collar noted
214:15:04:05.662 - SRB separation noted
No anomalies detected

Film Quality Description

Poor color balance
Temporary loss of video signal before SRB separation
Dirt on lens

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number KTV2

Location:	SLF CONVOY	**Film Quality**	
Camera Type:	VIDEO RCA	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:	14X10	Exposure:	GOOD
FPS:	30	Timing:	YES*
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	SI,JD,MS,BG

Orientation

RCA TK76A FUJINON 14 X 10 ZOOM lens with a 2 X extender or a 30 x 26 lens with a 1.7 X extender. SRB exhaust.

Comments

No anomalies detected

Film Quality Description

Minor intermittent video noise noted
*Timing discrepancy noted

Photo/TV Analysis Group Evaluation Report
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Item Number KTV4A

Location:	PAD B	**Film Quality**	
Camera Type:	VIDEORCA	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:	30X26	Exposure:	GOOD
FPS:	30	Timing:	YES*
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	JD,SI,MS,RB

Orientation
RCA TK76B color camera.

Comments
214:15:02:00.759 - -Liftoff
Vapor off right SRB stiffener rings after liftoff
Roll maneuver noted
214:15:02:18.544 - Sun glint off the forward cabin windows
214:15:02:42.234-214:15:02:55.680 - Condensation collar around the SLV noted
214:15:03:21.306-214:15:03:43.461 - Orange brightening noted in SRB exhaust prior to SRB separation
Plume brightening prior to SRB separation
214:15:04:05.617 - SRB separation

Film Quality Description
*Timing discrepancy in days, minutes and seconds columns
Ghost images bisible after liftoff

Photo/TV Analysis Group Evaluation Report
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Item Number KTV5

Location:	VAB ROOF	**Film Quality**	
Camera Type:	VIDEO RCA	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:	30X26	Exposure:	VARIABLE
FPS:	30	Timing:	YES*
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	JD,SI,BG,MS,RB,JH

Orientation

RCA TK760B color camera SCHNEIDER 30 X 26 lens with a 1.7 X extender and 900 feet of camera cable. Viewed from southwest. Prior to liftoff past SRB separation.

Comments

214:15:03:23.175-214:15:03:38.223 - Orange discoloration in SRB exhaust plume noted
214:15:03:43.769-214:15:02:57.749 - Condensation collar around the SLV noted
214:15:04:05.617 - SRB separation
No anomalies detected

Film Quality Description

*Timing discrepancy noted
Exposure variable
Camera vibration noted
Ghost images visible

Photo/TV Analysis Group Evaluation Report
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Item Number KTV7A

Location:	PAD B	Focus:	GOOD
Camera Type:	VIDEORCA	FOV:	
Film:		Exposure:	GOOD
Lens Focal Length:	14X10	Timing:	YES*
FPS:	10	Date Received:	08/02/91
Timing:		Date Screened:	08/02/91
		Screened By:	SI,RB,JH,JD,BG,MS

Film Quality

Orientation
RCA RK76B Camera with AC Power Pack and FUJINON 14 X 10 ZOOM lens with a 2 X extender. This camera is located at the Launch Pad perimeter camera site 2 (CS-2) on a remotely controlled mount to provide a profile view for prelaunch and liftoff. View from east.

Comments
Twang noted
No anomalies detected

Film Quality Description
*Timing discrepancy noted

Item Number KTV11

Location:	TV TOWER 1	Focus:	GOOD
Camera Type:	VIDEO RCA	FOV:	
Film:		Exposure:	GOOD
Lens Focal Length:		Timing:	YES*
FPS:	30	Date Received:	08/02/91
Timing:		Date Screened:	08/02/91
		Screened By:	JD,SI,MS,BG,RB,JH

Film Quality

Orientation
From the north TV tower # 7 at SLF. RCA TK76B color camera, w/ a 2X extender and a 1.7X teleconverter.

Comments
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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Item Number KTV13

Location:	COCOA BEA.	**Film Quality**	
Camera Type:	VIDEO RCA	Focus:	SOFT
Film:		FOV:	**
Lens Focal Length:		Exposure:	LIGHT
FPS:	30	Timing:	YES*
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	SI,JD,MS,BG,RB,JH

Orientation
RCA TK710 provides coverage after loss of view from KSC cameras.

Comments
214:15:02:55.514-214:15:03:42.201 - Condensation collar noted around the SLV
214:15:03:34.020-214:15:03:45.064 - Recirculation 214:15:04:05.601 - SRB separation noted
No anomalies detected

Film Quality Description
**214:15:03:31.324-214:15:03:41.234 - View changes
Focal length changes
*Timing discrepancy noted

Photo/TV Analysis Group Evaluation Report
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Item Number KTV18

Location:	MALABAR	**Film Quality**	
Camera Type:	VIDEO RCA	Focus:	SOFT
Film:		FOV:	
Lens Focal Length:		Exposure:	DARK
FPS:	30	Timing:	YES*
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	SI,JD,BG,MS,RB,JH

Orientation
RCA TK710 ITEK-Long range optics - Black and White

Comments
No anomalies detected

Film Quality Description
Image appears low in FOV
Intermittent tracking
*Timing discrepancy

Photo/TV Analysis Group Evaluation Report
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Item Number KTV21A

Location:	S. OF PADA	**Film Quality**	
Camera Type:	VIDEO	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	GOOD
FPS:	30	Timing:	YES*
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	SI,MS,BG,CD,JD,JH,RB

Orientation
View from south liftoff past SRB separation.

Comments
Vehicle obscured at liftoff by exhaust plume
Roll maneuver noted
Condensation collar noted around the SLV
214:15:04:05.617 - SRB separation
No anomalies detected

Film Quality Description
*Timing discrepancy
Camera vibration
214:15:03:29.281 - Change of exposure
214:15:01:52.417 - Change of FOV

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number OTV009

Location:	Pad A FSS 95	**Film Quality**	
Camera Type:	Video	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	GOOD
FPS:		Timing:	YES
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	JD,MS,SI,RB,JH,BG

Orientation
Left side of vehicle. Orbiter ET interface and TPS. East side.

Comments
Small amount of vapor noted around umbilical prior to liftoff
Ice debris from LH2 umbilical area noted prior to liftoff
214:15:01:40.143 - White debris falls below 17" flange near ET
White debris falls from LH2 umbilical disconnect area along body flap at liftoff.
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
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09/16/91

Item Number OTV041

Location:	39A-2	**Film Quality**	
Camera Type:	Video	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	VARIABLE
FPS:	30	Timing:	YES
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	SI,JD,CD,BG

Orientation
Upper portion of vehicle on pad. Short range tracker. Black and white video.

Comments
Deluge water noted
ROFI start noted
Twang noted
214:15:01:59.595 - ~SRB ignition
Roll maneuver noted
No anomalies detected

Film Quality Description
Internal reflection in lens
Exposure dark after liftoff

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number OTV048

Location:	39A-6	**Film Quality**	
Camera Type:	Video	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	VARIABLE
FPS:	30	Timing:	YES*
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	SI,JD,BG,MS,RB,JH,CD

Orientation

Goertz track video. Black and white video. Looks at upper part of vehicle from northwest. Photo tracker Boresight.

Comments

FSS deluge water noted
Vapor off SRB stiffener rings noted
No anomalies detected

Film Quality Description

Lens flares
*Timing discrepancy noted

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number OTV049

Location:	Pad A MLP 0	**Film Quality**	
Camera Type:	Video	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	GOOD
FPS:		Timing:	YES*
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	SI,JD,BG,CD

Orientation
T-0 LO2 umbilical disconnect. Left side of 1-E.

Comments
Rofi noted at bottom of scene
RCS paper debris noted
Twang noted
214:15:02:00.062 - -LO2 T-0 disconnect noted
214:15:02:01.731 - Two pieces of white debris noted between the main engine and the body flap
No anomalies detected

Film Quality Description
*Timing discrepancy noted in minutes columns

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number OTV051

Location:	Pad A MLP	**Film Quality**	
Camera Type:	Video	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	GOOD
FPS:		Timing:	YES
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	SI,JD,BG,CD

Orientation
LO2 AFT umbilical interface, APU exhaust No. 3 & main engine area.
Side 1-East.

Comments
Ice on vent nozzle of SSMEs noted
Rofi noted
Vapor cloud from T-0 disconnect noted
Possible slight horizontal motion noted at liftoff
214:15:02:02.492 - Dark piece of debris in SRB plume noted
No anomalies detected

Film Quality Description
Horizontal banding noted at liftoff
Water on lens at liftoff

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number OTV054

		Film Quality	
Location:	Pad A MLP	Focus:	GOOD
Camera Type:	Video	FOV:	
Film:		Exposure:	GOOD
Lens Focal Length:		Timing:	YES*
FPS:		Date Received:	08/02/91
Timing:		Date Screened:	08/02/91
		Screened By:	CD,JD,SI,BG

Orientation
MLP side 4, 0-ft. level. Orbiter to ET interface underside of Orbiter wind and TPS.

Comments
Twang noted
214:15:01:56-214:15:01:57 - Several small pieces of debris noted falling from umbilical area
214:15:02:01.530 - One large white piece of debris noted falling from LH2 umbilical area. Appears to strike underside Orbiter TPS at 214:15:02:01.330. No damage noted.
Several other white pieces of debris noted from the LH2 umbilical area.

Film Quality Description
Horizontal banding after liftoff
*Timing discrepancy noted throughout in seconds column.

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number OTV060

Location:	Pad A	**Film Quality**	
Camera Type:	Video	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	GOOD
FPS:		Timing:	YES
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	SI,JD,BG,CD

Orientation

LOX vent arm hood seals (color) water tower- View from north east SRB attach points stiffener rings field joints and factory joints visible. Good view of north side of vehicle and tail as it moves through scene at liftoff.

Comments

FSS deluge water noted
GH2 vent arm appears to retract normally
Twang noted
214:15:02:03.165 - White object to south of vehicle at liftoff believed to be part of the FSS structure
No anomalies detected

Film Quality Description

Water spots on lens after liftoff

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number OTV061

Location:	Pad A FSS 255	**Film Quality**	
Camera Type:	Video	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	GOOD
FPS:	30	Timing:	YES*
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	SI,JD,BG,CD

Orientation

ET scan (color) fire surveillance - left SRB and TPS on left side of Orbiter as vehicle moves through scene.

Comments

Twang noted
Normal venting from GOX vent noted
No anomalies detected

Film Quality Description

Timing discrepancy noted
Video drop out in upper left quarter of scene
Dirt on lens before liftoff

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number OTV063

Location:	Pad A FSS 155	Focus:	GOOD
Camera Type:	Video	FOV:	
Film:		Exposure:	GOOD*
Lens Focal Length:		Timing:	YES
FPS:	30	Date Received:	08/02/91
Timing:		Date Screened:	08/02/91
		Screened By:	SI,JD,CD,BG

Film Quality

Orientation
Lower third of vehicle left SRB - left side of Orbiter and external and external tank attach point with Orbiter.

Comments
Small amount of vapor noted in umbilical area prior to liftoff
Twang noted
214:15:01:56 - Several pieces of ice debris noted falling from LH2 umbilical area prior to liftoff
214:15:02:01.797 - Ice debris appears to skim along body flap. No damage to TPS noted
Deluge water noted after liftoff

Film Quality Description
Umbilical area in shadow

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number OTV070

Location:	SE Pad A	**Film Quality**	
Camera Type:	Video	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	GOOD
FPS:	30	Timing:	YES
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	BG,SI,JD,CD

Orientation

Fire surveillance (color) south east field close up of SSMEs at ignition.

Comments

Left to right motion in the vertical stabilizer noted at liftoff
214:15:01:59.629 - Discoloration in SSME #2 mach diamond noted
214:15:02:01.865 - White debris to left of LO2 TSM noted

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number OTV071

Location:	SW Pad A	**Film Quality**	
Camera Type:	Video	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	GOOD
FPS:	30	Timing:	YES*
Timing:		Date Received:	08/02/91
		Date Screened:	08/02/91
		Screened By:	CD,JD,BG,SI,MS

Orientation
Fire surveillance (color) fixed service structure on left and water tower on right full vehicle. View from southwest.

Comments
Rofi start noted
214:15:01:59.895 - Small white pieces of debris (probably ice) falling from behind vertical stabilizer
214:15:01:59.628 - Discoloration in SSME #2 mach diamond noted
Debris noted in exhaust plume after liftoff

Film Quality Description
*Timing discrepancy

Photo/TV Analysis Group Evaluation Report
STS-43
09/17/91

Item Number E802

Location:	IFLOT,TK Site B	**Film Quality**	
Camera Type:	35 PS	Focus:	GOOD
Film:	ECD 400'	FOV:	GOOD
Lens Focal Length:	135mm	Exposure:	NO
FPS:	48	Timing:	08/20/91
Timing:	B	Date Received:	08/20/91
		Date Screened:	JD,BG
		Screened By:	

Orientation

Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency.

Use Range Type Cable, Edge Timing only.

Comments

Frame 683 - Main gear touchdown (view too distant to distinguish between right and left)
Frame 1174 - Nose gear touchdown
Wheel stop not determined
No anomalies detected

Film Quality Description

No first frame identifier - black frame prior to view of vehicle

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Photo/TV Analysis Group Evaluation Report
STS-43
09/17/91

Item Number E803

Location:	S.Twr.Trk. Site C	**Film Quality**	
Camera Type:	35 PS	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	135mm	Exposure:	GOOD
FPS:	48	Timing:	NO
Timing:	B	Date Received:	08/20/91
		Date Screened:	08/20/91
		Screened By:	JD,BG

Orientation

Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possibly contingency. Provide coverage for both north and south landings.
Be alert for emergency crew evacuation after wheel-stop.

Use Range Type Cable, Edge Timing only.

Comments

Frame 1432 - Unidetified flying white object (possible bird moves across field of view from right to left)
Frame 4804 - Wheel doors open
Frame 5667 - Main gear touchdown
Frame 5901 - Last frame (prior to nose gear touchdown)
No anomalies detected

Film Quality Description

No first frame identifier - first frame with view of Orbiter used
Short film run

Photo/TV Analysis Group Evaluation Report
STS-43
09/17/91

Item Number E806

Location:	N.Twr.Trk Site F	Focus:	GOOD
Camera Type:	35 PS	FOV:	
Film:	ECD 400'	Exposure:	GOOD
Lens Focal Length:	135mm	Timing:	NO
FPS:	48	Date Received:	08/20/91
Timing:	B	Date Screened:	08/20/91
		Screened By:	JD,BG

Film Quality

Orientation

Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency. Provide coverage for both north and south landings.
Be alert for emergency crew evacuation after wheel-stop.

Use Range Type Cable, Edge Timing only.

Comments

Frame 392 - Wheel doors open
Frame 1252 - Right main gear touchdown
Frame 1255 - Left main gear touchdown
Frame 1770 - Nose gear touchdown
Frame 3782 - - Wheel stop
No anomalies detected

Film Quality Description

No first frame identifier - first frame with view of Orbiter used
Good for threshold analysis
Possibly good for sink rate analysis

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E807

Location:	N.End,SLF Site 1	Focus:	GOOD
Camera Type:	16 Mit	FOV:	
Film:	ECD 400'	Exposure:	GOOD
Lens Focal Length:	12"	Timing:	NO
FPS:	96	Date Received:	08/16/91
Timing:	B	Date Screened:	08/16/91
		Screened By:	JD,BG

Film Quality

Orientation

Camer located on runway centerline. Level camera with spirit-level.
Provide view looking south to cover nose gear and main gear tracking during touchdown and rollout.
To be run during north and south landings.
Also to view elevon and speed-brake positions.

Remote start 6

Comments

Frame 1263 - Detached/torn beta blanket visible on SSME #1 and #2.
Bright spot between SSME #1 and SSME #3 visible (M)
Frame 1721 - Right main wheel touchdown
Frame 1730 - Left main wheel touchdown
View of nose wheel touchdown obscured by dust at nose wheel touchdown
Could not determine wheel stop due to view angle and distance
Frame 14897 - Last frame
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E808

Location:	S. End,SLF Site 4	**Film Quality**	
Camera Type:	16 Mit	Focus:	GOOD
Film:	ECD 400'	FOV:	GOOD
Lens Focal Length:	12"	Exposure:	NO
FPS:	96	Timing:	08/16/91
Timing:	B	Date Received:	08/16/91
		Date Screened:	JD,BG
		Screened By:	

Orientation

Camera located on runway centerline. Level camera with spirit-level.
Provide view looking north to cover nose gear and main gear tracking during touchdown and rollout.
To be run during north and south landings.
Also to view elevon and speed-brake positions.

Remote start 2

Comments

Wing tip vorticies visible during landing flare and touchdown
Main gear and nose gear touchdown could not be accurately determined because of reflection off runway surface
Wheel stop could not be determined due to view angle and runway surface reflection
Frame 9579 - Speed brakes close after landing
Frame 14756 - Last frame
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/17/91

Item Number E809

Location:	N. End Site 1	**Film Quality**	
Camera Type:	35 PS	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	105mm	Exposure:	GOOD
FPS:	96	Timing:	NO
Timing:	B	Date Received:	08/20/91
		Date Screened:	08/20/91
		Screened By:	JD,BG

Orientation
View looking north to record landing gear deployment.
Locate camera on runway gear centerline and at elevation of 15 degrees.

Edge timing only.
Remote start 5

Comments
Frame 1424-1568 - Orbiter in view
Aircraft seen in background on right side of vehicle during entire length of film
Landing gear deployed prior to vehicle entering field of view
No anomalies detected

Film Quality Description
No first frame identifier - first view of sky used
Close view of underside of Orbiter

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E810

		Film Quality	
Location:	S. End Site 4	Focus:	
Camera Type:	35 PS	FOV:	
Film:	ECD 400'	Exposure:	
Lens Focal Length:	105mm	Timing:	
FPS:	96	Date Received:	/ /
Timing:	B	Date Screened:	09/04/91
		Screened By:	

Orientation
View looking south to record landing gear deployment.
Locate camera on runway centerline and at elevation of 15 degrees.

Edge Timing only.
Remote Start 1

Comments
Not received

Film Quality Description

Item Number E812

		Film Quality	
Location:	IFLOT, Trk Site B	Focus:	GOOD
Camera Type:	16 PS	FOV:	
Film:	ECD 400'	Exposure:	GOOD
Lens Focal Length:	50mm	Timing:	NO
FPS:	48	Date Received:	08/16/91
Timing:	B	Date Screened:	08/16/91
		Screened By:	JD,BG

Orientation
Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency.
Provide coverage for both north and south landings.
Be alert for emergency crew evacuation after wheel-stop.

Use Range Type Cable, Edge Timing only.

Comments
Frame 676 - ~ Main landing wheel touchdown
Frame 1174 - Nose wheel touchdown
Frame 2461 - LOV during landing rollout prior to wheel stop
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E813

Location:	S.Twr.Trk. Site C	**Film Quality**	
Camera Type:	16 PS	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	75mm	Exposure:	GOOD
FPS:	48	Timing:	NO
Timing:	B	Date Received:	08/16/91
		Date Screened:	08/16/91
		Screened By:	JD,BG

Orientation

Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency. Provide coverage for both north and south landings.
Be alert for emergency crew evacuation after wheel-stop.

Use Range Type Cable, Edge Timing only.

Comments

Frame 1353-2349 - Unknown flying object (possible bird) moves across view from right to left above the Orbiter prior to wheels down.
Frame 5672 - - Main wheel touchdown
Could not accurately determine nose wheel down frame number
Frame 8382 - Wheel stop
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/17/91

Item Number E816

Location:	N.Twr.Trk. Site F	**Film Quality**	
Camera Type:	16 PS	Focus:	GOOD
Film:	ECD 400'	FOV:	LIGHT
Lens Focal Length:	75mm	Exposure:	*YES
FPS:	48	Timing:	08/20/91
Timing:	B	Date Received:	08/20/91
		Date Screened:	JD,BG
		Screened By:	

Orientation

Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency. Provide coverage for both north and south landings. Be alert for emergency crew evacuation after wheel-stop.

Use Range Type Cable, Edge Timing only.

Comments

Frame 479 - Wheel doors down
Frame 1362 - Right main gear touchdown
Frame 1366 - Left main gear touchdown
Frame 1872 - Nose gear touchdown
Frame 3953 - - Wheel stop
Frame 6539 - Last frame
No anomalies detected

Film Quality Description

Lights on left margin bleed into frame
*Timing marks appear blurred
Good view for threshold analysis

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E820

Location:	UCS-9/ IFLOT	**Film Quality**	
Camera Type:	16 MIT	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	40"	Exposure:	GOOD
FPS:	48	Timing:	NO
Timing:	B	Date Received:	08/16/91
		Date Screened:	08/16/91
		Screened By:	MS,BG

Orientation

Comments
Frame 4415 - Wheel doors open
Touchdown and wheel stop obscured by trees
No anomalies detected

Film Quality Description

Item Number E821

Location:	UCS-15 IFLOT	**Film Quality**	
Camera Type:	16 Mit	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	40"	Exposure:	GOOD
FPS:	48	Timing:	NO
Timing:	B	Date Received:	08/16/91
		Date Screened:	08/16/91
		Screened By:	MS,BG

Orientation
Tracking coverage of ORB during approach for landing to LOV. Start camera at first acquisition BUT NOT BEFORE L-4 MINUTES.
In event of crew ejection, continue track of vehicle.

Comments
LOV before wheel doors open due to vegetation
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E822

		Film Quality	
Location:	UCS-26 IFLOT	Focus:	
Camera Type:	16 Mit	FOV:	
Film:	ECD 400'	Exposure:	
Lens Focal Length:	40"	Timing:	
FPS:	48	Date Received:	/ /
Timing:	B	Date Screened:	09/04/91
		Screened By:	

Orientation
Tracking coverage of ORB during approach for landing to LOV. Start camera at first acquisition BUT NOT BEFORE L-4 MINUTES.
In event of crew ejection, continue track of vehicle.

Comments
Not received

Film Quality Description

Item Number E823

		Film Quality	
Location:	UCS-13 IFLOT	Focus:	GOOD
Camera Type:	16 Mit	FOV:	
Film:	ECD 400'	Exposure:	GOOD
Lens Focal Length:	40"	Timing:	NO
FPS:	48	Date Received:	08/16/91
Timing:	B	Date Screened:	08/16/91
		Screened By:	MS,BG

Orientation
Tracking coverage of ORB during approach for landing to LOV. Start camera at first acquisition BUT NOT BEFORE L-4 MINUTES.
In event of crew ejection, continues track of vehicle.

Comments
Frame 1588 - Nose gear door opens
LOV prior to touchdown due to trees
No anomalies detected

Film Quality Description
Erratic tracking

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E830

Location:	Fixed Site 3	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	32mm	Exposure:	GOOD
FPS:	100	Timing:	NO
Timing:	N/R	Date Received:	08/16/91
		Date Screened:	08/16/91
		Screened By:	JD,BG

Orientation
Fixed coverage of Orbiter landing to show touchdown.
Touchdown point centered in left half of frame.

Remote Start 3

Comments
AOV after touchdown
Frame 3087 - ~ Wheel stop
Frame 5714 - Speed brakes close
Frame 7545 - Last frame
No anomalies detected

Film Quality Description

Item Number E831

Location:	Fixed Site 2	**Film Quality**	
Camera Type:	16 DBM5	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	32mm	Exposure:	GOOD
FPS:	100	Timing:	NO
Timing:	N/R	Date Received:	08/16/91
		Date Screened:	08/16/91
		Screened By:	MS,BG

Orientation
Fixed coverage of Orbiter landing to show touchdown.
Touchdown point centered in right half of frame.

Remote Start 7

Comments
Frame 1610 - Main gear touchdown
LOV before nose gear touchdown
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/17/91

Item Number E832

Location:	IFLOT Trk Site A	**Film Quality**	
Camera Type:	35 PS	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	135mm	Exposure:	GOOD
FPS:	48	Timing:	YES
Timing:	B	Date Received:	08/20/91
		Date Screened:	08/20/91
		Screened By:	JD,BG

Orientation

Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency. Provide coverage for both north and south landings.
Be alert for emergency crew evacuation after wheel-stop.

This item will be supported contingent upon site completion.

Comments

54:21:23:05 (Frame 257) - Wheel doors open
54:21:23:24.901 (Frame 1176) - Right main gear touchdown
54:21:23:24.984 (Frame 1180) - Left main gear touchdown
54:21:23:35.979 (Frame 1706) - - Nose gear touchdown
Wheel stop not determined
Possibly good view for sink rate analysis
No anomalies detected

Film Quality Description

No first frame identifier - first view of sky used
Timing discrepancy (days & hours appear to be incorrect)
Erratic tracking

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E833

Location:	IFLOT Trk. Site A	**Film Quality**	
Camera Type:	16 PS	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	50mm	Exposure:	GOOD
FPS:	48	Timing:	NO
Timing:	B	Date Received:	08/16/91
		Date Screened:	08/16/91
		Screened By:	MS,BG

Orientation
Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency. Provide coverage for both north and south landings.
Be alert for emergency crew evacuation after wheel-stop.

This item will be supported contingent upon site completion.

Comments
Frame 333 - Wheel doors open
Frame 1190 - Right main gear touchdown
Frame 1194 - Left main gear touchdown
Frame 1721 - ~ Nose gear touchdown
Wheel stop undeterminable
No anomalies detected

Film Quality Description
Film may be good for sink rate

Photo/TV Analysis Group Evaluation Report
STS-43
09/17/91

Item Number E834

Location:	IFLOT Trk. Site D	**Film Quality**	
Camera Type:	35 PS	Focus:	GOOD
Film:	ECD 400'	FOV:	
Lens Focal Length:	135mm	Exposure:	GOOD
FPS:	48	Timing:	*YES
Timing:	B	Date Received:	08/20/91
		Date Screened:	08/20/91
		Screened By:	JD,BG

Orientation

Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency. Provide coverage for both north and south landings.
Be alert for emergency crew evacuation after wheel-stop.

This item will be supported contingent upon site completion.

Comments

93:00:25:10.189 (Frame 1462) - - Right main gear touchdown
93:00:25:10.302 (Frame 1467) - - Left main gear touchdown
93:00:25:21.014 (Frame 1944) - - Nose gear touchdown
93:00:26:07.442 (Frame 4012) - - Wheel stop
Frame 6240 - Last frame
No anomalies detected

Film Quality Description

No first frame identifier - Frame with timing 93:00:24:37.324 used
*Appears to be inaccurate

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E835

Location:	IFLOT Trk. Site D	**Film Quality**	
Camera Type:	16 PS	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	50mm	Exposure:	GOOD
FPS:	48	Timing:	NO
Timing:	B	Date Received:	08/16/91
		Date Screened:	08/16/91
		Screened By:	MS,BG

Orientation

Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency. Provide coverage for both north and south landings.
Be alert for emergency crew evacuation after wheel-stop.

This item will be supported contingent upon site completion.

Comments

Frame 1520 - - Main gear touchdown
Nose gear touchdown undeterminable
Frame 4299 - Wheel stop
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/17/91

Item Number E836

Location:	IFLOT Trk. Site E	**Film Quality**	
Camera Type:	35 PS	Focus:	GOOD
Film:	ECD 400'	FOV:	GOOD
Lens Focal Length:	135mm	Exposure:	YES
FPS:	48	Timing:	08/20/91
Timing:	B	Date Received:	08/20/91
		Date Screened:	JD,BG
		Screened By:	

Orientation

Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency. Provide coverage for both north and south landings.
Be alert for emergency crew evacuation after wheel-stop.

This item will be supported contingent upon site completion.

Comments

90:12:23:06.905 (Frame 320) - - Wheel doors open
90:12:23:25.145 (Frame 1158) - Right main gear touchdown
90:12:23:25.189 (Frame 1160) - Left main gear touchdown
90:12:23:36.108 (Frame 1662) - Nose gear touchdown
90:12:24:20.784 (Frame 3716) - Wheel stop
90:12:25:14.907 (Frame 6203) - Last frame
No anomalies detected

Film Quality Description

No first frame identifier - first frame with timing 90:12:23:59.955 used
View of right side of vehicle

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E837

Location:	IFLOT Trk. Site E	**Film Quality**	
Camera Type:	16 PS	Focus:	GOOD
Film:	ECD 200'	FOV:	
Lens Focal Length:	50mm	Exposure:	GOOD
FPS:	48	Timing:	
Timing:	B	Date Received:	08/16/91
		Date Screened:	08/16/91
		Screened By:	MS,BG

Orientation

Tracking coverage from final flare, when ORB assumes horizontal flight prior to touchdown thru wheel-stop. To view for possible contingency. Provide coverage for both north and south landings.
Be alert for emergency crew evacuation after wheel-stop.

This item will be supported contingent upon site completion.

Comments

Frame 849 - Main gear touchdown
Frame 1351 - Nose gear touchdown
Frame 3468 - Wheel stop
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/17/91

Item Number E845

		Film Quality	
Location:	MIGOR UCS-7	Focus:	
Camera Type:	35 Mit	FOV:	GOOD
Film:	ECD 1000'	Exposure:	
Lens Focal Length:	180"	Timing:	GOOD
FPS:	48	Date Received:	NO
Timing:	B	Date Screened:	08/20/91
		Screened By:	08/20/91
			JD,BG

Orientation

Tracking Telescope coverage of Orbiter during approach for Landing to LOV. Track from first acquisition but do not start camera before T-6 Min. In event of Crew Bail-out, continue track of Orbiter. Mount open to north.

Comments

Frame 3262 - Vapor or smoke behind vehicle prior to Heading Alignment Cylinder maneuver
Frame 7836 - LOV due to tracking
Frame 12878 - AOV
Frame 15857 - Last frame (prior to wheel doors open)
No anomalies detected

Film Quality Description

No first frame identifier - first view of sky used
Erratic tracking - vehicle not in field of view 33% of film
View is reversed

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number E846

		Film Quality	
Location:	MIGOR UCS-12	Focus:	
Camera Type:	35 Mit	FOV:	
Film:	ECD 1000'	Exposure:	
Lens Focal Length:	360"	Timing:	
FPS:	48	Date Received:	/ /
Timing:	B	Date Screened:	09/04/91
		Screened By:	

Orientation

Tracking Telescope coverage of Orbiter during approach for Landing to LOV. Track from first acquisition but do not start camera before T-6 Min. In event of Crew Bail-out, continue track of Orbiter. Mount open to south.

Comments

Not received

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number KTV5L

Location:	VAB Video	**Film Quality**	
Camera Type:	RCA	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:	30x26	Exposure:	GOOD
FPS:		Timing:	YES
Timing:		Date Received:	08/11/91
		Date Screened:	08/11/91
		Screened By:	JD,BG,SI,CD

Orientation

RCA TK760B color camera, Schneider 30x26 lens with a 1.7x extender.
Left side of vehicle.

Comments

223:12:22:58.109 - Contrails seen from both wing tips
223:12:23:05.750 - Wheel doors start to open
223:12:23:24.936 - Right main gear touchdown
223:12:23:25.003 - Left main gear touchdown
223:12:23:35.947 - Nose gear touchdown
223:12:24:22.994 - ~Wheel stop
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number KTV6L

Location:	MDD Video	**Film Quality**	
Camera Type:	RCA	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:	14x10	Exposure:	GOOD
FPS:		Timing:	YES
Timing:		Date Received:	08/11/91
		Date Screened:	08/11/91
		Screened By:	JD,SI,BG,CD

Orientation
RCA TK76B color camera. 14x10 Fujinon lens. Left side of vehicle.

Comments
View is too far away to accurately determine times for doors open, main gear touchdown and nose wheel touchdown
223:12:24:23.180 - Wheel stop
No anomalies detected

Film Quality Description

Item Number KTV11L

Location:	Tower #1 Video	**Film Quality**	
Camera Type:	RCA	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:	14x10	Exposure:	GOOD
FPS:	30	Timing:	YES
Timing:		Date Received:	08/11/91
		Date Screened:	08/11/91
		Screened By:	JD,SI,BG

Orientation
RCA TK6B color camera. 14x10 Fujinon zoom lens with a 2x extender and a 1.7x teleconverter. Left side of vehicle.

Comments
223:12:23:07.654 - -Doors open
223:12:23:24.938 - Main gear touchdown
223:12:23:35.982 - -Nose gear touchdown
223:12:24:23.297 - Wheel stop
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number KTV15L

Location:
Camera Type:
Film:
Lens Focal Length:
FPS:
Timing:

Film Quality

Focus:	GOOD
FOV:	
Exposure:	GOOD
Timing:	YES
Date Received:	08/11/91
Date Screened:	08/11/91
Screened By:	JD,SI,BG,CD

Orientation
View of right side of vehicle.

Comments
223:12:23:24.995 - Main gear touchdown
223:12:23:35.932 - Nose gear touchdown
Vehicle too far away to determine wheel stop
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number KTV33L

Film Quality

Location:		Focus:	GOOD
Camera Type:		FOV:	
Film:		Exposure:	GOOD
Lens Focal Length:		Timing:	YES
FPS:		Date Received:	08/11/91
Timing:		Date Screened:	08/11/91
		Screened By:	JD,SI,BG,CD

Orientation
View of left side of vehicle.

Comments
223:12:23:06.083 - Wheel doors start to open
223:12:23:24.902 - Right main gear touchdown
223:12:23:25.002 - Left main gear touchdown
223:12:23:35.947 - Nose gear touchdown
223:12:24:22.727 - Wheel stop
Loose material noted at the SSME #2 beta blanket at the 7:00 position.
White spot noted between SSME #2 and SSME #3 on the base heat shield.

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number KTV2L

		Film Quality	
Location:		Focus:	GOOD
Camera Type:	Video	FOV:	
Film:		Exposure:	GOOD
Lens Focal Length:		Timing:	YES
FPS:		Date Received:	08/11/91
Timing:		Date Screened:	08/11/91
		Screened By:	JD,SI,BG,CD

Orientation
Left side of vehicle

Comments
223:12:23:05.685 - LOV due to trees
223:12:23:52.565 - AOV during landing rollout
Replay cut short before wheel stop
No anomalies detected

Film Quality Description

Item Number KTV13L

		Film Quality	
Location:		Focus:	SOFT
Camera Type:	Video	FOV:	
Film:		Exposure:	GOOD
Lens Focal Length:		Timing:	YES
FPS:		Date Received:	08/11/91
Timing:		Date Screened:	08/11/91
		Screened By:	CD,JD,SI,BG

Orientation
Right side of vehicle
Black and white view

Comments
223:12:22:56.357 - LOV due to vegetation
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number KTV14L

Location:		**Film Quality**	
Camera Type:	Video	Focus:	GOOD
Film:		FOV:	
Lens Focal Length:		Exposure:	GOOD
FPS:		Timing:	YES
Timing:		Date Received:	08/11/91
		Date Screened:	08/11/91
		Screened By:	CD,JD,SI,BG

Orientation
Left side of vehicle

Comments
223:12:22:57.508 - Contrails seen from both wing tips
223:12:23:05.716 - Wheel doors start to open
223:12:23:16.894 - LOV due to vegetation
No anomalies detected

Film Quality Description

Photo/TV Analysis Group Evaluation Report
STS-43
09/16/91

Item Number NASA SEL

Location:
Camera Type: VIDEO
Film:
Lens Focal Length:
FPS:
Timing:

Film Quality

Focus:	GOOD
FOV:	
Exposure:	GOOD
Timing:	YES
Date Received:	08/11/91
Date Screened:	08/11/91
Screened By:	JD,SI,BG,CD,DP

Orientation
Landing view left side

Comments
223:12:18:40.003-223:12:18:41.105 - White vapor seen possilby aft of vehicle prior to the HAC
223:12:22:57.294 - Contrails seen from both wing tips
223:12:23:05.635 - Wheel doors start to open
223:12:23:24.821 - Right main gear touchdown
223:12:23:24.955 - Left main gear touchdown
223:12:23:35.899 - Nose gear touchdown
223:12:24:22.679 - Wheel stop
Loose material noted at the SSME #2 beta blanket at the 7:00 position.
White spot noted between SSME #2 and SSME #3 on the base heat shield.

Film Quality Description

Daily Reports To Mission Management

JSC Photo and TV Analysis Report

The STS-43 launch of Atlantis occurred at 15 hours 02 minutes 00.759 seconds GMT on August 2, 1991 (Day 214) as seen from KTV-04A. SRB separation occurred at 15 hours 04 minutes 05.605 seconds GMT as seen in KTV-13.

On launch day, 25 videos (out of 25 expected) were screened. Twenty 16 mm films are expected Saturday night.

The following items merit mentioning, but are not considered anomalous.

Camera OTV-070 and OTV-071 - A discoloration was noted in the SSME #2 plume mach diamond at 15:01:59.629 GMT. The plume appeared to change from a blue to an orange tint. A similar event was noted on ascent for STS-32.

Camera OTV-054, OTV-009, OTV-063 - Pieces of white debris, probably ice originating from the LH2 ET/Orbiter umbilical, were seen falling aft at liftoff. A large piece of the debris appears to strike the TPS (OTV-054), but no damage to the TPS was noted.

Camera ET-204, ET-208, ET-212 - A large piece of light debris fell aft of the vertical stabilizer at approximately 43 seconds MET. This piece will be studied further from the films.

DTO-0312 - The commentator on NASA Select TV announced that the crew was performing DTO-0312.

Rockwell/Downey engineers noted from their accelerometer data that there was a possible holddown bolt hang up. This will be checked on the pad films as they arrive.

JSC Photo and TV Analysis Report
Day 1 film: screened 8/2/91

On Saturday, twenty 16mm films arrived out of twenty expected. Fifteen films were screened on Saturday. The remaining five will be screened Sunday morning. A total of 15 films and 25 videos have been screened to date. Eighteen new films are expected on Sunday.

The following item may be considered anomalous. This phenomenon will be reviewed in films that will arrive over the next few days:

Camera E2, E3 - Six distinct discolorations (blue to orange tint) within the SSME #2 plume mach diamond were seen prior to liftoff on Camera E2. Two of these events were visible on Camera E3.

The following items merit mentioning but are not considered anomalous:

Camera E9 - A slight shoe hangup was noted at the RSRB holddown post M-1 at liftoff.

Camera E26 - A single piece of white debris appeared to originate near the ring (Beta blanket) at the base of SSME #2 and fell away after liftoff. This debris did not appear to strike the orbiter.

Camera E18, E26 - Base heat shield erosion was noted between SSME #2 nozzle and the RCS.

Camera E12 - A small, white piece of debris originated from the DCS area during PIC firing at holddown post M-5 of the LSRB. This piece of debris did not appear to strike the orbiter.

At the time of TDRS deploy, down-linked video showed a piece of curved debris to the right of the left OMS pod. Measurements were taken from enhanced frames of this video in an effort to quantify this debris. This effort is summarized below.

At about 23:00 MET, a down-link of the TDRS deploy contained about 22 seconds of video of a piece of curved debris to the right of the left OMS pod (to the left of the Orbiter).

From the video screening, the piece was characterized as curved, having a thin dimension along the curve and a wider dimension perpendicular to the curve. The piece is much longer than it is wide. The piece tumbles in the field of view. During the tumbling, the object appears to change from light (white) to dark (grey to black). The dark and light appearance of the piece is most likely due to shadows rather than a real color difference. The convex side of the piece has a roughness to the surface. The concave side appeared smoother.

This debris has may characteristics that are similar to debris seen on STS 41 and STS 35. On those missions, the debris was determined to be ice which came from the SSME bell.

The voice transmission accompanying the video went like this:

ORBITER: Now I want everybody to start looking here pretty close. During the deploy sequence right afterwards look at that big piece of something come out of the back of the vehicle. We got that on camcorder. Jeff did a good job of that. You all take a look at that. That came off the back of the vehicle.

CAPCOM: Yes we can see that.

ORBITER: Okay we don't know what it is but you can look at it there.

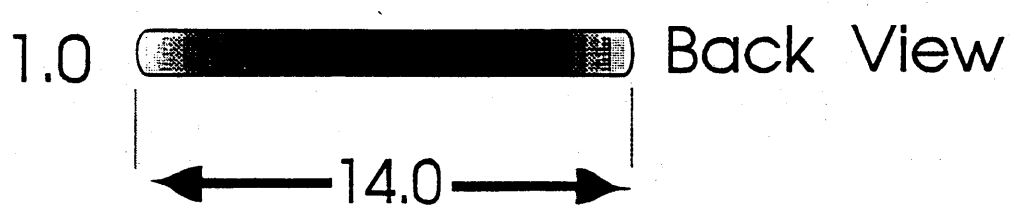
Summary of Analysis:

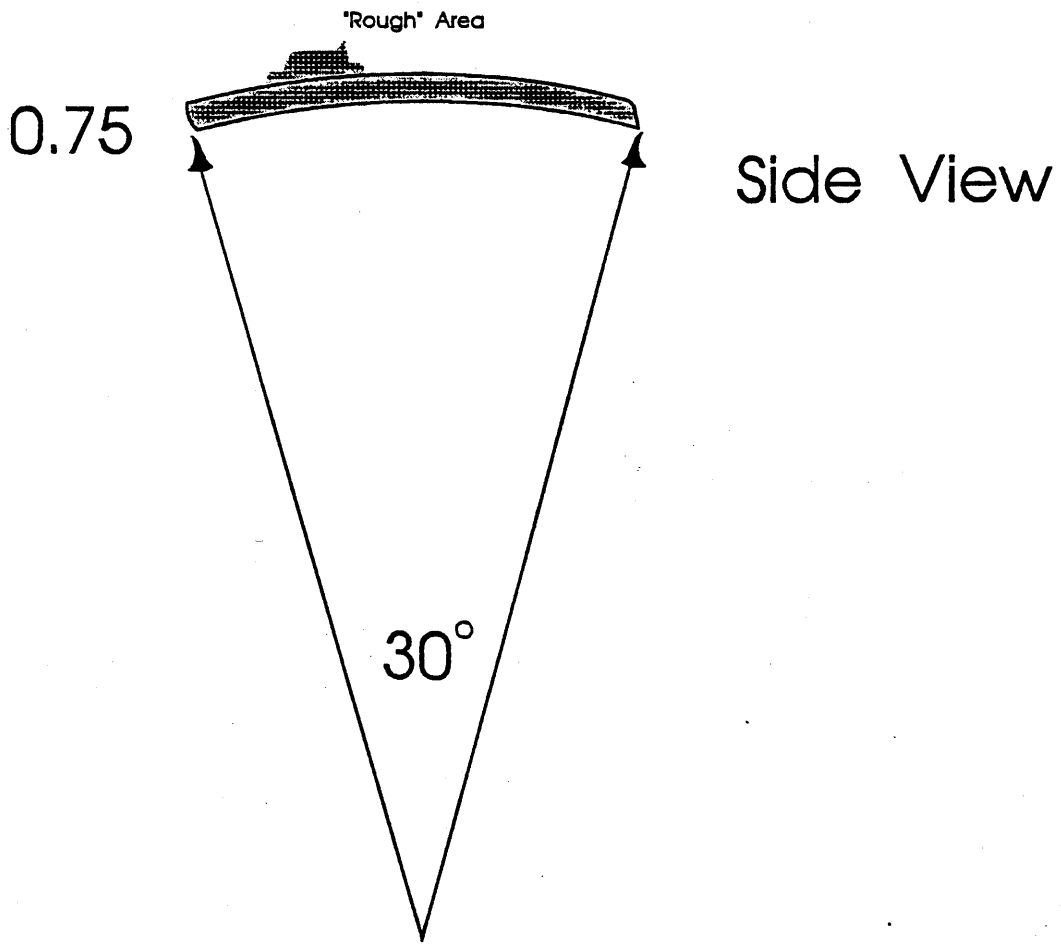
The object subtends approximately 30 degrees of an arc. Due to lack of information, there are no true linear measurements which can be derived, but relative (unit-less) measurements were as follows: the broader face of the object has an average width of 1, the narrower face has a width of 0.75, and the length of the object is 14. Due to the lack of resolution in the video, these measurements could be off by +/- 0.37.

A short video of three sequences of enhancement to the down linked video was compiled. Sequences 1 and 2 showed registered images of the debris. The third sequence is a zoomed version of 200 frames of the debris. A copy of this video was given to the MER.

STS-43R

On-Orbit Crescent-Shaped Debris





NOTE: Linear measurements are unit-less.
No true scaling available.

JSC Photo and TV Analysis Report

August 5, 1991

On Sunday, the five remaining 16mm films received Saturday were screened. Eight out of eight 16mm films and eight out of ten 35mm films expected on Sunday were received. A total of 36 films and 25 videos have been screened to date.

The following event may be anomalous and is being investigated by MSFC:

Camera E63 - A discoloration (blue to orange tint) was noted in the SSME #2 plume mach diamond prior to liftoff. This event was seen previously on OTV-070, OTV-071, E2, and E3.

The following events merit mentioning but are not considered anomalous:

Camera E36 - Several small pieces of debris passed through the camera field of view right to left (South to North) during liftoff. None of the debris appeared to strike the vehicle.

Camera E40 - Numerous pieces of debris were seen in the exhaust plume after liftoff. None of the debris appeared to strike the vehicle.

Camera E65 - Three pieces of white debris (probably ice) were seen moving aft along the body flap after liftoff and did not appear to strike the vehicle.

Camera E7 - A slight rebound was noted on the blast deflector shield for holddown post M-4 of RSRB at liftoff.

Camera E23 - Slight heat shield erosion at the base of the right OMS nozzle was noted prior to liftoff.

Camera E24 - The RCS paper on the left RCS stinger (L4U) cover appeared to be discolored.

Camera E8, E13 - The GN2 purge line was venting beneath both SRBs after liftoff.

Due to a projector failure the following films were given a preliminary screening.They will be viewed more thoroughly on the 35mm film analyzer on Monday.

Camera E54, E223 - Several pieces of small debris were seen falling aft of the vertical stabilizer immediately after the roll maneuver and did not appear to strike the SLV.

Camera E223 - At least three flares were noted in the SSME plume prior to condensation collar formation.

Camera E54 - Small light debris was seen in the SRB plume after roll maneuver and did not appear to strike the vehicle.

Camera E207 - A small piece of debris was seen falling aft of the vertical stabilizer after condensation collar formation and did not appear to strike the vehicle.

Camera E59 - A medium-sized piece of light-colored debris was noted falling aft along the underside of the left outboard elevon prior to the roll maneuver and did not appear to strike the vehicle.

JSC Photo and TV Analysis Report
8/6/91 1:53 AM

On Monday, twenty-one of twenty-one expected films arrived. The eleven 35mm films were screened on Monday and the ten 16mm films will be screened Tuesday morning. No new films are expected until Wednesday evening.

The following events may be anomalous and are still under investigation:

Camera E220, E204, E208, E218 - A large, light-colored piece of debris appeared to originate from above SSME #2 traveled around the left RCS stinger, along the SSME nozzle and then fell aft of the vehicle (at approximately 43 seconds MET). Light flashes were also noted near SSME #1 nozzle area at around 43 seconds MET on Camera E-222.

Camera E222, E76 - Up to six discolorations in the SSME #2 plume mach diamond were noted prior to liftoff. This event had been seen previously on OTV-070, OTV-071, E2, E3, and E63.

The following events merit mentioning but are not considered anomalous:

Camera E222 - Several large pieces of light-colored debris were noted falling aft of the vehicle after roll maneuver. Several pieces of light colored debris were also seen aft of the vehicle after the roll maneuver. Orange debris (possibly baggy material) fell from behind the orbiter near the SRBs at 23 seconds MET.

Camera E204, E208, E212, E213, E218, E220, E222 - Several flares were noted in the SSME plume after the roll maneuver.

Camera E212, E218 - A linear optical effect was seen moving along the vehicle after formation of the condensation collar.

JSC Photo and TV Analysis Report

August 7, 1991

On Wednesday, the fourteen films that were expected arrived. All of the 16mm films and three of the 35mm films were screened on Wednesday. The three remaining 35mm films will be screened on Thursday. A total of 68 films and 25 videos have been screened to date.

No new issues were noted.

Camera E28 - A bolt hangup, previously seen on E11, was noted at LSRB holddown post M-7 at liftoff. Four pieces of dark debris, probably shim material, (5"x3" and smaller) were seen originating from the side of the shoe facing the SRB. Three small pieces of dark debris were noted from the DCS area after PIC firing. None of the debris was seen to strike the vehicle.

Camera E77 - Several discolorations (blue to orange) were noted in the SSME #2 plume prior to liftoff. This event has been seen previously on OTV-070, OTV-071, E2, E3, and E63.

Camera E21 - Vapor was noted from the LO2 carrier lines (possible leak). A loose piece of tape was seen on the backside of the carrier plate.

Cameras E52, E53 - Flashes were noted in both the SRB and SSME plumes after roll maneuver.

Cameras E52, E53 - A large piece of light-colored debris originated between SSME #1 and SSME #2 and fell aft of the vehicle at approximately 10 seconds MET. This debris did not appear to strike the vehicle.

Camera E53 - A small white piece of debris originated from the left elevon area and fell aft of the vehicle during roll maneuver. This debris did not appear to strike the vehicle.

JSC STS-43 Landing Day Report

Landing of STS-43 occurred on runway 15 at the Kennedy Space Center. Right main gear touchdown was at 12 hours 23 minutes 24.902 seconds UTC on August 11 (day of year 223) as seen from KTV-33L. Nose wheel touchdown occurred at 12 hours 23 minutes 35.947 seconds UTC as seen from KTV-33L. Wheel stop was at approximately 12 hours 24 minutes 23.297 seconds UTC as seen on KTV-11L.

White vapor appeared aft of the vehicle at 12 hours 18 minutes 40.003 seconds during descent. Also, a piece of loose material was noted at the 7 o'clock position on the SSME #2 beta blanket after touchdown from KTV33L. A white spot was noted on the base heat shield between SSME #2 and SSME #3 after touchdown. Live television coverage of the aft end of the orbiter was sketchy.

Post Landing Handheld Video Views

A fluid was seen dripping on the ground underneath one of the umbilicals. A U-shaped metal object was seen on the ground at the same area.

Liquid (possible condensation) was seen in the oxygen umbilical well.

A liquid was also seen on the ground under the left main landing gear. A red stain (possibly from hydraulic fluid) was seen on the left main landing gear.

The left inboard main gear tire had a worn strip on the tread.

STS-43 Timing Data Report

STS-43 TIMING REPORT

After the photography from the Engineering and Tracking Cameras were screened for events of interest for the STS-43 Launch; frame counts were noted. These events were located on the 16mm and 35mm photography and timed from the encoded film edge timing marks. The following are the events of interest per camera and their associated times. (It should be noted that the times have been corrected for camera offset.) A first frame identifier and camera offset were found on all rolls of photography stated in this report except for Camera E205 which did not have a first frame identifier.

Camera E2 (16mm)

Items of Interest	Frame #	Start Time	Stop Time
Discolorations of the SSME #2 plume	2636 to 2660	214:15:01:57.661	214:15:01:57.720
	2726 to 2737	214:15:01:57.882	214:15:01:57.910
	2933 to 2939	214:15:01:58.390	214:15:01:58.404
	2981 to 2984	214:15:01:58.410	214:15:01:58.416
	3059 to 3067	214:15:01:58.700	214:15:01:58.720
	3122 to 3127	214:15:01:58.854	214:15:01:58.867
	3288 to 3290	214:15:01:59.262	214:15:01:59.267
	3426 to 3436	214:15:01:59.596	214:15:01:59.625
Timing IRIG A		Total Frames 6575	

Camera E8 (16mm)

Items of Interest	Frame #	Start Time	Stop Time
Pic Firing	4241	214:15:01:59.987	
Timing IRIG A		Total Frames 5385	

Camera E204 (35mm)

Items of Interest	Frame #	Start Time	Stop Time
Flares in SSME plume	2364	214:15:02:36.007	
	2397	214:15:02:36.472	
White debris noted aft of vertical stabilizer	2873	214:15:02:43.207	
Timing IRIG B		Total Frames 15066	

Camera E212 (35mm)

Items of Interest	Frame #	Start Time	Stop Time
Flares in SSME plume	1732	214:15:02:34.858	
	1764	214:15:02:35.362	
	1835	214:15:02:36.485	
	1857	214:15:02:36.833	
	1904	214:15:02:37.576	
	1925	214:15:02:37.911	
Timing IRIG B		Total Frames 15530	

Camera E223 (35mm)

Items of Interest	Frame #	Start Time	Stop Time
Debris falling aft of SLV	4852	214:15:02:43.208	
Timing IRIG B		Total Frames 15021	

CAMERA OFFSETS AND SPEEDS

Camera		Offset (mm)	Film Speed (fps) Begin	End
E2	(16mm)	97	408	407
E8	(16mm)	102	399	399
E204	(35mm)	300	71	71
E212	(35mm)	295	63	63
E223	(35mm)	300	102	96

PHOTOGRAPHIC ANALYSIS

OF

SHUTTLE MISSION STS-43

August 2, 1991

1.0 FILM REVIEW AND PROBLEM REPORTS

A total of 146 film and video data items, which included 49 videos, 61 16mm films, 31 35mm films, five 70mm films; and seventeen on-orbit still frames, were reviewed starting on launch day.

No Problem Reports or IFA's were generated as a result of the film and video reviews. Post Launch Anomalies observed in the reviews were presented to the Mission Management Team, Shuttle managers, and vehicle systems engineers. These anomalies are listed in Section 11.

1.1 LAUNCH FILM AND VIDEO SUMMARY

No major vehicle damage or lost flight hardware was observed that would have affected the mission.

One hour into cryo load (T-4:57:54 through T-4:56:36) ten to fifteen drips with vapor trails fell from the aft part of the LH2 ET/ORB umbilical (LH2 recirculation line interface) and appeared to originate from the area of the ice/frost formation along this interface (OTV 009, 063). There was no evidence of a blowing leak, nor did the drips appear for a consistent, frequent, or extended duration. The drips fell below the field of view before completely vaporizing and behaved like liquid air rather than hydrogen. Since that area had just chilled down due to the start of recirculation, the source of the cryogenic drips probably was a small TPS void or defect that had cryopumped locally for a short period of time. No more cryogenic drips occurred for the remainder of cryoload, stable replenish, and flight pressurization. Helium purge vapors and ice build-up on the LH2 umbilical had been typical. There were no unusual vapors or cryogenic drips during liftoff.

SSME gimbal profile appeared normal. Free burning hydrogen was blown under the body flap by southerly winds (OTV 051, 063, 070, 071). Numerous flashes and discolorations, possibly caused by contaminants, occurred in the SSME #2 Mach diamond during ignition (OTV 070, E-2). Orange streaks, typically caused by debris, were visible on the edge of the SSME #1 plume (E-3, 19, 20). Numerous orange flashes occurred in the SSME plume during ascent (E-207, 212, 223).

The closeout blanket around SSME #2 was pulled loose or torn along the outer perimeter at the 11 o'clock position. The separation was approximately 10 inches in length and occurred during SSME ignition (E-24).

SSME ignition acoustics/vibration caused ice to fall from the LO2 and LH2 ET/ORB umbilicals. One piece hit the umbilical cavity sill and was deflected outward (E-25). No tile damage was visible. Two pieces of ice from the LO2 feedline upper bellows and one piece from the LO2 feedline support bracket at station 1377 fell aft without impacting Orbiter tiles (E-5, 25). SSME ignition acoustics/vibration caused the loss of tile surface coating material from one location on the base heat shield near SSME #2, two locations on the base heat shield near SSME #3 (E-23), two locations near the LH OMS nozzle (E-19, 24), six locations near the RH OMS nozzle, and one place from the body flap +Z side (E-17).

The Orbiter T-0 umbilicals disconnected and retracted properly. The liquid oxygen leak in the LO2 TSM had no effect on disconnect and retraction of the carrier plate (OTV 049, 054). Separation of the GUCP from the External Tank was nominal. The GH2 vent arm retracted and latched properly. There was no excessive slack in the static retract lanyard. (OTV 004, OTV 013, E-31, 33, 41, 42, 50)

Film items E-11 and 28 confirmed a stud hang-up on HDP #7. The stud did not begin to drop into the holddown post until the aft skirt passed the doghouse blast cover. The stud rocked slightly from side to side after clearing the aft skirt stud hole. The stud pulled loose EPON shim material, three small pieces adjacent to the stud hole, from the aft skirt foot. No ordnance fragments fell from the HDP #7 DCS/stud hole. Closure of the doghouse blast cover was not affected by the stud hang-up.

Three ordnance fragments fell from the HDP #2 DCS/stud hole shortly after liftoff (E-8). One dark, thin object, possibly a frangible nut web or piece of firing cable, fell between the doghouse blast cover and the HDP #8 shoe (E-14). The new optimized frangible links were installed in the SRB DCS's for this mission.

Numerous particles were ejected out of the SRB exhaust holes after T-0. Many film and video items recorded various amounts of flying debris on and around the pad after the vehicle cleared the tower. This debris is SRB throat plug material and shredded sound suppression water troughs, which is an expected occurrence.

The MLP-1 deck southwest rainbird did not activate at T-0. No water was visible exiting the rainbird as the vehicle cleared the tower and SRB plume obscured the rainbird. (E-4, 31, 60)

A white object fell from the aft end of the Orbiter at T+42.844 seconds MET in film item E-220, frames 4276 through 4342. The object, believed to be a section of the SSME closeout blanket, appeared to originate near SSME #2, crossed the base heat shield, passed behind the LH aft RCS stinger, reappeared near the LH OMS nozzle, moved aft along SSME #1, moved around the

SSME #1 nozzle, and finally fell aft of the Orbiter before being lost against the SRB plume. (Film items E-208, 213, 218, 222; video items ET-204, 208, 212, TV-4A)

Light-colored particles, believed to be pieces of aft skirt instafoam or small chunks of SRB propellant, fell out of the SRB plume during ascent (TV-4A).

ET aft dome charring, plume recirculation, and SRB separation appeared normal.

1.2 ON-ORBIT FILM AND VIDEO SUMMARY

Review/analysis of on-orbit photography included seventeen 70mm still frames of the ET after separation from the Orbiter (DTO-312) and one 16mm motion picture film of payload deployment.

No major vehicle damage or lost flight hardware was observed that would have affected the mission.

Two light spots on the LH2 tank-to-intertank flange appeared to be possible divots 6-8 inches in diameter in the TPS closeout. The divots were located in the -Y-Z quadrant below the intertank access door and were not a debris threat to the Orbiter. Bright spots on the LH2 tank acreage outboard of the -Y longeron and near the aft hard point were sanded repair areas.

There were no apparent anomalies on LO2 tank, LH2 tank, and aft dome TPS acreage. The BSM burn scars were typical. The nosecone, intertank access door, GH2 umbilical carrier plate, -Y ET/SRB fitting, and RSS antennae were in nominal configuration.

Detail on the +Y and +Z sides of the External Tank was not discernible due to shadows and underexposure of the film.

Shortly after TDRSS/IUS deployment, a light-colored, curved object with a smooth concave side and rough, textured convex side appeared to originate from the aft end of the Orbiter and drifted over the left wing. Similar floating objects have been observed previously on STS-35 and STS-41. The most likely candidate for the object is solid, or frozen, oxygen dislodged from one of the SSME nozzles. The Main Propulsion System contains over 3800 pounds of residual oxygen at ET separation. Of this total, 270 pounds is vented through the SSME seal drain lines at the nozzle exit plane, 3400 pounds is dumped through the SSME nozzles, and the remainder is vented through the LO2 T-0 umbilical fill and drain valve. At a temperature below -360 degrees F, the oxygen solidifies and accumulates on the SSME nozzles. Photographs from previous missions show this ice adhering to the exit plane of the SSME nozzles. Transmitting a vibration through the Orbiter structure, such as the deployment of a payload, or melting from the sun, causes the ice to be dislodged from the SSME nozzles.

1.3 LANDING FILM AND VIDEO SUMMARY

Orbiter performance in the Heading Alignment Circle (HAC) and final approach was nominal.

Five dark objects, possibly small pieces of black tile material, fell from the LH aft side of the Orbiter while crossing the runway threshold.

Both main landing gear touched down almost simultaneously with the right side slightly ahead of the left gear. Touchdown of the nose gear was smooth. There were no vehicle anomalies or unusual control surface deflections during the rollout.

No significant tile damage was visible on the Orbiter lower surface except for one site on the right side of the Orbiter nose below the forward RCS module. Frayed pieces of SSME closeout blankets flapped in the airflow from portions of all three SSME collars during the rollout.

1.4 LAUNCH FILM AND VIDEO REVIEWS

EX1
400 FPS
16mm

Camera is located on MLP deck south of RH SRB exhaust duct and looks north to view SRB Heater Umbilical during ignition and liftoff.

Focus : O.K.
F. O. V.: O.K. excessive camera shake
Exposure: O.K.

Comments: Facility debris particles moved across MLP deck during SSME ignition. SRB HDP shoe rocked backward 3/8-inch at T-0. Small pieces of instafoam and SRB throat plug material were ejected after T-0. A dark particle, probably a piece of shim putty, fell from inside the SRB aft skirt foot (frame 5119).

EX2
400 FPS
16mm

Camera is located on the MLP deck west of RH SRB flame duct and looks east to view SRB Heater Umbilical during ignition and liftoff.

Focus : O.K.
F. O. V.: Offset to right.
Exposure: O.K.

Comments: Umbilical separation was normal with separation planes remaining generally parallel. One sacrificial connector appeared to protrude slightly on left-hand side of umbilical. Facility debris and instafoam trimmings were ejected out of SRB exhaust hole after T-0.

EX3
400 FPS
16mm

Camera is located on the MLP deck east of LH SRB flame duct and looks west to view SRB Heater Umbilical during ignition and liftoff.

Focus : O.K.
F. O. V.: Offset to left.
Exposure: O.K.

Comments: Umbilical separation was normal with separation planes remaining generally parallel. Facility debris and instafoam trimmings were ejected out of SRB exhaust hole after T-0. One piece of instafoam was ejected out of SRB exhaust hole at frame 4364.

EX4
400 FPS
16mm

Camera is located on MLP deck south of LH SRB flame duct and looks north to view LH SRB Heater Umbilical during ignition and liftoff.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Ice particles fell from ET/ORB LH2 umbilical at SSME ignition. A small particle (shim type material) originated from front or sidewall of holddown post shoe at frame 4320. SRB shoe rotated 0.5 inch after separation. SRB throat plug material was ejected out of SRB exhaust hole after T-0.

E-1
400 FPS
16mm

Camera is located on the NE corner of the MLP deck and views the lower ET, SRB's, and Orbiter.

Focus : Soft.
F. O. V.: O.K.
Exposure: O.K.

Comments: Ice particles fell from LH2 ET/ORB and T-0 umbilicals from SSME ignition through liftoff. Condensate on ET aft dome vaporized after T-0. A particle entered the frame near the RH outboard elevon but did not contact the vehicle.

E-2
400 FPS
16mm

Camera is located on the SE corner of the MLP deck and views Orbiter SSME and OMS engine nozzles.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Prevailing wind blew intertank access structure water deluge to the north. Numerous flashes and discolorations were visible in SSME #2 shock diamond during start-up. Residual GOX lingered near SSME #3 after LO2 T-0 separation. LH2 TSM door rebounded slightly while closing. Condensate on RH SRB stiffener rings vaporized after T-0.

E-3
400 FPS
16mm

Camera is located on the SW corner of the MLP deck and views Orbiter SSME and OMS engine nozzles.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: RCS paper covers entering SSME #1 plume caused orange streaks. Ice particles fell from LO2 T-0 umbilical during SSME ignition and umbilical retraction. Residual GOX was present after LO2 T-0 umbilical separation. LO2 TSM door rebounded after closure. A light colored object, possibly ice, fell from behind LH elevon.

E-4
400 FPS
16mm

Camera is located on the NW corner of the MLP deck and views lower ET, SRB's, and Orbiter.

Focus : Soft.
F. O. V.: O.K.
Exposure: O.K.

Comments: Water deluge on ET intertank access structure was flowing properly. Condensate on ET aft dome vaporized after T-0. Southwest rainbird on the MLP deck had not activated by the time the vehicle cleared the tower and the SRB plume obscured the rainbird.

E-5
400 FPS
16mm

Camera is located on the east side of the MLP deck and views the Orbiter RH wing, body flap, and lower ET/SRB.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Ice particles fell from ET/ORB umbilicals during SSME ignition. Ice also fell from LO2 T-0 umbilical at SSME ignition. Ice particles from the upper feedline bellows fell outboard of the EO fitting. No ice contacted Orbiter tiles. Residual GOX vapors from LO2 T-0 lingered around SSME after separation. SSME acoustics ripped the RCS paper covers on the RH stinger.

E-6
200 FPS
16mm

Camera is located on the east side of the MLP deck and views the RH lower Orbiter wing, body flap, ET lower LOX feedline, and ET/Orbiter umbilical area.

Focus : O.K.
F. O. V.: O.K.
Exposure: Slightly underexposed.

Comments: Ice particles fell from ET/ORB umbilicals during SSME ignition through liftoff, but none contacted the vehicle. A large quantity of residual GOX was present after T-0. Slight inboard elevon movement was detected during SSME ignition. Three ice particles entered top field of view probably from upper feedline bellows and support brackets. Facility debris was visible on FSS side of the LH SRB. Water on ET aft dome and in SRB stiffener rings vaporized during liftoff.

E-7
400 FPS
16mm

Camera is located on the MLP deck and views the RH SRB northeast holddown post (HDP #4).

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: HPU exhaust was visible prior to T-0. SRB holddown post blast covers closed nominally. SRB throat plug material and facility debris were ejected out of SRB exhaust hole at T-0. Ice particles fell from EB-8 fitting and were blown to the north.

E-8
400 FPS
16mm

Camera is located on the MLP deck and views the RH SRB southeast holddown post (HDP #2).

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: SRB holddown post shoe rocked 2 inches during liftoff. Two dark particles, each measuring 1"x3/4", fell from the DCS/ stud hole (frame 4453). The southeast corner of the holddown post shoe bound up slightly and scraped off some shim material (putty) as it released.

E-9
400 FPS
16mm

Camera is located on the MLP deck and views the RH SRB southwest holddown post (HDP #1).

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Condensate run-off from the tank was evident in camera foreground. Small particles of deck debris were drawn toward the SSME plume by aspiration. No particles fell from the DCS/stud hole. Holddown post shoe rocked slightly during liftoff.

E-10
400 FPS
16mm

Camera is located on the MLP deck and views the RH SRB northwest holddown post (HDP #3).

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: No movement of the HDP shoe was visible. No debris fell from the DCS/stud hole. SRB HDP blast cover closed normally. SRB throat plug material was ejected out of SRB exhaust hole after T-0.

E-11
400 FPS
16mm

Camera is located on the MLP deck and views the LH SRB northeast holddown post (HDP #7).

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Smoke from Hydrogen Ignitors obscured the image prior to T-0. The HDP #7 stud hung up at frame 5097. The stud did not begin to drop into the holddown post until the aft skirt passed the doghouse blast cover. The stud rocked slightly from side to side after clearing the aft skirt stud hole. The stud pulled loose three pieces of EPON shim material adjacent to the stud hole. No ordnance fragments fell from the DCS/stud hole. The SRB HDP blast cover closed normally.

E-12
400 FPS
16mm

Camera is located on the MLP deck and views the LH SRB southeast holddown post (HDP #5).

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: At T-0, a particle was ejected from behind the DCS. Numerous particles of throat plug material were ejected out of SRB exhaust hole after T-0. No particles fell from the DCS/stud holes.

E-13
400 FPS
16mm

Camera is located on the MLP deck and views the LH SRB southwest holddown post (HDP #6).

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: SRB HPU exhaust was visible prior to T-0. A dark colored liquid, probably dirty water, flowed past the base of the DCS at T-0. SRB holddown post shoe rocked slightly during liftoff and remained tilted while in view.

E-14
400 FPS
16mm

Camera is located on the MLP deck and views the LH SRB northwest holddown post (HDP #8).

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Throat plug material and facility debris were ejected out of SRB exhaust hole after T-0. Rotation of SRB holddown post shoe was minimal and the blast cover closed nominally. A 3"x1/2" object, possibly a sliver of frangible nut, was visible behind the blast cover after the aft skirt foot was clear (Frame 5949).

E-15
400 FPS
16mm

Camera is located on the MLP deck and views the RH SRB skirt, sound suppression water troughs, and RH lower Orbiter body flap.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Ice particles fell from LO2 TSM prior to T-0. Holddown post blast cover closure was normal. Numerous pieces of throat plug material and SRB sound suppression water trough material moved away from the vehicle after T-0.

E-16
400 FPS
16mm

Camera is located on the MLP deck and views the LH SRB skirt, sound suppression water troughs, and LH lower Orbiter body flap.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Water leaked from west J-pipe joint. Body flap moved slightly during SSME ignition. Large quantity of ice fell from LH2 ET/ORB umbilical, but no contact with tiles was visible. SRB blast covers closed normally. Pieces of SRB throat plug material were ejected out of SRB exhaust hole at T-0. No debris fell from HDP #7 or #8 DCS/stud holes.

E-17
400 FPS
16mm

Camera is located on the MLP deck and views the -Z side of the LO2 T-0 Umbilical and TSM.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Very little LOX vapors inside LO2 TSM prior to SSME ignition. Free burning hydrogen was blown under body flap. Large quantity of ice fell from T-0 disconnect. LO2 T-0 disconnect and retraction were nominal. Residual GOX vapors were drawn into SSME #3 plume. A black tile chip appeared from +Z side of body flap at frame 2929. A 2"x1" object, light on one side and dark on the other, entered FOV from top in frame 4505.

E-18
400 FPS
16mm

Camera is located on the MLP deck and views the -Z side of the LH2 T-0 umbilical and TSM.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Free burning hydrogen visible prior to SSME ignition. Ice particles fell from ET/ORB umbilicals from T-0 through lift-off. Orbiter body flap moved slightly during ignition. Engine acoustics tore aft RCS paper covers during ignition. Residual LH2 vapors were present from T-0 and in Orbiter QD.

E-19
400 FPS
16mm

Camera is located on the SE side of the MLP deck and views the SSME/OMS nozzles and Orbiter aft heat shield area.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: SSME acoustics tore the aft RCS paper covers during ignition. Ice particles fell from LO2 T-0 umbilical during SSME ignition. LH2 TSM door rebounded after closure. Residual GOX was present from LO2 T-0 disconnect. Ice particles fell from ET/ORB umbilical during liftoff. After residual GOX cloud dissipated, a 3"x4" paint chip fell from behind LO2 TSM. In frame 4111, an RCS paper cover entered the SSME plume and created an orange streak. One small tile chip appeared on LH OMS pod base heat shield in frame 3702.

E-20
400 FPS
16mm

Camera is located on the SW side of the MLP deck and views the SSME/OMS nozzles and Orbiter aft heat shield area.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: RCS paper covers were torn by ignition acoustics and pulled into SSME plume. LO2 TSM door rebounded after closure. Residual GOX was present from LO2 T-0 umbilical after disconnect. Ice particles fell from LO2 T-0 umbilical during SSME ignition and umbilical separation. An orange streak occurred in SSME #1 (frame 4045).

E-21 Camera is located inside the LO2 TSM and views
200 FPS the disconnection of the T-0 umbilical.
16mm

Focus : O.K.
F. O. V.: O.K.
Exposure: Overexposed

Comments: A large amount of ice/frost had formed inside the LO2 TSM on the 2-inch fill/drain line near the masthead. Vapors were also visible on this line inside the TSM. Ice/frost particles fell from LO2 T-0 umbilical when retraction was complete. Vibration/acoustics caused both lights inside TSM to fail. No rebound apparent on TSM door. Residual vapors were visible in flight QD.

E-22 Camera is located inside the LH2 TSM and views
200 FPS the disconnection of the T-0 umbilical.
16mm

Focus : O.K.
F. O. V.: O.K.
Exposure: Overexposed

Comments: LH2 purge barrier was already torn at beginning of film. T-0 umbilical separation/retraction appeared normal. Ice/frost particles fell from T-0 umbilical at end of retraction. Residual vapors were visible in flight QD. Vibration/acoustics caused one TSM light to fail.

E-23 Camera is located on the MLP deck and views the
400 FPS RH OMS engine nozzle.
16mm

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: No LOX vapors were visible inside TSM prior to T-0. RCS paper covers were torn loose by engine acoustics and pulled into plume. Numerous ice particles fell from LO2 T-0 disconnect during ignition and retraction. A large quantity of residual GOX was present after T-0. During ignition water drops appeared to be pulled from inside an RCS nozzle. Eight tile dings appeared on the base heat shield: 6 at base of OMS nozzle, one at the 2 o'clock position of SSME #3, and one between SSME #1, #3, and the OMS nozzle.

E-24
400 FPS
16mm

Camera is located on the MLP deck and views the LH OMS engine nozzle.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Free burning hydrogen was visible near OMS nozzles. SSME ignition caused the LH2 TSM purge barrier to tear and flutter. Ice particles fell from LH2 ET/ORB umbilical after liftoff. RCS paper covers were torn loose by engine acoustics and pulled aft by aspiration. Ignition caused a 10 inch section of SSME closeout blanket at the 11 o'clock position to detach from the outer ring. Three tile chips appeared on base heat shield: SSME #2 11 o'clock position, 3 o'clock position at the base of the OMS nozzle, and between SSME #1, #2 and the OMS nozzle.

E-25
400 FPS
16mm

Camera is located on the east side of the MLP and views between Orbiter and ET/SRB during liftoff.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Residual GOX was present after LO2 T-0 separation. Ice particles fell from ET/ORB umbilical during ignition and liftoff. One umbilical ice particle contacted the ET door cavity sill and broke into several pieces. After SSME ignition, two pieces of ice from the LO2 feedline upper bellows and one piece from the LO2 feedline support bracket at station 1377 fell aft without impacting Orbiter tiles.

E-26
400 FPS
16mm

Camera is located on the west side of the MLP and views between Orbiter and ET/SRB during liftoff.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Ice particles fell from ET/ORB umbilicals after SSME ignition. Water on ET aft dome vaporized after T-0. At T-0, ice particles fell from EB-3/5 fittings. Facility debris fell but did not contact the vehicle (frame 3941).

E-27
400 FPS
16mm

Camera is located on the MLP deck and views RH SRB northwest holddown post (HDP #3) blast cover.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Pieces of SRB throat plug material/instafoam were ejected out of SRB exhaust hole after T-0. In frame 4464 a small piece of shim side wall material was pulled loose and fell to the east of the HDP. SRB shoe rotated just over an inch and returned to the horizontal position when the blast cover closed.

E-28
400 FPS
16mm

Camera is located on the MLP deck and views LH SRB northeast holddown post (HDP #7) blast cover.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Opposite view of HDP #7 stud hang-up. Three pieces of EPON shim material were torn loose as the stud broached the inside of the stud hole. Stud rocked from side to side before dropping into the holddown post. SRB blast cover closed with no anomaly. SRB throat plug material was ejected out of SRB exhaust hole after T-0.

E-30
400 FPS
16mm

Camera is located on the FSS 195 foot level and views LH SRB and sound suppression water troughs.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Ice fell from ET/ORB umbilical during liftoff. A less than usual amount of water geysered from the sound suppression water troughs. The southwest rainbird did not appear to activate at T-0. No water flowed from the rainbird as the vehicle cleared the tower and the rainbird was obscured by SRB plume.

E-31
100 FPS
16mm

Camera is located on the FSS 95 foot level and views the LH Orbiter wing, body flap, and ET/Orbiter LH2 umbilical area.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Piece of ice fell from the ET/ORB umbilical and appeared to make a 'glancing' impact with Orbiter tiles, but no damage was visible. Residual hydrogen vapors were present in the Orbiter flight QD as the vehicle crossed the FOV. Aft RCS paper covers were torn. Numerous pieces of facility debris visible after vehicle cleared tower.

E-33
400 FPS
16mm

Camera is located on the FSS 235 foot level and views the ET GH2 vent line and GUCP.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: No unusual vapors or ice formations were present on the GUCP. Ice particles fell from GUCP at SSME ignition and T-0. GUCP retraction/separation appeared normal. Residual vapors in the ET disconnect were visible after T-0. A small ice particle glanced off the SRB as the vehicle ascended, but no damage was visible.

E-34
400 FPS
16mm

Camera is located on FSS at 255 foot level and views upper Orbiter tile surfaces.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Ice particles fell from ET/ORB umbilicals during liftoff. GUCP separation was normal. Reflections were visible off LH2 umbilical baggie material during liftoff. Residual LH2 vapors were present in the Orbiter flight QD.

E-35
400 FPS
16mm

Camera is located on the FSS 255 foot level and views the mid-Orbiter/ET/SRB area.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Free burning hydrogen was present prior to T-0. Residual LH2 vapors were present in the Orbiter flight QD during liftoff. Facility debris entered the FOV after vehicle had cleared the tower.

E-36
400 FPS
16mm

Camera is located on the FSS 255 foot level and views lower Orbiter, ET, SRB's, and water trough.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Free burning hydrogen was present prior to T-0. Ice particles fell from ET/ORB umbilicals at SSME ignition. The southwest rainbird on the MLP deck did not appear to activate after T-0. Numerous pieces of facility debris entered the FOV during liftoff. A six inch long piece of debris fell down from above and landed in the ET intertank access structure area. In frame 3786, a dark object traveled over the LH2 TSM and under the LH wing before being pulled into the SRB plume. In frame 4057, an object 4 inches long fell from the FSS but did not contact the vehicle.

E-40
400 FPS
16mm

Camera is located on the FSS 275 foot level and views the ET ogive, SRB nosecone, and Orbiter tiled surfaces.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Light frost and GOX vapors were present in the -Y louver. Forward RCS paper covers were intact during initial ascent. Condensate on ET aft dome and in SRB stiffener rings vaporized during liftoff. Residual vapors were present in the LH2 flight QD during liftoff. Numerous debris particles crossed field of view from right to left, but no vehicle impacts occurred. RCS paper cover from the stinger fell between LH stinger and base of vertical stabilizer.

E-41
400 FPS
16mm

Camera is located on the FSS 255 foot level and views the GH2 vent line during rotation. Also shows clearance between structure and SRB aft skirt.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: A debris particle passed close to the camera lens at frame 6818. GH2 vent line retraction and latchback normal. No excess slack was present in the static retract lanyard. Facility debris entered the FOV after the vehicle cleared the tower.

E-42
400 FPS
16mm

Camera is located on the FSS 185 foot level and views the GH2 vent line drop, deceleration, and latchback.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: GH2 vent line retraction was nominal. No excessive slack was present in GH2 vent line static retract lanyard. Numerous pieces of facility debris entered the FOV after the vehicle cleared the tower.

E-44
400 FPS
16mm

Camera is located on the FSS 155 foot level and views the LH OMS Pod leading edge tiles during ignition and liftoff.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Tiles on leading edge of OMS pod were intact prior to liftoff. Residual vapors from LH2 T-0 umbilical were present after separation. Numerous pieces of facility debris entered the FOV after vehicle cleared tower.

E-48
400 FPS
16mm

Camera is located on the FSS 215 foot level (ET Intertank access arm structure) and views the GH2 vent line during GUCP disconnection, rotation, and latchback

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: GUCP separation and retraction appeared nominal. Ice fell from GUCP at T-0. Residual vapors visible in ET flight QD after separation. No TPS anomalies on ET. Ice/frost remained on EB-8 fitting. Condensate on ET aft dome and in SRB stiffener rings vaporized during liftoff.

E-50
400 FPS
16mm

Camera is located at camera site 1 at NE pad perimeter and views entire GH2 vent line and GUCP during rotation and latchback.

Exposure: Underexposed
Comments: No data due to underexposure.

E-52
96 FPS
35mm

Camera is located at camera site 2 on the east pad perimeter. Remote tracking of lower one-third of launch vehicle from ignition to 1200 feet.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Condensate on ET aft dome and in SRB stiffener rings vaporized. Numerous pieces of ice and paper fell aft during ascent. Umbilical purge barrier baggie material fell shortly after roll maneuver. No unusual vapors were visible near umbilicals. Numerous particles fell out of SRB plume during ascent and are most likely pieces of aft skirt instafoam or chucks of propellant slag.

E-53
96 FPS
35mm

Camera is located at camera site 2 on the east pad perimeter. Remote tracking of middle one-third of launch vehicle from ignition to 1200 feet.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Condensate on ET aft dome and in SRB stiffener rings vaporized. Numerous pieces of ice and RCS paper covers fell aft during ascent. Umbilical purge barrier baggie material fell shortly after roll maneuver. No vapors visible near umbilicals. Numerous particles of slag/instafoam fell out of SRB plume during flight.

E-54
96 FPS
35mm

Camera is located at camera site 2 on the east pad perimeter. Remote tracking of upper one-third of launch vehicle from ignition to 1200 feet.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Condensate on ET aft dome and in SRB stiffener rings vaporized. Numerous pieces of ice and RCS paper covers fell aft during ascent. Umbilical purge barrier baggie material fell shortly after roll maneuver. No vapors visible near umbilicals. Numerous particles of slag/instafoam fell out of SRB plume during flight.

E-57
96 FPS
35mm

Camera is located at camera site 6 on the NW pad perimeter. Remote tracking of lower one-third of launch vehicle from ignition to 1200 feet.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Facility water activated properly. Large RCS paper cover from LH FWD RCS fell past under side of wing as vehicle cleared the tower. Residual vapors emanated from ET flight QD. Condensate vaporized on ET aft dome.

E-58
96 FPS
35mm

Camera is located at camera site 6 on the NW pad perimeter. Remote tracking of center one-third of launch vehicle from ignition to 1200 feet.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Facility water activated properly. Large RCS paper cover from LH FWD RCS fell past under side of wing as vehicle cleared the tower. Residual vapors emanated from flight QD. Condensate vaporized on ET aft dome.

E-59
96 FPS
35mm

Camera is located at camera site 6 on the NW pad perimeter. Remote tracking of upper one-third of launch vehicle from ignition to 1200 feet.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Facility water activated properly. Large RCS paper cover from LH FWD RCS fell past under side of wing as vehicle cleared the tower. Residual vapors emanated from flight QD. Condensate vaporized on ET aft dome.

E-60
96 FPS
35mm

Camera is located on north pad perimeter at camera site 1 and views the entire launch vehicle, FSS, and MLP zero level.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Hydrogen Ignitor smoke drifted from SSME area prior to ignition. ET/ORB umbilical ice fell during liftoff. Condensate vaporized on ET aft dome after T-0. GH2 vent line latched nominally. Several birds were in FOV but none near the vehicle. Southwest rainbird on the MLP deck did not appear to activate at T-0. No water was visible exiting the rainbird as the vehicle cleared the tower and the rainbird was obscured by SRB plume. A white debris particle fell out of plume after vehicle cleared tower and may have been the LH forward RCS paper cover.

E-61
100 FPS
35mm

Camera is located at camera site 2 on the east pad perimeter and views the launch vehicle, FSS, and MLP.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Rusty facility water flowed on south side of MLP and ET intertank access structure. Ice particles fell from ET/ORB umbilicals. Condensate vaporized on ET aft dome. No unusual vapors were visible around ET/ORB umbilicals as the vehicle cleared the tower.

E-62
96 FPS
35mm

Camera is located on the SE pad perimeter at camera site 3 and views entire vehicle, FSS, and MLP.

Comments: No data due to camera malfunction.

E-63
96 FPS
35mm

Camera is located on SW pad perimeter at camera site 4 and views entire launch vehicle, FSS, and MLP.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Facility water activation was normal. Ice fell from ET/ORB LO2 umbilicals. Condensate on ET aft dome vaporized after T-0. Southwest rainbird did not activate at T-0.

E-64
96 FPS
35mm

Camera is located on NW pad perimeter at camera site 6 and views entire launch vehicle, FSS, and MLP.

Comments: No data due to camera problem.

E-65
100 FPS
16mm

Camera is located on east pad perimeter at camera site 2 and views ET LO2 feedline, ET intertank, and RH SRB as vehicle passes through the frame.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Ice particles fell from ET/ORB umbilical during lift off. No ET LO2 feedline anomalies. No unusual vapors in ET/ORB umbilical area.

E-76
96 FPS
35mm

Camera is located on SE pad perimeter at camera site 3 and views SSME engines #1 and #3 and the RH OMS engine nozzle.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Ten streaks occurred in SSME #2 Mach diamond during SSME ignition. LO2 T-0 retraction was nominal. Residual LO2 vapors were present in the T-0 QD after separation. Ice particles fell from ET/ORB umbilicals after liftoff.

E-77
96 FPS
35mm

Camera is located on SW pad perimeter at camera site 4 and views SSME engines #1 and #2 and the LH OMS engine nozzle.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Frost fell from SSME drain lines during SSME ignition. RCS paper covers were torn by engine acoustics and pulled into plume. Residual vapors were present at both the LH2 and LO2 T-0 disconnects. Numerous flashes occurred in the SSME #2 Mach diamond during SSME ignition. Ice particles fell from LO2 umbilical during early ascent.

E-78
400 FPS
16mm

Camera is located on SE pad perimeter at camera site 3 and views RH OMS Pod leading edge.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Residual vapors were present in the Orbiter disconnect as vehicle ascended. Tiles on leading edge of RH OMS pod were intact at liftoff. ET/ORB umbilical ice particles fell behind body flap during liftoff.

E-79
100 FPS
16mm

Camera is located on east pad perimeter at camera site 2 and views the ET nosecone, louver, and ogive.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Light frost was present on ET northeast louver. ET twang was approximately 32 inches. ET nosecone/pressure spike returned to the 12-inch mark at T-0.

E-201
30 FPS
70mm

UCS-9 IFLOT tracking of launch vehicle from ignition and early flight through LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Condensate on ET aft dome and in SRB stiffener rings vaporized after liftoff. Flashes occurred in the SSME plume during ascent. White object passed SSME #1 from SSME #2 side and fell aft into plume. The object was most likely a section of the SSME closeout blanket. Localized flow condensation at various points on the vehicle were typical.

E-202
30 FPS
70mm

UCS-15 IFLOT tracking of launch vehicle from ignition and early flight through LOV.

Comments: No data, film jammed at start.

E-203
30 FPS
70mm

UCS-6 IFLOT tracking of launch vehicle from ignition and early flight through LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Condensate on ET aft dome and in SRB stiffener rings vaporized. Pieces of aft skirt instafoam or chunks of SRB propellant fell out of the SRB plume during flight. Charring on the ET aft dome was minimal.

E-204
48 FPS
35mm

PAFB IGOR tracking of launch vehicle from acquisition to SRB separation. Tracks ET/ORB after SRB separation to LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Hazy picture due to atmospheric conditions. Plume recirculation and SRB separation appeared normal.

E-205
48 FPS
35mm

Shiloh IFLOT tracking of launch vehicle from acquisition to SRB separation. Tracks ET/ORB after SRB separation to LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Too hazy for detail.

E-206
48 FPS
35mm

Melbourne Beach ROTI tracking of launch vehicle from acquisition to SRB separation. Tracks ET/ORB after SRB separation to LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Hazy view, not much detail. SRB separation appeared normal. Typical amounts of slag fell from SRB exhaust plumes after separation.

E-207
96 FPS
35mm

UCS-10 MIGOR tracking of launch vehicle from acquisition to SRB separation. Tracks ET/ORB after SRB separation to LOV.

Focus : Soft.
F. O. V.: O.K.
Exposure: O.K.

Comments: Local flow condensation at various points on the vehicle were typical. SRB separation appeared normal.

E-208
48 FPS
35mm

Cocoa Beach DOAMS tracking of launch vehicle from acquisition to SRB separation. Tracks ET/ORB after SRB separation to LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: A white object appeared in the SSME region and was pulled into the plume (frame 32-01). SSME plume recirculation appeared normal. SRB separation was nominal. SRB slag fell out of exhaust plumes at tailoff.

E-209
30 FPS
70mm

SHILOH IFLOT intermediate tracking of launch vehicle from acquisition to LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Vehicle too distant for engineering analysis.

E-210
30 FPS
70mm

UCS-26 IFLOT intermediate tracking of launch vehicle from acquisition to LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: SRB separation appeared nominal. Vehicle too distant for engineering analysis.

E-211 UCS-13 IFLOT intermediate tracking of forward portion of ORB and ET from acquisition to LOV.
96 FPS
35mm

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Tracking acquired late and clouds obscured a large portion of the imagery. Localized flow condensation at various points on vehicle leading edges was typical.

E-212 UCS-23 MIGOR tracking of launch vehicle from acquisition to LOV.
64 FPS
35mm

Focus : Soft
F. O. V.: Excessive camera shake
Exposure: Underexposed

Comments: Flashes in the SSME plume occurred at frames 110-01, 114-08, 115-14, 118-15, and 120-04. Slight movement around the SSME's may be attributed to a piece of the SSME closeout blanket coming loose and flapping in the air flow. No carrier panels or tiles were missing from the aft end of the Orbiter. Charring of the ET aft dome was typical. An optical linear distortion moved across the vehicle at frame 195-00. Motion of the body flap was similar in amplitude and frequency to that observed on previous flights. No unusual brightening events occurred in the SRB plume. SRB separation appeared normal. Slag particles fell out of the SRB exhaust plumes after separation.

E-213 UCS-7 MOTS tracking of forward portion of ORB and ET from acquisition to LOV.
96 FPS
35mm

Focus : O.K.
F. O. V.: O.K.
Exposure: Light reflection on lens - exposure problem?

Comments: A white object was first visible near SSME #2 at the 7 or 8 o'clock position and then fell aft of the vehicle at T+43 seconds (frame 253-09). The object is believed to be a section of the SSME closeout blanket.

E-217
30 FPS
70mm

Beach Road IFLOT close-in tracking of launch vehicle during ignition, liftoff, and early portion of flight through LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Several flashes occurred in the SSME plume during ascent. Numerous particles of ice and RCS paper covers fell during early ascent. Condensate in SRB stiffener rings vaporized. Orbiter purge barrier baggie material fell from behind body flap. A white object first appeared between SSME #1 and #2 and appeared to get hung up on the SSME #1 hat band before falling aft of the vehicle. The object is most likely a section of the SSME closeout blanket.

E-218
96 FPS
35mm

UCS-26 IFLOT intermediate tracking of launch vehicle from acquisition through LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Numerous flashes occurred in the SSME plume during ascent. At approximately T+43 seconds, a white object appeared from behind LH RCS stinger and fell aft of the vehicle. The object is most likely a section of an SSME closeout blanket.

E-219
30 FPS
70mm

UCS-3 IFLOT close-in tracking of launch vehicle during ignition, liftoff, and early portion of flight through LOV.

Comments: This item was deleted for STS-43.

E-220 96 FPS 35mm	UCS-15 IFLOT close-in tracking of forward portion of ORB and ET during ignition, liftoff, and early portion of flight through LOV.

Focus : Soft
F. O. V.: O.K.
Exposure: O.K.

Comments: Numerous flashes occurred in the SSME plume during ascent. Movement of the body flap was similar in amplitude and frequency to that observed on previous flights. A white object believed to be a section of the SSME closeout blanket was visible in the SSME area (frames 285-01 through 289-07) before falling aft of the vehicle at T+43 seconds MET. A light colored object, most likely a piece of the umbilical purge barrier baggie material, appeared under the aft dome of the ET (frame 365-15), moved toward the Orbiter near the body flap, and fell aft into the SSME plume. Localized flow condensation at various points on the vehicle leading edges was typical. An optical linear distortion moved across the vehicle at frame 542-00. No vehicle anomalies.

E-221 96 FPS 35mm	UCS-3 IFLOT close-in tracking of forward portion of ORB and ET during ignition, liftoff, and early portion of flight through LOV.

Comments: This item was deleted for STS-43.

E-222 96 FPS 35mm	Beach Road IFLOT close-in tracking of forward portion of ORB and ET during ignition, liftoff, and early portion of flight through LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Several flashes occurred in the SSME plume during ascent. Numerous particles of ice and RCS paper covers fell during early ascent. Condensate in SRB stiffener rings vaporized. Orbiter purge barrier baggie material fell from behind body flap at GMT 15:02:18.264. A white object first appeared between SSME #1 and #2 at GMT 15:02:42.844 and appeared to get hung up on SSME #1 hat band before falling aft of the vehicle. The object is most likely a section of the SSME closeout blanket.

E-223
96 FPS
35mm

UCS-9 IFLOT intermediate tracking of forward portion of ORB and ET during ignition, liftoff, and early portion of flight through LOV.

Focus : Soft.
F. O. V.: O.K.
Exposure: Underexposed.

Comments: Condensate on ET aft dome and in SRB stiffener rings vaporized after liftoff. Flashes occurred in the SSME plume during ascent in frames 266-09 and 276-06. White object passed SSME #1 from SSME #2 side in frame 325-02 and fell aft into plume. The object was most likely a section of the SSME closeout blanket. Localized flow condensation at various points on the vehicle were typical.

E-224
100 FPS
35mm

UCS-6 IFLOT close-in tracking of entire launch vehicle during ignition, liftoff, and early flight through LOV.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Condensate on ET aft dome and in SRB stiffener rings vaporized. Pieces of aft skirt instafoam or chunks of SRB propellant fell out of the SRB plume during flight. Charring on the ET aft dome was minimal.

OTV 001
B/W M-II

Views aft end of Orbiter from the FSS 255 foot level.

Comments: TSM light activated. Disconnect and retraction of LH2 T-0 nominal.

OTV 003
B/W M-II

Views GUCP and GH2 vent line.

Comments: Vehicle twang typical. GUCP disconnect and retraction nominal. Residual vapors were present in flight QD.

OTV 004
U-Matic

Views GH2 vent line and GUCP.

Comments: Vehicle twang normal. Ice particles fell from GUCP. GUCP disconnect and retraction normal. No anomalies on flight half of disconnect. Some residual vapors were present in the QD. No vehicle anomalies.

OTV-009 Views ET/Orbiter LH2 umbilical area from the 95
B/W M-II foot level of the FSS.

Comments: Ice fell from umbilical at SSME ignition and T-0. No unusual vapors or cryo drips occurred in the umbilical area.

OTV-013 Views ET nosecone and SW louver from the FSS.
U-Matic

Comments: Residual vapors exited the louver, but no ice was visible. No damage to nose cone, fairing, louver, or footprint. Tumble valve cover was intact. No vehicle anomalies. No vapors around ET/ORB umbilicals as vehicle cleared tower.

OTV 033 Views Orbiter and ET TPS (+Y side) and umbilicals.
U-Matic

Comments: Normal elevon and wing movement. Ice from umbilical shaken loose by ignition and T-0. No unusual events at LO2 TSM. Large piece of ice fell from LH2 umbilical but did not contact Orbiter tiles.

OTV 041 Views and tracks vehicle from camera site 2.
B/W

Comments: Ignition and T-0 normal. No unusual vapors around ET/ORB umbilicals. Roll program nominal.

OTV 043 Views east side of launch vehicle and pad from
B/W camera site 2.

Comments: SSME ignition normal. Free burning hydrogen under MLP. No anomalies.

OTV 048 Launch and tracking view from camera site 6.
B/W

Comments: FSS water deluge activated properly. Ignition and T-0 nominal. Flash off wing tip during roll maneuver was a reflection. Particle below SSME before roll most likely RCS paper cover material.

OTV 049 Views Orbiter LO2 T-0 umbilical from MLP deck.
B/W M-II

Comments: T-0 disconnect normal. Residual GOX vapors drawn aft. No unusual event associated with leak in LO2 TSM. Ice particles fell from SSME area.

OTV 050 Views Orbiter LH2 T-0 umbilical from SW MLP deck.
B/W M-II

Comments: TSM light activated. Disconnect and retraction of LH2 T-0 umbilical was nominal.

OTV 051 Views main engine cluster.
B/W M-II

Comments: SSME ignition and gimbal profile appeared normal. RCS paper covers tore. LOX T-0 disconnect normal. Residual GOX drawn aft. Piece of ice from ET/ORB umbilical area silhouetted against SRB plume.

OTV 054 Views ET/Orbiter LO2 umbilical and Orbiter RH wing
B/W M-II

Comments: Ice from umbilical shaken loose by ignition and T-0. No unusual events at LO2 TSM due to interior leak. Large piece of ice fell from LH2 umbilical. One piece may have made a 'glancing' impact with Orbiter tiles, but no damage was visible.

OTV 055 Views RH SRB and underside of Orbiter RH wing.
B/W M-II

Comments: Ice fell from umbilicals. No anomalies.

OTV 056 Views LH SRB and underside of Orbiter LH wing.
B/W M-II

Comments: Ice from ET/ORB umbilicals fell during SSME ignition. Ice, frost, and vapors drawn into plume by aspiration.

OTV 060 Views ET nosecone and NE louver from water tower.
Color M-II

Comments: FSS water activated properly. GH2 vent line retracted with no rebound. Condensate on ET aft dome vaporized after lift off. No vehicle anomalies.

OTV 061 Views ET nosecone and SW louver from the FSS.
Color M-II

Comments: Residual vapors exited louver, but no ice was visible. No damage to nose cone, fairing, louver, or footprint. No vehicle anomalies. No vapors around ET/ORB umbilicals as vehicle cleared the tower.

OTV 062 Views -Y side of vehicle.
U-Matic

Comments: Residual vapors exited louver, but no ice was visible. No damage to nose cone, fairing, louver, or footprint. No vehicle anomalies. No vapors around ET/ORB umbilicals as vehicle cleared the tower.

OTV 063 Views ET/Orbiter umbilical and Orbiter T-0
Color M-II umbilical from the FSS.

Comments: LH2 TSM light activated. Ice fell from ET/ORB umbilicals, but did not contact tiles. LH2 T-0 disconnect normal. Free burning hydrogen blown under body flap by south winds. Residual GH2 vapors were present in flight QD. No unusual vapors or cryo drips were visible around ET/ORB umbilicals. Large ice pieces continued to fall through early ascent.

OTV 064 Views LH2 ET/ORB umbilical.
U-Matic

Comments: Wing and elevon motion during SSME ignition was typical. No unusual events, such as vapors or cryogenic drips, occurred near ET/ORB umbilicals.

OTV 065 Views +Y-Z side of overall vehicle.
U-Matic

Comments: FSS water activated properly. Vehicle twang normal. GH2 vent line retracted with no rebound. Ice continued to fall from ET/ORB LO2 umbilical. No vehicle anomalies.

OTV 066 Views +Y+Z side of overall vehicle.
U-Matic

Comments: Vehicle twang normal. FWD RCS paper covers were intact. No LO2 feedline anomalies. Condensate in SRB stiffener rings vaporized after liftoff.

OTV 067 Views -Y-Z side of overall vehicle.
U-Matic

Comments: FSS water activation was normal. Condensate on ET aft dome vaporized after liftoff. No vehicle anomalies.

OTV 070 Views overall vehicle from SE direction.
Color M-II

Comments: Rusty deluge water flowed on MLP south side. SSME ignition and gimbal profile appeared normal. Vertical stabilizer exhibited typical side to side movement during SSME ignition. LOX T-0 disconnect was normal. Residual GOX vapors drawn aft. Pieces of ice from umbilicals fell aft. Numerous flashes occurred in SSME #2 plume.

OTV 071 Views overall vehicle from SW direction.
Color M-II

Comments: SSME ignition and gimbal profile appeared normal. RCS paper covers tore.

STI (C/S 2) Infrared view from camera site 2.
B/W M-II

Comments: No data due to hardware problem.

STI (RSS) Infrared view from RSS roof.
B/W M-II

Comments: SSME ignition was typical and appeared normal. No vehicle anomalies.

TV-2 Views launch from SLF.
Color M-II

Comments: View too distant for detail. No plume anomalies.

TV-4A Views Pad A launch from Beach Road IFLOT site
Color M-II north of complex 41.

Comments: Rusty deluge water flowed on south side of MLP. SSME ignition and T-0 normal. Condensate on ET aft dome and stiffener rings vaporized after liftoff. Sunlight reflected off CDR window during roll. Some particles of aft skirt instafoam or propellant dropped out of SRB plume during ascent. White object fell aft of vehicle at T+43 seconds MET was most likely a piece of the SSME closeout blanket. Localized flow condensation at various points on the vehicle were typical. Two white objects aft of SSME's and along side LH SRB plume 55 seconds into flight. First one visible near vertical stabilizer. SRB separation appeared normal.

TV-5 Views launch from VAB roof.
Color M-II

Comments: Too distant for detail. No anomalies.

TV-7 Views launch vehicle from camera site 2 east
Color M-II of pad.

Comments: SSME ignition normal. Free burning hydrogen under MLP. No anomalies.

TV-11 Views launch from TV Tower #1 east of SLF.
Color M-II

Comments: Too distant for detail. LOV in clouds.

TV-13 Cocoa Beach DOAMS tracking of launch vehicle
Color M-II from acquisition to LOV.

Comments: Localized flow condensation at various points on the vehicle were typical. Aft dome charring and recirculation normal. No unusual SRB plume brightening events. No vehicle anomalies. SRB separation appeared normal. Optical linear distortion moved across vertical stabilizer.

TV-16 Views launch from helicopter orbiting west of
Color M-II Pad and VAB.

Comments: Too distant for detail.

TV-18 Malabar ITEK tracking of launch vehicle from
Color M-II acquisition to LOV.

Comments: Inconsistent tracking. Hazy image. Cloud cover obscured FOV.

TV-21A Views Pad A launch from UCS-15.
Color M-II

Comments: Too distant for detail. No vehicle anomalies. SRB separation appeared normal.

ET-204 Patrick IGOR video. Tracks launch vehicle from
Color M-II acquisition to LOV.

Comments: A white object, believed to be a section of an SSME closeout blanket, fell aft of the vehicle at T+43 seconds MET. Local flow condensation at various points on the vehicle was typical. Plume recirculation, SRB tailoff, and separation were normal.

ET-206 Melbourne Beach ROTI video. Tracks launch vehicle
Color M-II from acquisition to LOV.

Comments: A white object, believed to be a section of an SSME closeout blanket, fell aft of the vehicle at T+43 seconds MET. Localized flow condensation at various points on the vehicle was typical. Plume recirculation, SRB tailoff, and separation were normal. Slag particles fell out of the SRB exhaust plumes after separation.

ET-207 UCS-10 MIGOR video. Tracks launch vehicle from
Color M-II acquisition to LOV.

Comments: At end of roll maneuver, two unfocused white objects passed through the field of view and were probably birds near camera. Localized flow condensation at various points on the vehicle was typical. SRB separation appeared normal.

ET-208 Cocoa Beach DOAMS video. Tracks launch vehicle
Color M-II from acquisition to LOV.

Comments: A light-colored object was visible at T+43 seconds MET near SSME #1. Localized flow condensation on the vehicle was typical. Plume recirculation and SRB separation normal.

ET-212 UCS-23 MIGOR video. Tracks launch vehicle from
Color M-II acquisition to LOV.

Comments: A light-colored object was visible at T+43 seconds MET near SSME #1. Localized flow condensation on the vehicle was typical. Plume recirculation and SRB separation normal.

ET-213 UCS-3 MOTS video. Tracks launch vehicle from
Color M-II acquisition to LOV.

Comments: Liftoff and roll maneuver were normal. Film was overexposed afterwards and did not yield much detail.

1.5 ON-ORBIT FILM REVIEW

Review/analysis of on-orbit photography included seventeen 70mm still frames of the ET after separation from the Orbiter (DTO-312) and one 16mm motion picture film of payload deployment.

No major vehicle damage or lost flight hardware was observed that would have affected the mission.

Two light spots on the LH2 tank-to-intertank flange appeared to be possible divots 6-8 inches in diameter in the TPS closeout. The divots were located in the -Y-Z quadrant below the intertank access door and were not a debris threat to the Orbiter. Bright spots on the LH2 tank acreage outboard of the -Y longeron and near the aft hard point were sanded repair areas.

There were no apparent anomalies on LO2 tank, LH2 tank, and aft dome TPS acreage. The BSM burn scars were typical. The nosecone, intertank access door, GH2 umbilical carrier plate, -Y ET/SRB fitting, and RSS antennae were in nominal configuration.

Detail on the +Y and +Z sides of the External Tank was not discernible due to shadows and underexposure of the film.

Shortly after TDRSS/IUS deployment, a light-colored, curved object with a smooth concave side and rough, textured convex side appeared to originate from the aft end of the Orbiter and drifted over the left wing. Similar floating objects have been observed previously on STS-35 and STS-41. The most likely candidate for the object is solid, or frozen, oxygen dislodged from one of the SSME nozzles. The Main Propulsion System contains over 3800 pounds of residual oxygen at ET separation. Of this total, 270 pounds is vented through the SSME seal drain lines at the nozzle exit plane, 3400 pounds is dumped through the SSME nozzles, and the remainder is vented through the LO2 T-0 umbilical fill and drain valve. At a temperature below -360 degrees F, the oxygen solidifies and accumulates on the SSME nozzles. Photographs from previous missions show this ice adhering to the exit plane of the SSME nozzles. Transmitting a vibration through the Orbiter structure, such as an IUS deployment, or melting from the sun, causes the ice to be dislodged from the SSME nozzles.

1.6 LANDING FILM AND VIDEO REVIEWS

E-802 KSC Tracking Site B IFLOT close-in tracking of 35mm Orbiter from final flare through rollout.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Landing gear already extended at beginning of film. Birds near touchdown end of runway moved away from flight path. Both main gear touched down almost simultaneously. Smooth touch down of nose gear. No unusual control surface deflections. No vehicle anomalies or major tile damage was visible.

E-803 KSC South Tower Tracking Site C tracking of 35mm Orbiter from final flare through rollout.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Vehicle appeared nominal while in HAC, final approach, and landing gear extension. Film ended right after MLG touchdown.

E-806 KSC North Tower Tracking Site F tracking of 16mm Orbiter from final flare through rollout.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Landing gear extension and final approach were nominal. Both MLG touched down almost simultaneously. Nose gear touchdown was smooth. Tile damage on right side of nose below RCS module was visible.

E-807 Camera is located on north end runway centerline, 16mm SLF site 1. View looks south to record Orbiter landing gear speed brake extension, and control surface deflections.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: RH landing gear touched down slightly ahead of left. Smoke obscured touchdown of nose landing gear. Pieces of SSME closeout blanket were visible flapping from portions of all three SSME collars during landing rollout.

E-808 Camera is located on south end runway centerline, 16mm SLF site 4. View looks north to record Orbiter landing gear speed brake extension, and control surface deflections.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Landing gear already deployed at start of film. MLG and nose landing gear touchdown appeared nominal. Slight adjustment to steering was visible with no anomalies.

E-809 Camera located on north end Site 1 runway center 35mm line. View looks north to record approach/landing gear deployment.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: No anomalies during final approach and flare. No significant tile damage visible on lower surface. Five dark objects, possibly pieces of black tile, fell from LH aft side of Orbiter while crossing threshold.

E-812 KSC Tracking Site B IFLOT close-in tracking of 16mm Orbiter from final flare through rollout.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Vehicle too distant for main landing gear detail. NLG touchdown nominal. No obvious TPS damage from landing.

E-813 KSC South Tower Tracking Site C tracking of 16mm Orbiter from final flare through rollout.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: View too distant for landing gear door opening. RH main landing gear touched down slightly ahead of the left. Nose landing gear touchdown and vehicle roll-out appeared nominal.

E-816 KSC North Tower Tracking Site F tracking of 16mm Orbiter from final flare through rollout.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Landing gear extension and final approach were nominal. Both MLG touched down almost simultaneously. Nose gear touchdown was smooth.

E-820 UCS-9 IFLOT tracking of Orbiter during approach 16mm for landing.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Landing gear deployment appeared nominal. No anomalies prior to flare. Touchdown obscured by trees.

E-821 UCS-15 IFLOT tracking of Orbiter during approach 16mm for landing.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: No anomalies during flare. Trees obscured view prior to landing gear extension.

E-823 UCS-13 IFLOT tracking of Orbiter during approach 16mm for landing.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: No anomalies during final approach and flare. Nose landing gear deployment appeared nominal. Trees obscured landing gear touchdown.

E-830 Camera located at Fixed Site 3 to view Orbiter at 16mm touchdown.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Vehicle did not enter FOV until just prior to wheel stop. No anomalies were visible.

E-831 Camera located at Fixed Site 2 to view Orbiter at 16mm touchdown.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Main landing gear touchdown nominal. Nose landing gear had not yet occurred as vehicle passed out of FOV.

E-832 IFLOT camera located at Tracking Site A. View of 35mm Orbiter from final flare, horizontal flight to touchdown through wheel-stop.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Landing gear extension and final approach were nominal. Both MLG touched down almost simultaneously. Nose landing gear touchdown was smooth. No major tile damage was visible.

E-833 IFLOT camera located at Tracking Site A. View of 16mm Orbiter from final flare, horizontal flight to touchdown through wheel-stop.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Landing gear deployment was nominal. RH main landing gear touchdown occurred slightly ahead of LH gear. TPS damage on RH side of orbiter nose was visible.

E-834 IFLOT camera located at Tracking Site D. View of 35mm Orbiter from final flare, horizontal flight to touchdown through wheel-stop.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Final approach and touchdown too distant for detail. No anomalies during rollout. No significant tile damage or loss of material from tires was visible.

E-835 IFLOT camera located at Tracking Site D. View of 16mm Orbiter from final flare, horizontal flight to touchdown through wheel-stop.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: View too distant for detail.

E-836 IFLOT camera located at Tracking Site E. View of 35mm Orbiter from final flare, horizontal flight to touchdown through wheel-stop.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Landing gear extension and final approach were nominal. Both MLG touched down almost simultaneously. Nose landing gear touchdown was smooth. Tile damage on right side of nose below RCS module was visible.

E-837 IFLOT camera located at Tracking Site E. View of 16mm Orbiter from final flare, horizontal flight to touchdown through wheel-stop.

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: Landing gear already deployed at start of film. MLG touchdown appeared normal. Nose landing gear touchdown was smooth. No anomalies visible during rollout.

E-845 UCS-7 MIGOR
35mm

Focus : O.K.
F. O. V.: O.K.
Exposure: O.K.

Comments: No anomalies going into the HAC. Tracking lost then re-acquired late. Film ended before landing gear deployment.

TV-2 View from convoy position at SLF midfield.
Video

Comments: Touchdown obscured by trees.

TV-5 View from VAB roof.
Video

Comments: Final approach and landing gear deployment nominal. Main gear touchdown was almost simultaneous. Nose gear touchdown was smooth. No anomalies during rollout.

TV-6 View from top of Mate Demate Device at SLF.
Video

Comments: Too distant for detail. No anomalies during rollout.

TV-11 View from Shuttle Landing Facility TV Tower #1
Video east of the runway.

Comments: Final approach and landing gear deployment nominal. Main gear touchdown was almost simultaneous. Nose gear touchdown was smooth. No anomalies during rollout.

TV-13 View of Orbiter landing from Cocoa Beach DOAMS
Video long range tracker.

Comments: Atmospheric haze obscured detail.

TV-14 View of Orbiter landing from UCS-7 long range
Video tracker.

Comments: Final approach and landing gear deployment were nominal. Landing and vehicle rollout was obscured by trees.

TV-15 View from Shuttle Landing Facility TV Tower #2
Video west of the runway.

Comments: Too distant for detail.

TV-33 View from SLF midfield.
Video

Comments: Landing gear already extended at start of tape. Birds near touchdown end of runway moved away from flight path. Both main gear touched down almost simultaneously. Smooth touchdown of nose gear. No unusual control surface deflections. No vehicle anomalies or major tile damage was visible.

Analysis Tasks and Summary of Analysis of Visual Events

TASKS FOR STS-43

Task 1	Recirculation Characterization
Task 2	Check Effect of Synchronizers on IRIG Time Transmissions
Task 3	Determine Sink Rate from Video/Film
Task 4	Body Flap Analysis
Task 5	Umbilical Well Camera Analysis
Task 6	ET Onboard Hasselblad Photo Analysis
Task 7	Velocity Measurements of SRB Duct Debris
Task 8	STS-43 ET Tanking Screening
Task 9	Review past missions for horizontal motion at liftoff
Task 10	Characterize on orbit crescent shaped debris
Task 11	Characterize debris aft of vertical stabilizer at 43 seconds
Task 12	Measurement of dislodged beta blanket on SSME #2
Task 13	Characterize SSME plume
Task 14	Measure height of vehicle above threshold
Task 15	Analyze white cloud prior to HAC maneuver

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 1

Request Date : 06/21/91
Completion Date : 08/17/91

Requestor : B. Rosenbaum
Phone : 483-9006
Mail Code : EP

Analyst Name	Phone Number	Assignment
Team		Screen & Document
		Analysis & Reporting

Task Title

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Note start/stop time (frames) on all video and film cameras where recirculation is visible (produce a table to send to B. Rosenbaum). Use image processing techniques as necessary to characterize the recirculation.
   * Determine color of recirculation.
2) Document results

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
1

Title : Recirculation Characterization

Analysts : R. Bhaskar
Date : 09/10/91

Camera Number :
Frame Number :
GMT :

Requestor : B. Rosenbaum
Phone : 483-9006
Mail Code : EP

Description of Analysis

See attached

Image Analysis Tools & Techniques

Cameras on which recirculation was observed for STS-43

CAMERA	START (seconds MET)	STOP (seconds MET)
ET-204	96	105
ET-206	95	110
E-204	95	110
E-206	---	---
E-208	---	---
E-212	---	---
KTV-13	94	105

NOTE: **Intermittent cloud cover prevented acquisition of specific start and stop times for cameras E-206, E-208 and E-212.**

RECIRCULATION BY MISSION

MISSION	START (seconds MET)	STOP (seconds MET)
STS-26	92	112
STS-27	95	---
STS-29	92	112
STS-30	95	---
STS-28	94	104
STS-34	95	---
STS-33	95	112
STS-32	100	109
STS-36	93	103
STS-31	91	108
STS-41	91	112
STS-38	94	110
STS-37	92	107
STS-39	92	101
STS-40	---	---
STS-43	94	110

NOTES: **No recirculation was observed on STS-40. Intermittent cloud cover prevented acquisition of specific stop times for STS-27, STS-30 and STS-34.**

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 2

Request Date : 06/21/91
Completion Date : 08/20/91

Requestor : D. Pitts
Phone : 483-5066
Mail Code : SN15

Analyst Name	Phone Number	Assignment
Team		

Task Title

Check Effect of Snychronizers on IRIG Time Transmission

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Check known events with time recorded on video
   A) SRB Separation
   B) Main Gear Landing
   C) Wheel Stop
   D) Etc.
2) Determine if there is time difference. If there is, does a pattern exist?
3) Document results and send to TV Working Group through D. Pitts.

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
2

Title : Check Effect of Snychronizers on IRIG Time Transmission

Analysts : B. Gastineau
Date : 8/21/91

Camera Number : *
Frame Number :
GMT : 223:12:23

Requestor : D. Pitts
Phone : 483-5066
Mail Code : SN15

Description of Analysis

*TV-5, TV-11, TV-15, TV-33

Right main gear, left main gear, and nose gear touchdown times measured from 5 different cameras. Time difference determined between views. Time difference multiplied by 60 to get frame difference.

See attached

Image Analysis Tools & Techniques

RTMOV

STS-43 - Task #2
Landing Video IRIG Time Synchronization Analysis
09/20/91

Landing videos were screened using the real time image capturing capabilities of the VDAS and the RTMOV software. Frames were deinterleaved to increase the accuracy of the measurements (effectively increasing frame rate from 30 frames per second to 60). The GMT times for right main gear, left main gear, and nose gear touchdown were determined and can be found in the following table. The camera identified as NASA Select was the transmission occurring during landing which switched between numerous cameras. The times measured from this transmission were used as the reference for all other cameras. The following terms are used in the table to indicate the confidence in the measurements made:

not visible : unable to determine time due to view obstruction and/or a short film run.
not determinable : unable to determine time due to vehicle distance or viewing angle.
distant : accuracy questionable due to distance of vehicle.
shadowed : accuracy questionable due to focus or lighting problems from this view.

A rate of 60 fields per second indicates that these discrete events should be determinable to within 0.017 seconds. From the measurements made we find that referencing from the NASA Select transmission indicates the following frame errors:

TV-5	: 0.9 to 4.9 fields
TV-11	: 3.0 to 5.0 fields
TV-15	: 5.0 to 6.0 fields
TV-33	: 2.8 to 4.9 fields

By referencing from the TV-33 transmission the following frame errors occur:

NASA Select	: -4.9 to -2.8 fields
TV-5	: -2.0 to 1.0 fields
TV-11	: 1.2 to 2.2 fields
TV-15	: 0.1 to 3.2 fields

The NASA Select and the TV-33 views appear to be from the same camera and also show the best view of all three gear touchdowns. They are therefore used as the reference times. Both views were remeasured carefully and consistently (first frame showing dust rising from the runway was used as the touchdown point) to confirm that the discrepancy was not due to experimental error and the measurements did not change. This analysis indicates that a timing synchronization problem did exist during the filming of STS-43 landing.

STS-43 - Task #2
Landing Video IRIG Time Synchronization Analysis
(Touchdown times stated GMT, differences are referenced from NASA Select and stated in seconds)

CAMERA	R Main Gear	difference	L Main Gear	difference	Nose Gear	difference
NASA Select	223:12:23:24.872		223:12:23:24.955		223:12:23:35.932	
TV-2	not visible		not visible		not visible	
TV-5	223:12:23:24.936 (distant)	0.064	223:12:23:25.036 (distant)	0.081	223:12:23:35.947 (shadowed)	0.015
TV-6	not determinable		not determinable		not determinable	
TV-11	223:12:23:24.955 (distant)	0.083	not determinable		223:12:23:35.982 (distant)	0.050
TV-13	not visible		not visible		not visible	
TV-14	not visible		not visible		not visible	
TV-15	223:12:23:24.972 (shadowed)	0.100	223:12:23:25.038 (shadowed)	0.083	223:12:23:36.016 (shadowed)	0.084
TV-33	223:12:23:24.919	0.047	223:12:23:25.036	0.081	223:12:23:35.980	0.048

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 3

Request Date : 06/21/91
Completion Date : 09/10/91

Requestor : D. Hamilton
Phone : 483-8885
Mail Code : ES421

Analyst Name	Phone Number	Assignment
R. Bhaskar	244-5322	Video Sink Rater
S. Israel	244-5106	Two Camera Sink Rate

Task Title

Determine Sink Rate from Video/Film

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Choose video for analysis
2) Use D. Pitts sink rate analysis techniques
3) Document results
4) Report results to D. Hamilton/ES421
5) Choose film or films to determine sink rate using the film analyzers and appropriate software.
6) Report results to D. Hamilton at 483-8885

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
3

Title : Determine Sink Rate from Video/Film

Analysts : R. Bhaskar
Date : 09/10/91

Camera Number :
Frame Number :
GMT :

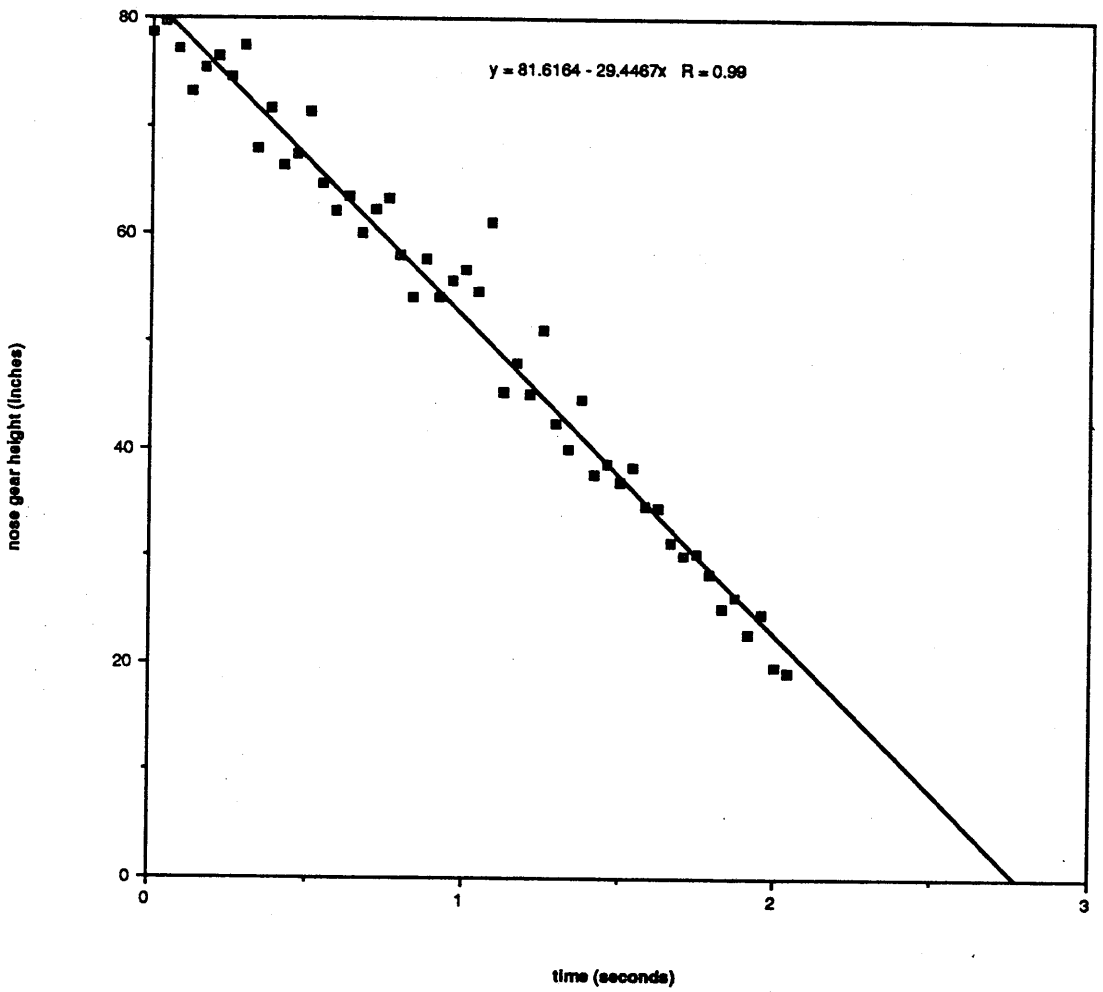
Requestor : D. Hamilton
Phone : 483-8885
Mail Code : ES421

Description of Analysis

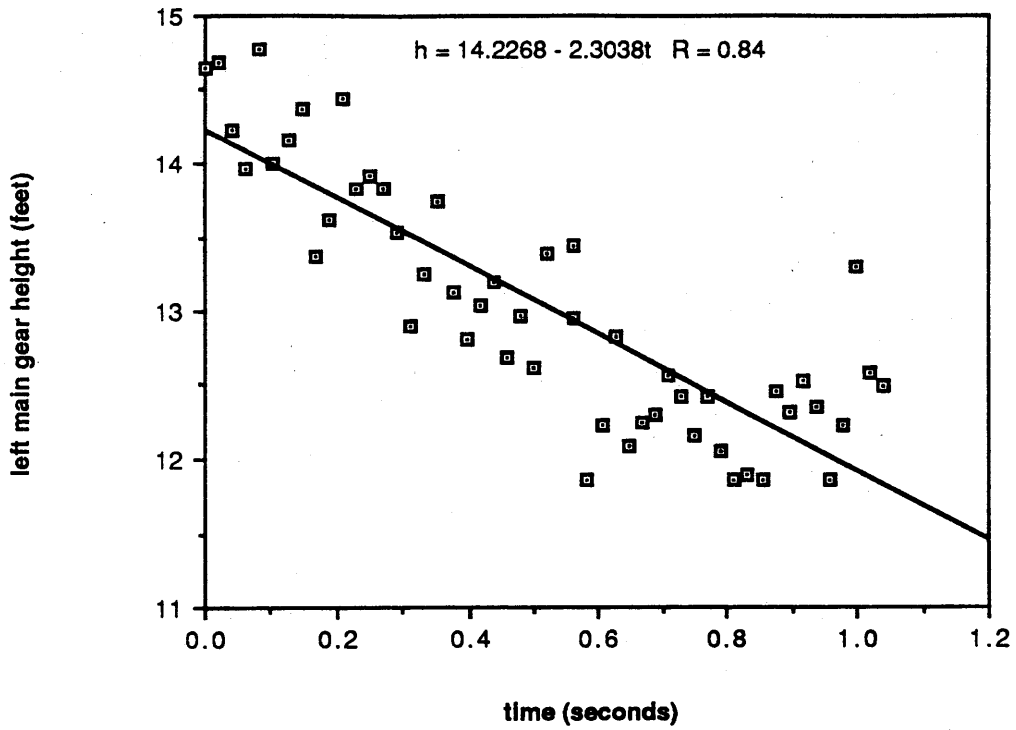
See attached

Image Analysis Tools & Techniques

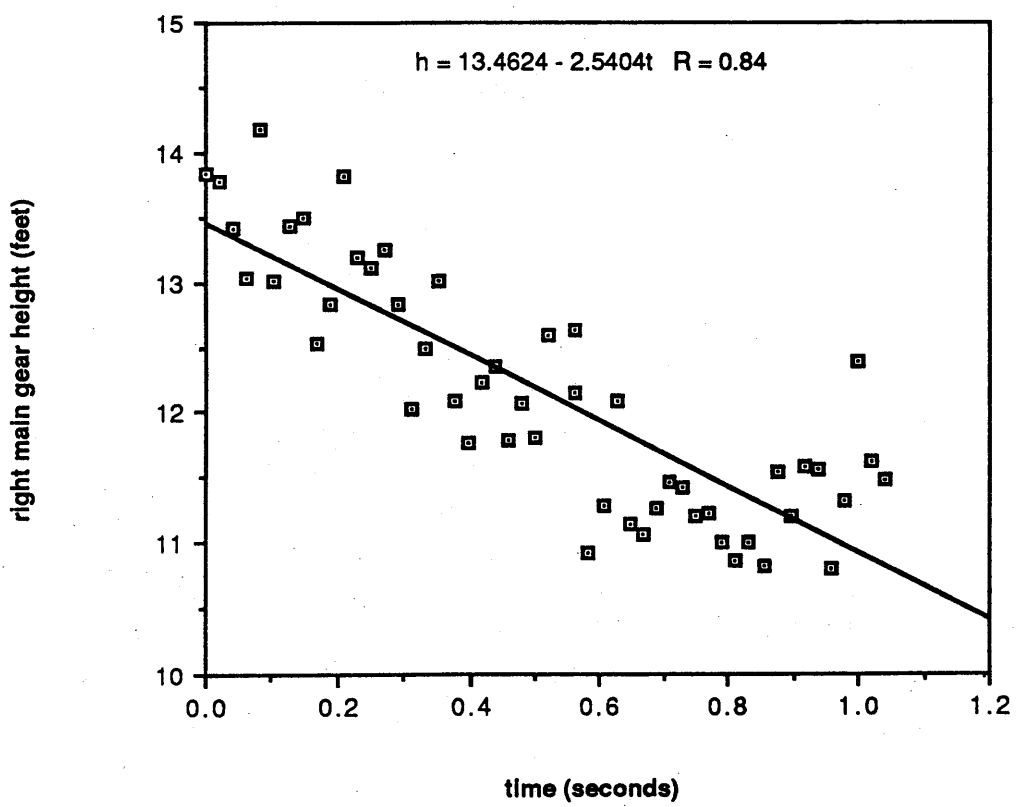
STS-43 - Sink Rate Analysis - E806 - Nose Gear



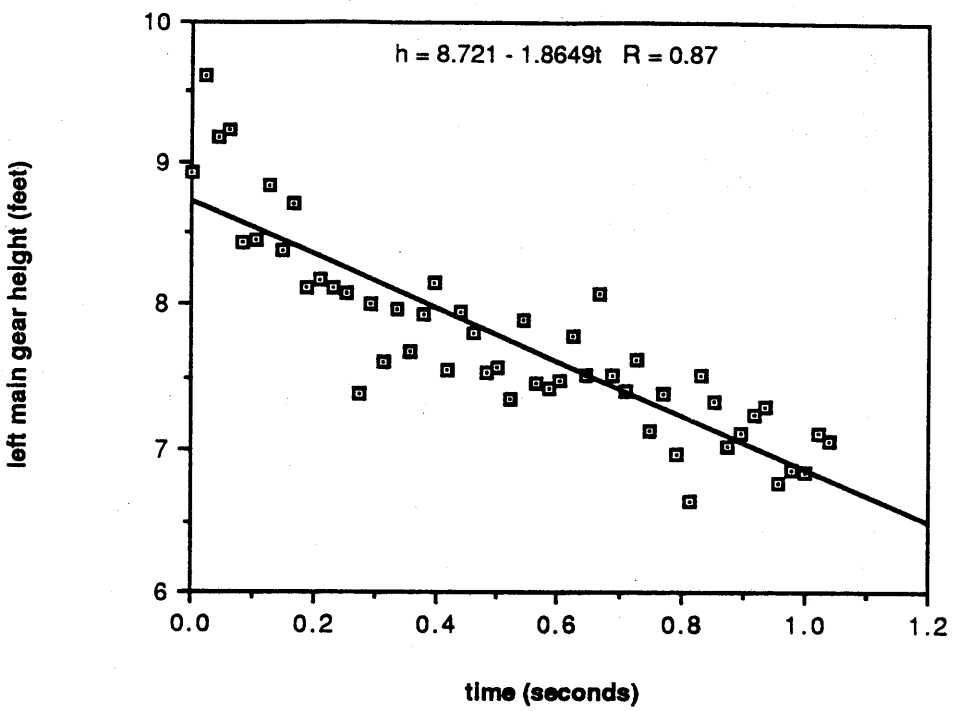
STS-43 - Sink Rate Analysis - E806 - Left Main Gear



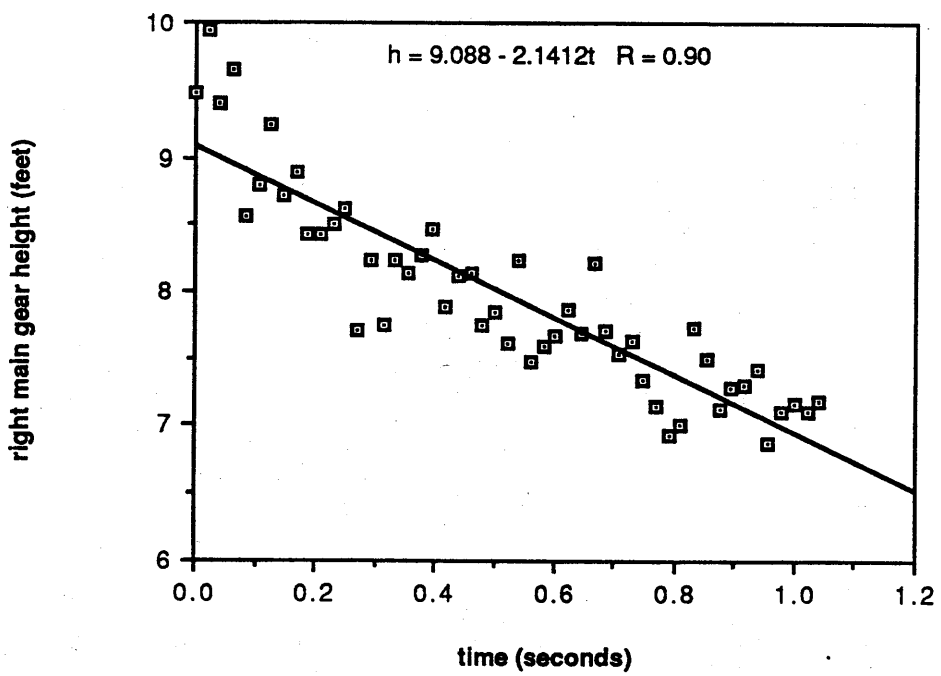
STS-43 - Sink Rate Analysis - E806 - Right Main Gear



STS-43 - Sink Rate Analysis - E833 - Left Main Gear

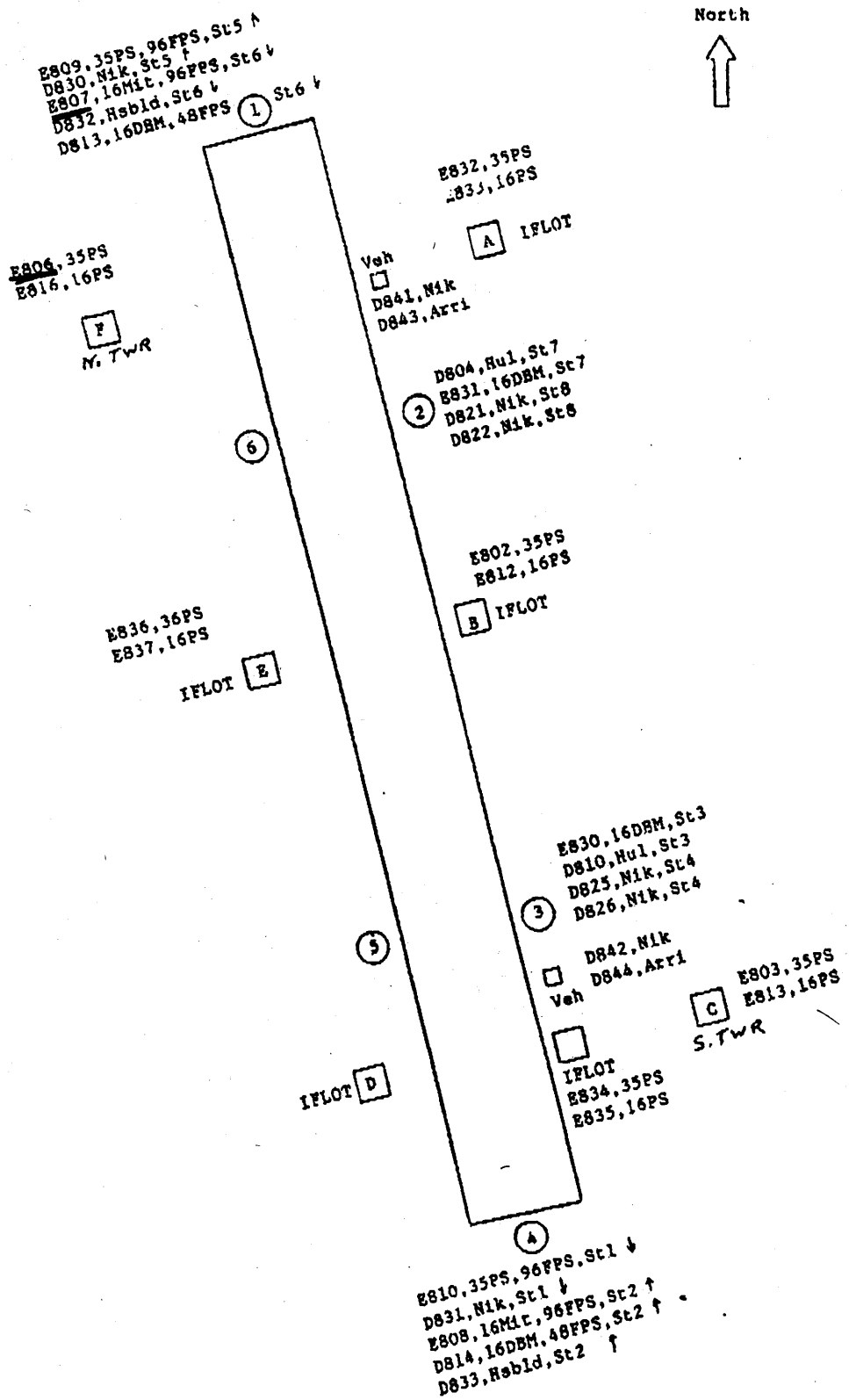


STS-43 - Sink Rate Analysis - E833 - Right Main Gear



Camera Locations

STS-43 Landing



Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 4

Request Date : 06/21/91
Completion Date : 08/29/91

Requestor : Debris Team
Phone : 483-0684
Mail Code :

Analyst Name	Phone Number	Assignment
M. Snyder	483-5171	Data Analysis
H. Harless/T. Morris	483-9143	Data Measurements
Team		Screening & Documentation

Task Title

Body Flap Analysis

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Screen films E-207, E-221, E-222, E-223, and others which may show motion of the body flap.
2) Note times/frames in which movement occurs
3) Measure motion - amplitude and frequency
4) Characterize and document motion
5) Report to appropriate Level II and MER personnel

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
4

Title : Body Flap Analysis

Analysts : M. Snyder
Date : 8/29/91

Camera Number : E220
Frame Number :
GMT :

Requestor : Debris Team
Phone : 483-0684
Mail Code :

Description of Analysis

Slight body flap motion was seen on Camera E-220. Compared to past missions this body flap motion was not as great. Given that body flap motion in past missions was greater and very difficult to measure, the slight amount of motion seen in this mission would not warrant a detailed measurement of body flap motion.

Image Analysis Tools & Techniques

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 5

Request Date : 06/21/91
Completion Date : 8/2/91

Requestor : Debris Team
Phone : 483-0684
Mail Code : WC13

Analyst Name	Phone Number	Assignment
J. Disler	483-5182	

Task Title

Umbilical Well Camera Analysis

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Screen photography for anomalies
2) Enhance photography for analysis
3) Analyze and document results

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
5

Title : Umbilical Well Camera Analysis

Analysts :
Date : 8/2/91

Camera Number :
Frame Number :
GMT :

Requestor : Debris Team
Phone : 483-0684
Mail Code : WC13

Description of Analysis

No umbilical cameras this mission

Image Analysis Tools & Techniques

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 6

Request Date : 06/21/91
Completion Date : 09/04/91

Requestor : Debris Team
Phone : 483-0684
Mail Code : WC13

Analyst Name	Phone Number	Assignment
S. Israel	244-5106	Measurement
J. Disler	483-5182	Analysis
J. Hartman	483-5337	Analysis

Task Title

ET Onboard Hasselblad Photo Analysis

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Determine resolution and distance of ET from shuttle
2) Determine size of debris flying with ET. Note other characteristics if possible.
3) Investigate to see if any anomalies exist?
4) Investigate results
5) Talk to Astronauts
6) In screening, try to determine rate and direction of tumbling
7) Compare to umbilical well cameras
8) Digitize

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
6

Title : ET Onboard Hasselblad Photo Analysis

Analysts : S. Israel, B. Gastineau, C. Dailey
Date : 08/12/91

Camera Number :
Frame Number :
GMT :

Requestor : Debris Team
Phone : 483-0684
Mail Code : WC13

Description of Analysis

See attached

Image Analysis Tools & Techniques

HASSELBLAD FILM DATA SHEET

Mission/Roll - STS-43-71

Frame #	Time	Focus	Exp	Comments
001	15:17:10	Good	Good	Left side of ET
002	15:17:19	Good	Good	Left side of ET
003	15:17:28	Good	Good	Left side of ET
004	15:17:37	Good	Good	Left side of ET
005	15:17:49	Good	Good	Left side of ET
006	15:18:21	Good	Dark	Left side of ET
007	15:18:29	Good	Dark	Left side of ET
008	15:18:31	Good	Dark	Underside of ET
009	15:18:34	Good	Dark	Underside of ET
010	15:18:36	Good	Dark	Underside of ET
011	15:18:38	Good	Dark	Underside of ET
012	15:18:48	Good	Dark	Right side of ET, image is dark, reprints should be enhanced
013	15:19:01	Good	Dark	Right side of ET
014	15:19:08	Good	Dark	Right side of ET
015	15:19:21	Good	Dark	Right side of ET
016	15:19:26	Good	Dark	Right side of ET, image is dark, reprints should be enhanced
017	15:19:29	Good	Dark	Right side of ET

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
6.01

Title : ET Onboard Hasselblad Photo Analysis

Analysts : B. Gastineau
Date : 8-16-91

Camera Number :
Frame Number :
GMT :

Requestor : Debris Team
Phone : 483-0684
Mail Code : WC13

Description of Analysis

See attached

Image Analysis Tools & Techniques

Monocomparator
Excel Spreadsheet
Cricket Graph

ET separation

	A	B	C	D	E	F
1	0.88045	0.52920	image (inches)	dist (inches)	time (hh:mm:ss)	frame
2	0.84630	0.57945	0.06076	53622	15:17:49	43-71-005
3	0.82010	0.59790				
4	0.86800	0.62220	0.05371	60655	15:18:21	43-71-006
5	0.89080	0.57240				
6	0.83760	0.57270	0.05320	61237	15:18:29	43-71-007
7	0.82510	0.50295				
8	0.77215	0.50440	0.05297	61504	15:18:31	43-71-008
9	0.76000	0.56810				
10	0.70660	0.56970	0.05342	60982	15:18:34	43-71-009
11	0.79230	0.62060				
12	0.73920	0.62250	0.05313	61314	15:18:36	43-71-010
13	0.76040	0.62820				
14	0.70830	0.64340	0.05427	60029	15:18:38	43-71-011
15	0.75230	0.67655				
16	0.70250	0.68595	0.05068	64284	15:18:48	43-71-012
17	0.73660	0.71150				
18	0.69025	0.72930	0.04965	65616	15:19:01	43-71-013
19	0.71745	0.77105				
20	0.67040	0.78530	0.04916	66270	15:19:08	43-71-014
21	0.75620	0.80345				
22	0.71405	0.82135	0.04579	71143	15:19:21	43-71-015
23	0.77345	0.75130				
24	0.73105	0.76600	0.04488	72597	15:19:26	43-71-016
25	0.76320	0.81460				
26	0.71950	0.82655	0.04530	71911	15:19:29	43-71-017
27						
28	CAMERA FOCAL LENGTH					
29	250	mm				

	A	B	C	D	E
1	**STS-43-Mag 71**	**x-coordinate**	**y-coordinate**	**length (film)**	**length (inches)**
2	**FRAME 001**				
3	ET	0.73540	0.66960		
4		0.67845	0.69250	0.06138	
5	Burn Scar	0.72825	0.67385		
6		0.71885	0.66585	0.01234	66.56173
7	**FRAME 002**				
8	ET	0.72605	0.69405		
9		0.67150	0.72710	0.06378	
10	Burn Scar	0.71790	0.69830		
11		0.70675	0.69420	0.01188	61.65251
12	**FRAME 003**				
13	ET	0.74025	0.75030		
14		0.69345	0.78765	0.05988	
15	Burn Scar	0.73200	0.75390		
16		0.72195	0.75120	0.01041	57.52633
17	Divot #1	0.70710	0.74100		
18		0.70460	0.74060	0.00253	13.99576
19	Divot #2	0.70380	0.73960		
20		0.70080	0.73940	0.00301	16.62079
21	Divot #3	0.70190	0.74270		
22		0.70040	0.74245	0.00152	8.40637
23	Divot #4	0.68810	0.74900		
24		0.68490	0.74860	0.00322	17.82724
25	Divot #5	0.63750	0.65770		
26		0.63515	0.65735	0.00238	13.13407
27	Divot #6	0.62240	0.66630		
28		0.62040	0.66610	0.00201	11.11113
29	**FRAME 004**				
30	ET	0.68165	0.66415		
31		0.62950	0.70495	0.06621	
32	Burn Scar	0.67960	0.64955		
33		0.66785	0.64770	0.01189	59.46137
34					
35	**AVERAGE BURN SCAR LENGTH (inches)**			61.30049	

STS-43 Task #56
ET Onboard Hasselblad Photographic Analysis
DTO-0312

The goal of the ET analysis is to determine the sizes of the possible anomalies including divots and burn scars on the surface of the ET. The spatial information is collected by using the Shadowgraph as a monocomparator at JSC. The Shadowgraph has a least count for measurements of 1000th of an inch in two degrees of freedom (x and y direction) and the process is fully manual. Sizes were computed by determining the distance between the extreme edges along the major diagonal of an object of interest.

Sizes of divots and burn scars are calculated using the formula.

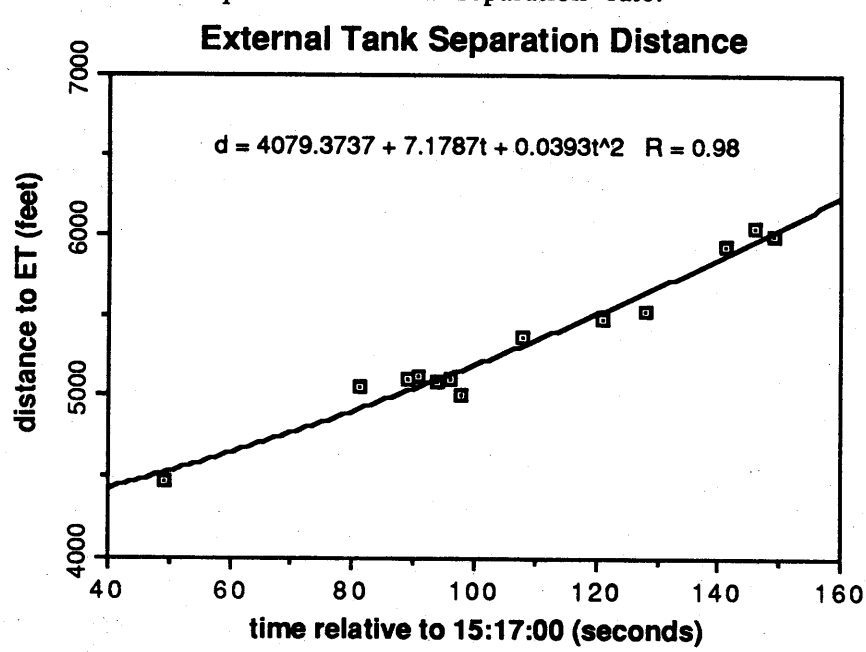
$$\text{size}_{actual} = \frac{\text{size}_{measured}}{\text{ET diameter}_{measured}} * \text{ET diameter}_{actual}$$

The distance to the external tank is calculated using the formula

$$\text{distance to object} = \frac{\text{focal length}}{\text{ET diameter}_{measured}} * \text{ET diameter}_{actual}$$

Hasselblad frame 43-71-003 was used to determine the sizes of 6 divots. Significant error is expected in these measurements due to an ill defined visual diameter of the ET. Frames 43-71-001 thru 43-71-004 are the only frames which showed divots or a burn scar. These frames had a shadowed side of the external tank which offered no contrast against a black background. The measurements made indicated the divots ranged in size from 8.4 inches to 18 inches. measurements of the burn scar from frames 001 thru 004 indicated a length of 61 inches.

Hasselblad frames 43-71-005 thru 43-71-17 were used to calculate a separation rate for the external tank. These images were backlit and dark disallowing use in the burn scar and divot measurements but were suitable for calculation of separation distance. Frames 001 thru 004 were not used for previously stated reasons. The following graph shows the separation distances calculated and a least squares fit for a separation rate.



Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
6.02

Title : ET Onboard Hasselblad Photo Analysis

Analysts : S. Israel
Date : 09/11/91

Camera Number :
Frame Number :
GMT :

Requestor : Debris Team
Phone : 483-0684
Mail Code : WC13

Description of Analysis

See attached

Image Analysis Tools & Techniques

STS-43 Task #6 ET Onboard Hasselblad Photographic Analysis DTO-0312

The goal of the ET analysis is to determine the sizes of the possible anomalies including divots and sizes of the burn scars on the surface of the ET. The spatial information is created by using the Shadowgraph as a monocomparator at JSC. The Shadowgraph has a least count for measurements of 1000th of an inch in two degrees of freedom (x and y direction) and the process is fully manual. Sizes were computed by determining the distance between the extreme edges along the major diagonal of an object of interest.

Distances calculated as:

$$\text{calculated distance} = \frac{\text{measured size - object}}{\text{measured diameter ET}} * \text{actual diameter ET}$$

time	15:17:10	GMT
focal length	0.2500	meters
diameter of ET	331.0000	inches

		MONOCOMPARATOR COORDINATE SYSTEM			
DIAMETER MEASUREMENTS	x1 in inches	y1 in inches	x2 in inches	y2 in inches	distance
photo STS43.71.001	0.4296	0.6143	0.3657	0.6335	0.0667
BURN SCAR MEASUREMENTS	0.4232	0.6471	0.4450	0.6616	0.0262

REAL WORLD DIMENSIONS

distance from orbiter	1240.2172	meters
left burn scar size	3.2991	meters

		MONOCOMPARATOR COORDINATE SYSTEM			
DIAMETER MEASUREMENTS	x1 in inches	y1 in inches	x2 in inches	y2 in inches	distance
photo STS43.71.002	0.4223	0.4556	0.4769	0.4238	0.0632
time 15:17:19					

REAL WORLD DIMENSIONS

distance from orbiter	1310.1586	meters

		MONOCOMPARATOR COORDINATE SYSTEM			
DIAMETER MEASUREMENTS	x1 in inches	y1 in inches	x2 in inches	y2 in inches	distance
photo STS43.71.003	0.5024	0.5923	0.5577	0.5678	0.0605
time 15:17:28					

REAL WORLD DIMENSIONS

distance from orbiter	1367.6672	meters

Measurements of Photograph 43-71-001 thru 43-71-003

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
6.03

Title : ET Onboard Hasselblad Photo Analysis

Analysts :
Date : 08/29/91

Camera Number :
Frame Number :
GMT :

Requestor : Debris Team
Phone : 483-0684
Mail Code : WC13

Description of Analysis

See attached

Image Analysis Tools & Techniques

AUGUST 29,1991

STS 43 DTO-312 DEBRIEF QUESTIONS

FIRST THANK YOU VERY MUCH FOR TAKING PICTURES OF THE EXTERNAL TANK FROM BOTH THE PHOTO/TV ANALYSIS PROJECT AND THE LEVEL II DEBRIS PANEL. WE APPRECIATE YOUR EFFORT IN TRYING TO BRING BACK INFORMATION ON THE CONDITION OF THE EXTERNAL TANK. THE PICTURES WERE VERY WELL FOCUSED AND TIMING WAS AVAILABLE TO HELP DETERMINE ROTATION RATES.

Who took the pictures?

Jim Adamson

Did you have any problems getting set up to take the pictures?

I didn't have any problem getting set up to take the pictures. The camera was easily accessible.

Could you readily acquire the ET visually?

As soon as we pitched into position... as soon as John ran through the pitch, the tank came into view. It was easy to continue to track it and watch it as it tumbled. It tumbled rather slowly.

Were the existing lighting conditions a problem? About what you expected?

Lighting conditions were not a problem.

Did the crew know that we want to get pictures of as many sides of the tank as possible? (particularly the areas that are prone toward having divots like the bipod area)

I did know that you wanted as many sides as possible and I tried to do that. I don't know how many photos I got. It must have been about twenty (actually 17).

Did you note any debris near ET? Can you comment on the relative size, shape, appearance or distance of the debris?

I did not notice any debris near the ET.

Have you seen any of the pictures that were taken? Do the ET photos appear similar to the way the ET appeared visually?

I have seen the pictures that were taken and that is the way it did appear to me.

Could you see the separation burn on the ogive of the ET?

I could see the sep burns on the ogive with my naked eye..

Were any "divots" in the ET TPS visible?

Couldn't tell if there were any divots.

Was preflight training / preparation adequate to perform the DTO?

Preflight training was adequate. I took the DTO before from a different window. Everything went smooth from that standpoint. I did turn on the data back on the camera.

Timing is important to some of our analyses. Could you comment on the way you remembered to turn on the data recording back?

Its a habit whenever I pick up the camera I turn the data back on. I've made mistakes in the past and I made one on this flight failing to turn one on. Generally speaking its in my habit pattern to do that.

Question about on-orbit debris:

Could you be specific about the location you saw it come from?

Astronaut 1:

From my perspective and I wasn't the first that saw it. But I then saw it on the video later that we downlinked. Especially the one big piece that looked like a snake. I would think that someone could look at that tape and zoom in on it real good, then blow it up and they could see exactly what it is. They could even look at the real orbiter and answer the question what it is instead of us trying to conjecture.

Astronaut 2:

I got some good 16mm that we bought back with us.

Astronaut 1:

Some outstanding 16mm and video. The 16mm is so in focus, that if you want to zoom in on the one area and blow it up I would have thought you could tell. From my viewpoint looking at the 16mm it didn't look like ice to me.

Shannon Lucid:

Well, in real life it didn't look like ice because ice looks sparkling and shiny.... Now it could have been and the light wasn't hitting it in the same way. But it certainly did not look like ice; it looked like a piece of something.

Astronaut 3:

And Shannon you might want to comment on this too. What happened was we had the deploy and we were all following that for a minute or two

until that was pretty much safely away. It was after that that someone looked back and said look at that big piece out there. So given that, it appeared to me that it was coming from the back end of the Orbiter and not from the payload bay. Although you had just had a deploy, right off the top of your head, you would think it was coming from the payload bay but it was far enough outside and far enough back, it seemed to me. Just a gut feel, it was coming from the back end of the vehicle.
Shannon did you get that kind of feeling at all?
(No response)

That's not scientific that's just looking out. That was a gut feeling.

Astronaut 1:

I'd look at the film. Look at the real vehicle, we ought to be able to know what it is.

Another voice:

We've seen this stuff before and we've looked at the vehicle when it came back and and everything that is supposed to be there is there. Nobody has been able to figure out what this is.

Mike Suffredini:

The other part is on 35 you could actually see ice on the engine bell and it been postulated that in fact the object is ice and why it gets there is because the purge and the oxygen coming out. Its actually oxygen.

Astronaut 1:

If it is ice, its awfully dirty ice.

Shannon Lucid:

It wasn't sparkly ice.

Astronaut 1:

It was black and more metallic.

Mike Suffredini:

That's it and we haven't seen the 16mm and that's part of how these questions came up. We have to go look at those.

Shannon Lucid:

Our first thought was maybe it was some RTV that had come loose. That was just speculation.

Mike Suffredini:

OK. Super.

Astronaut 4?:

Let me make some more comments about debris. Nobody seems to care too much...maybe its nominal... but about debris we see at ET sep. I guess that its ice, but there's alot coming off. I made the comment during post insertion sometime that I saw a fairly big piece of something. I said about 4 x 2 inches. I also noticed in reading a summary report the other day that something came off the right forward RCS. They discovered that after landing. I don't know what it was I saw. It was kind of shiney like an amber...like something that was on fire to me. After that kind of went away and things settled down, there was a lot of debris coming up on the port side from aft to forward. It could have been ice...But there was none from the right side of the Orbiter. That was all right after ET sep. We also had the ice, I guess, which is fairly normal at about Mach 8...Mach 12 during ascent coming off on both sides.

Shannon Lucid:

While we are talking about debris, I'd just like to mention I thought that the in cabin was super clean and KSC was doing a super job having a clean cabin.

Astronaut 1:

I thought the debris we saw on ascent and through ET sep wasn't any different then I've seen before.
Doesn't mean it was right, but it was the same.

Mike Suffredini:

Through ET sep? So it looked the way you've seen in the past?

Astronaut 1:

In fact, in one area, it was even less. Normally at SRB sep, you get some butcher paper. It makes a mark on W3 and W4. We had no butcher paper marks on W3 and W4.

Mike Suffredini:

... This was the flight where you thought 3 and 4 were...did you say 3 and 4 were dirtier than you had seen before but 2 and 5 were OK. That cleared up...

Astronaut 1:

The butcher paper didn't hit the 3 or 4 like is normally does on SRB sep.

(These conversations were transcribed to make sure the intent of what was said is present. They are not always exactly word for word. I have the tape and would be glad to forward it if some one wants to hear the conversation...Chris Dailey)

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 7

Request Date : 06/21/91
Completion Date : 08/21/91

Requestor : Debris Team
Phone : 483-1137
Mail Code : WC

Analyst Name	Phone Number	Assignment
S. Israel	244-5106	Data Collection
H. Harless/T. Morris	483-9143	Data Collection
Team		Screen & Document

Task Title

Velocity Measurements of SRB Duct Debris

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Look at Pad cameras for pieces of debris to study velocity coming from the SRB flame duct.
2) Choose several candidates at various times
3) Measure movement on film analyzers
4) Calculate velocities
5) Report to Debris Team

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
7

Title : Velocity Measurements of SRB Duct Debris

Analysts : B. Gastineau
Date : 8/13/91

Camera Number : E7, E14
Frame Number :
GMT :

Requestor : Debris Team
Phone : 483-1137
Mail Code : WC

Description of Analysis

See attached

Image Analysis Tools & Techniques

Film motion analyzer
PAST software
Cricket Graph

STS-43 - Task #7
Velocity Measurements of SRB Duct Debris
08/13/91

Many pieces of debris were noted moving upward from the SRB flame duct near the holddown posts after SRB ignition.

The trajectories of four fast moving pieces found on cameras E7 and E14 were digitized on a Film Motion Analyzer. The particles exit the flame duct area after SRB ignition and as the SRB clears the MLP. The velocities of these particles have been calculated. The peak velocity of these particles was determined to be over 115 feet per second. None of the observed debris appeared to strike the orbiter. Multiple cameras were reviewed to determine if an individual particle can be seen by more than one camera. The trajectory (a phototheodolite solution) of the individual particles would then be able to be calculated. No particles were found on two cameras which satisfy the restrictions of the phototheodolite solution. No follow-up action has been requested.

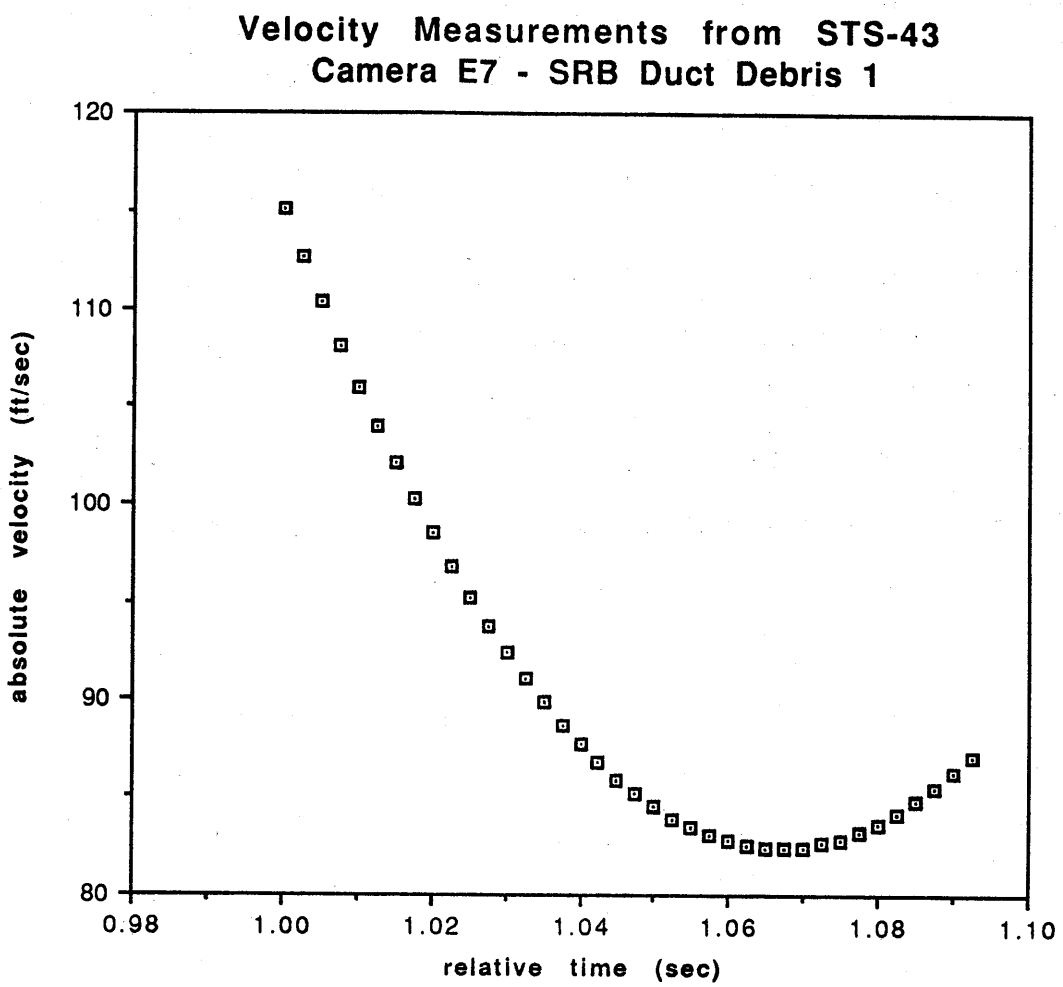
FILE STORAGE

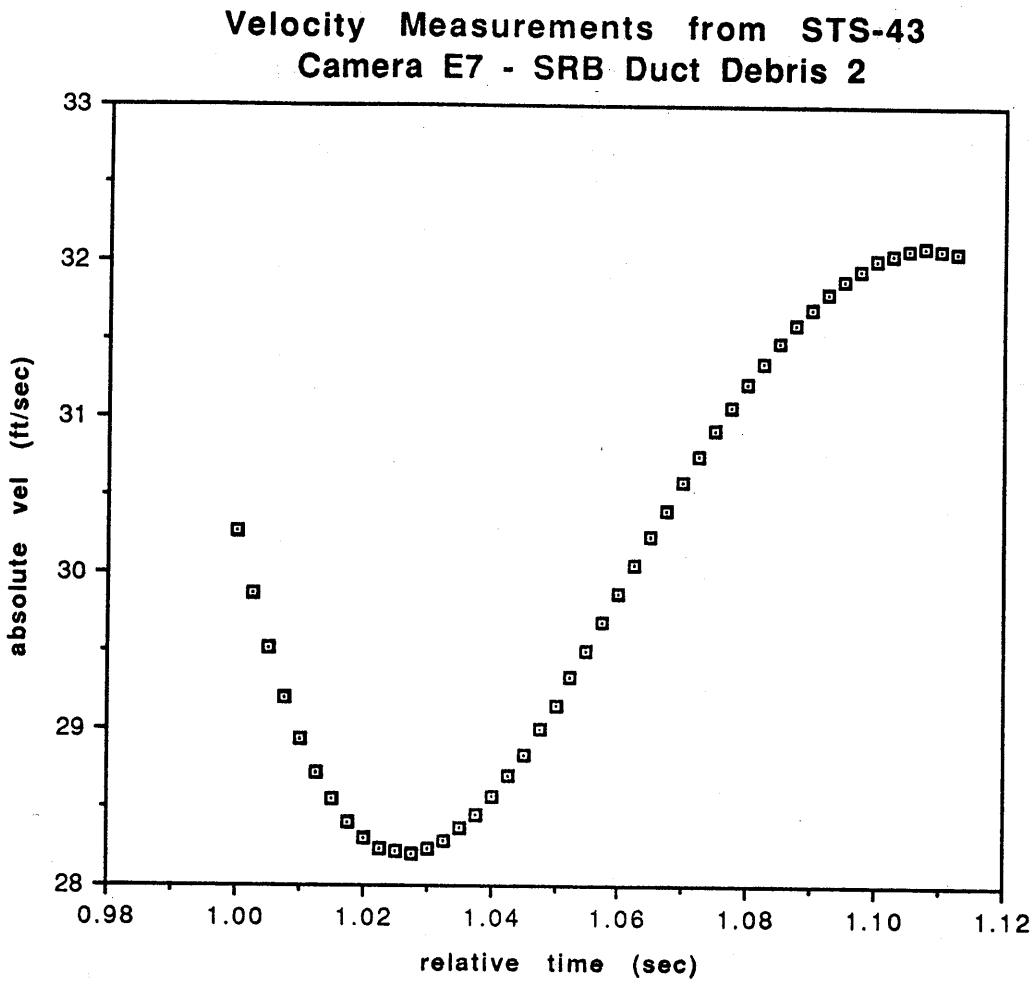
trajectory digitizations: STS43E7_1.LOG
STS43E7_2.LOG
STS43E7_3.LOG
STS43E14_1.LOG

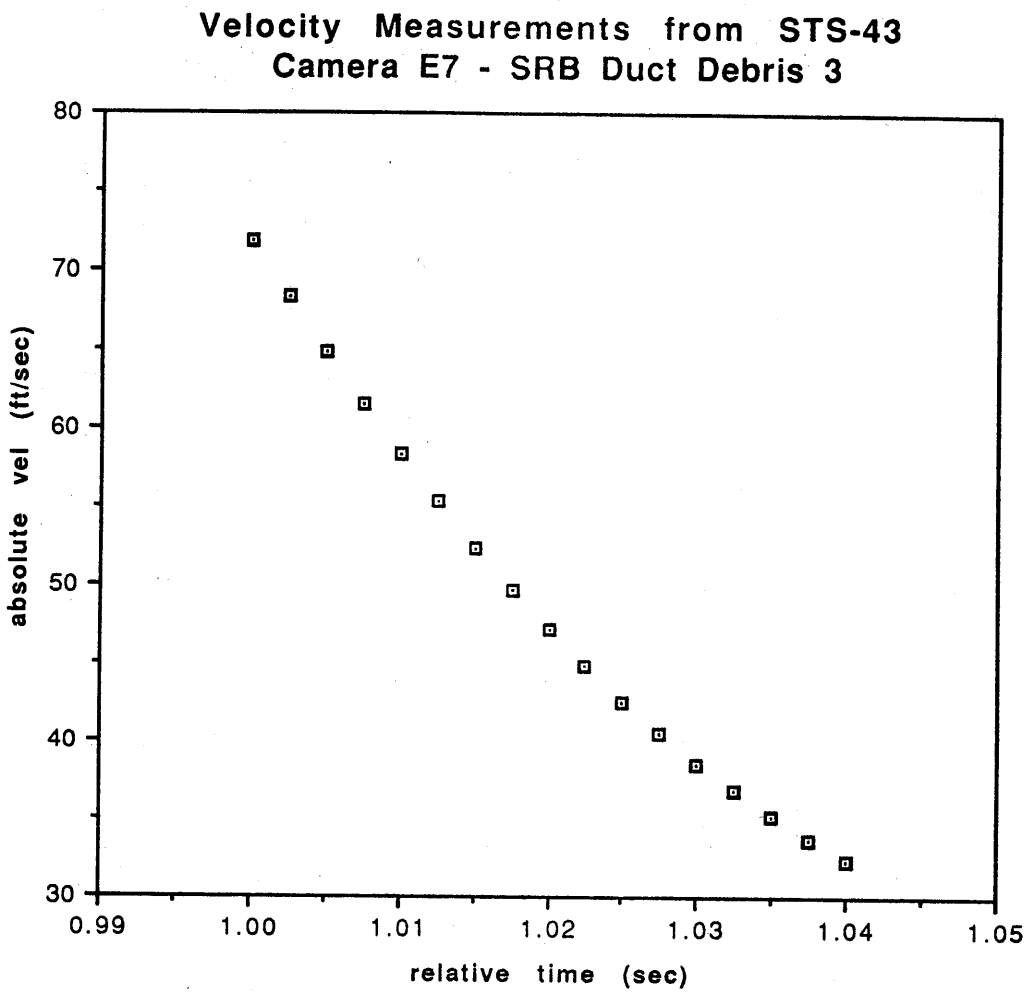
STS-43 Task 7 Velocity Measurements / SRB Duct Debris

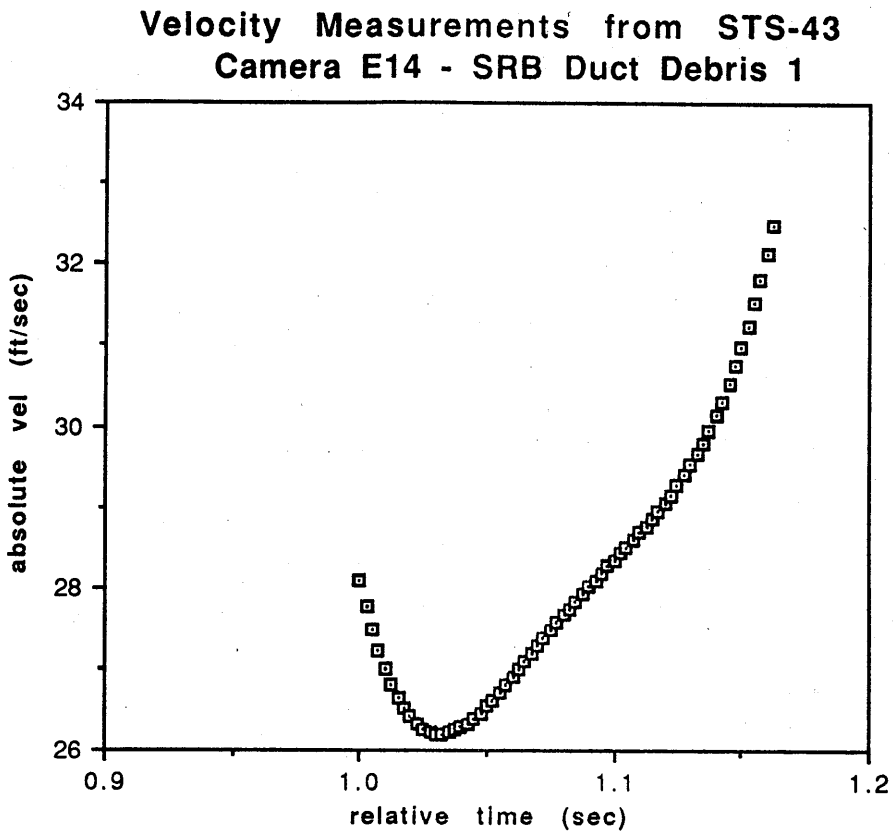
The goal in the velocity analysis is to model the path of a piece of debris as it exits the flame trough. Velocity is $\frac{\delta x}{\delta t}$. The spatial information is created by using the past software and the film motion analyzer at JSC. The temporal information is determined by using either the timing on the film or by the knowing the frame rate at which the film was recorded. The latter information will yield somewhat less precise results, but over a small amount of time, the error is negligible.

A cubic least squares curfit equation was applied to the input raw data. Then, the equation was differentiated with respect to time to determine the velocity. The values for velocity were then plotted using Cricket Graph.


Velocity Measurements from STS-43
Camera E7 - SRB Duct Debris 1
absolute velocity (ft/sec)
120
110
100
90
80
0.98
1.00
1.02
1.04
1.06
1.08
1.10
relative time (sec)


Velocity Measurements from STS-43
Camera E7 - SRB Duct Debris 2
absolute vel (ft/sec)
33
32
31
30
29
28
0.98
1.00
1.02
1.04
1.06
1.08
1.10
1.12
relative time (sec)


Velocity Measurements from STS-43
Camera E7 - SRB Duct Debris 3
absolute vel (ft/sec)
80
70
60
50
40
30
0.99
1.00
1.01
1.02
1.03
1.04
1.05
relative time (sec)


Velocity Measurements from STS-43
Camera E14 - SRB Duct Debris 1
absolute vel (ft/sec)
34
32
30
28
26
0.9
1.0
1.1
1.2
relative time (sec)

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 8

Request Date : 06/21/91
Completion Date : 8/9/91

Requestor : Troy Welch
Phone : 483-3335
Mail Code : VF

Analyst Name	Phone Number	Assignment
Team		Screen & Report

Task Title

STS-43 ET Tanking Screening

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Screen and tape the first 2 hours of ET tanking for STS-43.
2) Review MER and PAO views during real time to identify any anomalies.
3) Report to MER

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
8

Title : STS-43 ET Tanking Screening

Analysts : M. Snyder, B. Gastineau
Date : 7/25/91

Camera Number :
Frame Number :
GMT :

Requestor : Troy Welch
Phone : 483-3335
Mail Code : VF

Description of Analysis

See attached

Image Analysis Tools & Techniques

STS-43 Tanking
07/24/91

205:06:20:20	Recorders started. E-071 shown.
205:06:25:25	E-047 shown (not a view of orbiter).
205:06:35:00	T-6:00:00 countdown started. Tanking begins.
205:06:35:45	E-001 TSM umbilical shown.
205:06:36:40	Views begin to rotate between E-063, E-054, and E-009 views at approximate 15 second intervals.
205:06:42:07	E-063 Vapor noted above cable tray elbow in LH2 umbilical area.
205:06:44:10	E-009 Vapor noted in LH2 umbilical.
205:06:46:47	E-054 View pans up LOX line of external tank.
205:07:13:45	E-054 Vapor noted from LH2 umbilical area.
205:07:20:52	E-009 Vapor noted around LO2 umbilical area.
205:07:21:09	E-063 Vapor noted from 4 inch recirculation line.
205:07:22:52	Recorder stopped. Tapes replaced.
205:07:23:37	Recorders started.
205:07:25:53	E-063 Vapor noted above 17 inch line
205:07:39:25	E-054 View zooms in on LH2 4 inch recirculation line.
205:07:42:09	E-063 Liquid noted under cable tray. E-054 Liquid noted from 4 inch recirculation line.
205:07:46:23	E-009 View zoomed in.
205:07:52:00	E-063 Liquid noted above 17 inch line.

205:08:06:56	E-063 Stream of liquid noted falling along external tank.
205:08:07:15	E-054 Dark vapors noted.
205:08:26:18	Recorders stopped. Tapes replaced.
205:08:26:55	Recorders started.
205:08:27:30	E-054 View pans LO2 line.
205:08:28:00	E-063 Vapor and liquid formation continues.
205:08:34:16	E-054 Vapor noted from LO2 umbilical area.
205:08:37:27	E-009 Ice noted on LH2 umbilical.
205:09:16:30	Called MER. Failure on main engine controller unit. Possible scrub.
205:09:29:35	Recorders stopped. Tapes replaced.
205:09:30:10	Tapes started.
205:09:36:00	NASA Select transmission informs that tanking completed.
205:09:38:17	NASA Select transmission informs that launch is officially scrubbed due to #3 SSME controller unit failure.

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
8.01

Title : STS-43 ET Tanking Screening

Analysts : M. Snyder, R. Bhaskar
Date : 7/31/91

Camera Number :
Frame Number :
GMT :

Requestor : Troy Welch
Phone : 483-3335
Mail Code : VF

Description of Analysis

See attached

Image Analysis Tools & Techniques

STS-43 Tanking
07/31/91

213:06:40:00	Called MER/Tanking started
213:06:41:35	VCR-2 started (Timing encoded) cycling thru cameras 064, 009, 054, 063 (color)- Vapor noted from below 17" line (possibly helium plate purge)-(OTV054 unknown zoom view-appears to be of ET area-near and above 17" line)
213:06:46:31	Vapor noted from 4" line
213:06:50:00	Water drops noted from 4" recirculation line
213:06:52:00	Vapor from orbiter side of cable trax above 4" line
213:07:15:00	Vapor noted from purge port on 17" line
213:07:27:00	Vapor noted from 17" flange
213:07:47:00	Tape 2 started.
213:07:50:00	OTV064-Shows zoomed in image of 17" line purge vent area. Possible ice noted near vent-Vapor noted at vent area.
213:07:54:16	Lots of vapor noted from 17" and 4" lines-More water noted dripping from above FOV.
213:08:20:30	OTV054-Shows FOV pulled back to show whole umbilical area.
213:08:22:00	Apertures being opened and closed
213:08:26:00	OTV054-Zoomed in on cable tray bend and back out
213:08:27:15	OTV054-Zoomed in on the east side of LH_2 umbilical area.
213:08:39:00	OTV004-Vapors from GH_2 disconnect umbilical vent lines.
213:08:41:15	OTV002-Vapor is noted.
213:0841:30	OTV005-Unidentified view.

213:08:47:43 OTV008
OTV011-Color chart and circle
OTV012
OTV013
OTV014
OTV017

213:08:48:00 Tape stopped-repatching cables.

213:08:51:10 Tape 3 started-VCR3 also attempted.

213:08:59:00 OTV004-Vapor still noted on GH_2 disconnect-no ice visible from this view.

213:09:02:05 OTV010-Brief look at unidentified area (L-3 seconds) appears from camera schematic to be the GH_2 disconnect area.

213:09:10:22 OTV002-Brief view of OTV002.

213:09:10:39 Cycling cameras OTV054, 003, 009.

213:09:17:15 OTV054-Panned momentarily.

213:09:22:00 OTV005-Showing activity in crew loading area.

OTV009-Showing activity on platform.

OTV054-Panning.

213:09:25:00- OTV005-Activity in crew loading area.
213:09:36:00 OTV002
OTV001
OTV004

213:09:43:00 Called MER to verify end of tanking -Tapes stopped.

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
8.02

Title : STS-43 ET Tanking Screening

Analysts : J. Disler, L. Rovinelli
Date : 8/2/91

Camera Number :
Frame Number :
GMT :

Requestor : Troy Welch
Phone : 483-3335
Mail Code : VF

Description of Analysis

See attached

Image Analysis Tools & Techniques

TANKING STS-43
08/02/91

	Water drops noted falling from 4" and 17" lines prior to tape start and continuing.
214:06:42:00	Tapes started-Tanking begun. (No T-6 hour hold noted).
214:06:53:24	Called MER-Confirmed tanking has started (in chill down). There will be a T-3 hour hold.
214:06:56:48	OTV009-Vapor noted behind upper strut.
214:06:57:52	OTV063, OTV064-Same vapors.
214:07:05:10	OTV056-Vapor seen near orbiter-exact FOV unknown. Elevon and body flap visible, vapor not in vicinity of umbilicals.
214:07:09:10	View returns to OTV063,OTV064, and OTV009 switching between these every 10 seconds. No vapors at this time.
214:07:13:50	OTV063-Vapor noted near orbiter from purge vent port. (assume fast fill has begun).
214:07:16:05	OTV009-Vapor noted from 4" line orbiter side (possibly another purge vent). Drops noted still falling from 4" and 17" lines.
214:07:25:23	OTV008, OTV009, OTV006-Views shown.
214:07:25:54	OTV064-Moves to show close up of ET-exact position unknown.
214:07:26:32	OTV063, OTV009-Ice noted forming near the top of the baggie material at orbiter disconnect.
214:07:29:50	OTV064-Zooms out and returns to umbilical area.
214:07:42:00	VCR#3 stopped-tape replaced.

214:07:42:00	VCR#2 stopped-tape replaced.
214:07:46:00	OTV063, OTV009-Vapors appear to be coming from 4" flange ET side, also from below the FOV of unknown origin.
214:07:48:35	OTV063-Odd (different or thick-like) droplets noted falling from 4" flange ET side.
214:07:58:00	OTV009-Possible vapors noted below 17" line coming from flanges.
214:08:25:40	OTV063-Vapor noted to have greenish tint.
214:08:44:30	VCR#3 stopped-tape replaced.
214:08:44:30	VCR#2 stopped-tape replaced.
214:09:03:18	OTV063-Amount of drops falling from umbilical area seems to have increased.
214:09:26:55	No change from previous entries.
214:09:42:00	Tanking complete-Tanking appeared to be very normal.
214:09:42:44	Tapes stopped.

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 9

Request Date : 08/02/91
Completion Date : 8/2/91

Requestor : Photo/TV
Phone : 483-5336
Mail Code : C23

Analyst Name	Phone Number	Assignment
L. Rovinelli		

Task Title

Review past missions for horizontal motion at liftoff

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Review past missions for horizontal motion at liftoff on camera OTV-051
2) Compare to motion seen on STS-43
3) Document results

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
9

Title : Review past missions for horizontal motion at liftoff

Analysts : L. Rovinelli
Date : 8/2/91

Camera Number : *
Frame Number :
GMT :

Requestor : Photo/TV
Phone : 483-5336
Mail Code : C23

Description of Analysis

*OTV-051, OTV-151

In comparing OTV-051 from STS-40 and STS-39, no substanial difference was noted. STS-40 had slightly less motion.

Image Analysis Tools & Techniques

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 10

Request Date : 08/03/91
Completion Date : 08/12/91

Requestor : MER/Cochran
Phone : 483-4912
Mail Code :

Analyst Name	Phone Number	Assignment
C. Sapp		
C. Dailey		

Task Title

Characterize on orbit crescent shaped debris

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Capture video scenes of crescent shape debris
2) Extract as much information about the debris as possible from camera.
   -length
   -width
   -curvature
   -texture
   -color
   -tumble
3) Document results
4) Report to MMT/MER/Final Report

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
10

Title : Characterize on orbit crescent shaped debris

Analysts : C. Sapp
Date : 8/3/91

Camera Number : *
Frame Number :
GMT :

Requestor : MER/Cochran
Phone : 483-4912
Mail Code :

Description of Analysis

*Camcorder

Digitized 691 frames of video to RTDD volume #1.
Camera was zoomed in and out twice. Will attempt to create an animation sequence with constant zoom and rotation about line of sight removed.
Mult save CORV 507, 626, 2
Wrote program MREG for registering a sequence of images.
Using frame 153 for broad side view length = (287,221) to (294, 302)
Several measures of width
(285,229) to (291,229)
(284,239) to (291,239)
(285,250) to (291,250)
(286,261) to (292,261)
(288,272) to (293,272)
(288,281) to (294,281)
(291,292) to (296,292)
Using frame 61 for side on view length (243,302) to (274,234)
width (268,239) to (272,240)
(266,248) to (270,249)
(264,254) to (269,256)
(259,267) to (263,268)
(254,278) to (257,279)
(249,287) to (252,288)
Define curvature using frame 597 (PIXVAL)

Image Analysis Tools & Techniques

CURVE.XLS

X	Y	X0	Y0	Dist	StDev	Slope1	Slope2	Angle
369	237	436.5217	379.3731	157.5731	0.301829	2.108555	0.671928	30.72869
367	237			158.4404				
366	238			157.9863				
305	291			158.4543				

Excel 3.0 Answer Report
Worksheet: CURVE.XLS
Report Created: 8/3/91 7:42 PM

Target Cell (Min)

Cell	Name	Original Value	Final Value
F2	StDev	16.82007956	0.301829297

Adjustable Cells

Cell	Name	Original Value	Final Value
C2	X0	350	436.5216532
D2	Y0	250	379.373099

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
C2	X0	436.5216532	C2<=800	Not Binding	363.4783468
C2	X0	436.5216532	C2>=-400	Not Binding	836.5216532
D2	Y0	379.373099	D2<=800	Not Binding	420.626901
D2	Y0	379.373099	D2>=-800	Not Binding	1179.373099

Microsoft Excel 3.0 Limits Report
Worksheet: CURVE.XLS
Report Created: 8/3/91 7:42 PM

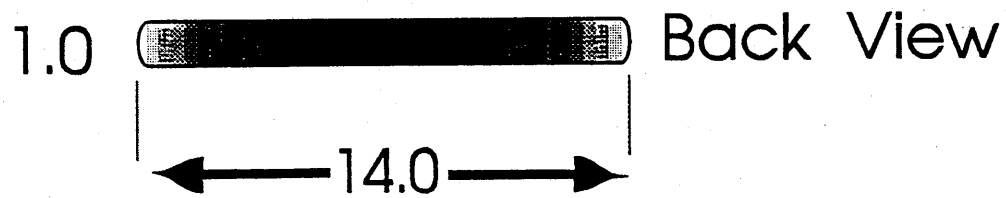
	Target	
Cell	Name	Value
F2	StDev	0.301829297

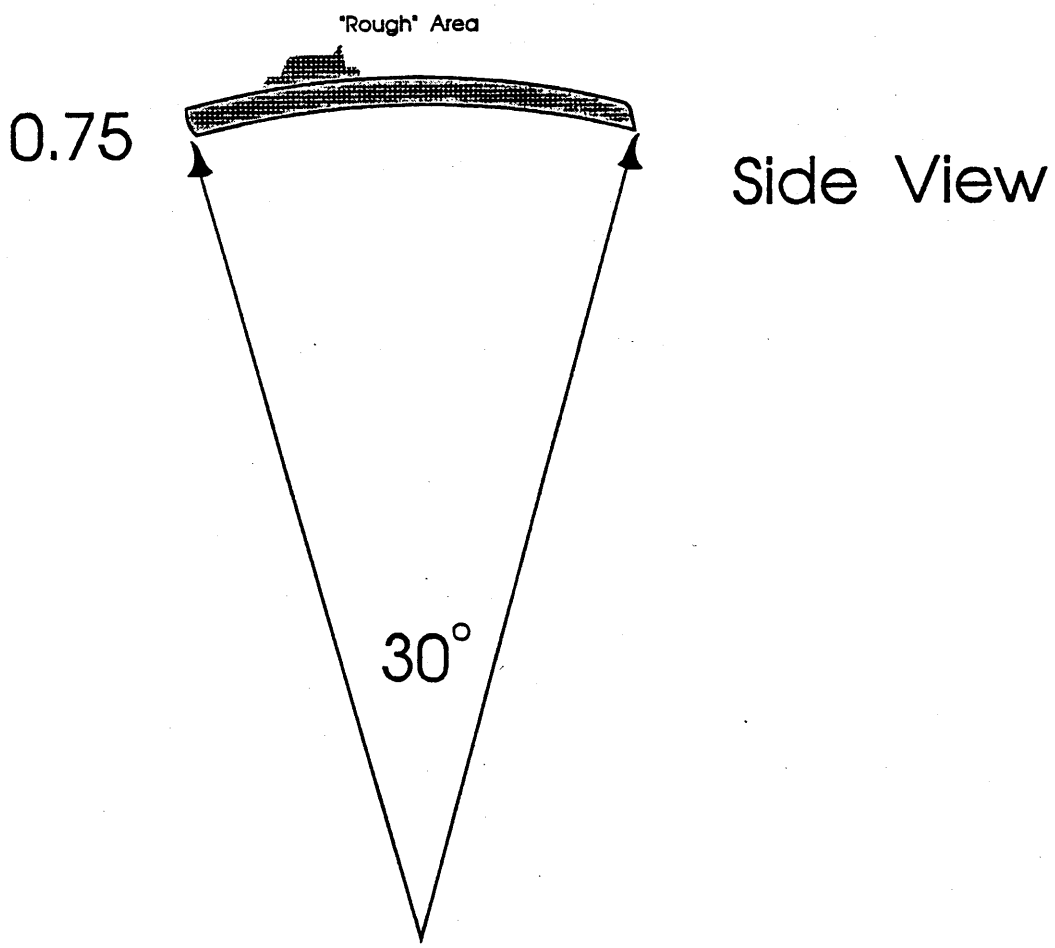
	Adjustable		Lower	Target	Upper	Target
Cell	Name	Value	Limit	Result	Limit	Result
C2	X0	436.5216532	-400	21.10868241	800	14.32263402
D2	Y0	379.373099	-800	17.6436393	800	12.25350585

STS-43R							
Task #10							
Side View							
	X_1	Y_1	X_2	Y_2	Dist		
Length	243	302	274	234	74.73286		
Width	268	239	272	240	4.123106	4.485528	
	266	248	270	249	4.123106	4.485528	
	264	254	269	256	5.385165	5.858523	
	259	267	263	268	4.123106	4.485528	
	254	278	257	279	3.162278	3.440243	
	249	287	252	288	3.162278	3.440243	
					4.013173	4.365932	
Back View							Side/Back
	X_1	Y_1	X_2	Y_2	Dist		0.750853242
Length	287	221	294	302	81.30191		
Width	285	229	291	229	6		
	284	239	291	239	7		
	285	250	291	250	6		
	286	261	292	261	6		
	288	272	293	272	5		
	288	281	294	281	6		
	291	292	296	292	5		
					5.857143		

STS-43R

On-Orbit Crescent-Shaped Debris





NOTE: Linear measurements are unit-less.
No true scaling available.

From: SN::DAILEY 3-AUG-1991 17:22:51.26
To: @PHOTOTV
CC:
Subj: On orbit debris report

STS 43 TASK #10

At about 23:00 MET a down link of the TDRSS deploy contained about 22 seconds of video of a piece of curved debris to the right of the left OMS pod (to the left of the Orbiter).

From the video screening, the piece was characterized as curved, having a thin dimension along the curve and a wider dimension perpendicular to the curve. The piece is much longer than it is wide. The piece tumbles in the field of view. During the tumbling, the object apears to change from light (white) to dark (grey to black). The dark and light appearance of the piece is most likely due to shades rather than a real color difference. The convex side of the piece has a roughness to the surface. The concave side appeared smoother.

This debris has may characteristics that are similar to debris seen on STS 41 and STS 35. On those missions, the debris was determined to be ice which came from the SSME bell.

The voice transmission accompanying the video went like this:

ORBITER: Now I want everbody to start looking here pretty close. During the deploy sequence right afterwards look at that big piece of something come out of the back of the vehicle. We got that on camcorder. Jeff did a good job of that. You all take a look at that. That came off the back of the vehicle.

CAPCOM: Yes we can see that.

ORBITER: Okay we don't know what it is but you can look at it there.

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 11

Request Date : 08/03/91
Completion Date : 08/07/91

Requestor : MER/Cochran
Phone : 483-4912
Mail Code :

Analyst Name	Phone Number	Assignment
Team		

Task Title

Characterize debris aft of vertical stabilizer - 43 sec

Objectives

Hypothesis

Reporting

Analysis Strategy

Light debris fall aft of the vertical stabilizer at approximately 43 seconds.

1) Identify all films/videos this is seen on
2) Characterize the piece in an attempt to identify its source.
   - Try to estimate size, shape, color, and relative velocity, etc.
3) Document results
4) Report to MER, MMT, Final Report

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
11

Title : Characterize debris aft of vertical stabilizer - 43 sec

Analysts : C. Sapp
Date : 8/3/91

Camera Number : ET212
Frame Number :
GMT :

Requestor : MER/Cochran
Phone : 483-4912
Mail Code :

Description of Analysis

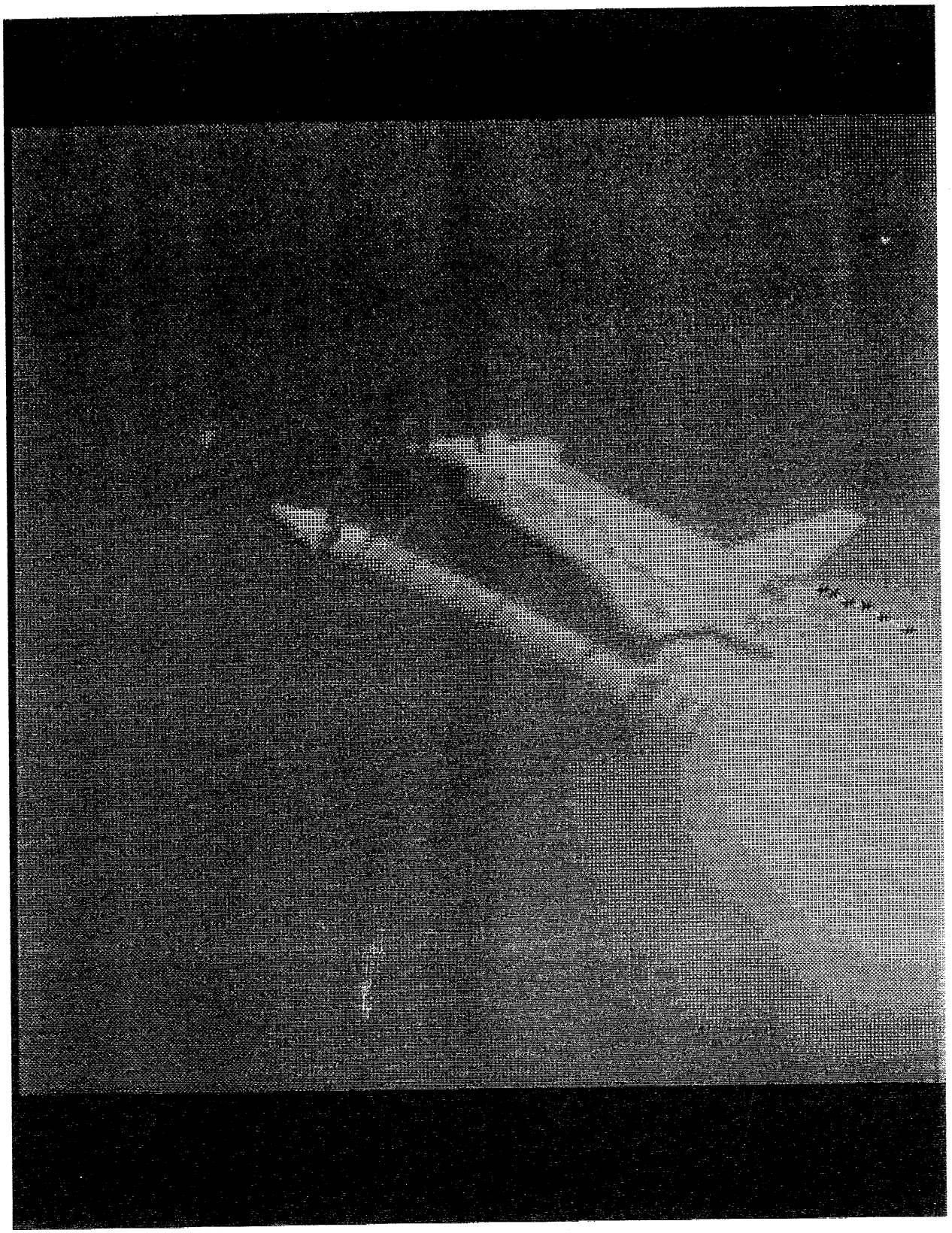
From 32, 33, 34
Saved three frames to [STS.LAUNCH.ET212]
TAIL032.PIC to TAIL034.PIC used MINTRLV to de-interleave images used MLOAD to put de-interleaved images to memory, and PIXVAL to measure positions. Data stored in TAIL.DAT
SRB diameter: (230, 225) to (255, 213)

Image Analysis Tools & Techniques

STS-43P
TAST #11
CAM ET 212

X,	Y,	VALUE,	CHANNEL
261,	60,	166,	0
259,	55,	167,	1
254,	47,	168,	2
252,	38,	169,	3
246,	29,	174,	4
239,	16,	178,	5

Mission STS-43R			**Camera ET-212**			
Task #11						
	Pixels	Feet	Fpp			
SRB Diam	27.73085	12.17	0.438861			
	X	Y	dX	dY	dist	**Vel (ft/sec)**
	261	60	-2	-5	5.385165	**323.11**
	259	55	-5	-8	9.433981	**566.04**
	254	47	-2	-9	9.219544	**553.17**
	252	38	-6	-9	10.81665	**649.00**
	246	29	-7	-13	14.76482	**885.89**
	239	16				



Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
11.01

Title : Characterize debris aft of vertical stabilizer - 43 sec

Analysts : B. Gastineau, S. Israel
Date : 8/7/91

Camera Number : E223
Frame Number : *
GMT :

Requestor : MER/Cochran
Phone : 483-4912
Mail Code :

Description of Analysis

*4845-4859

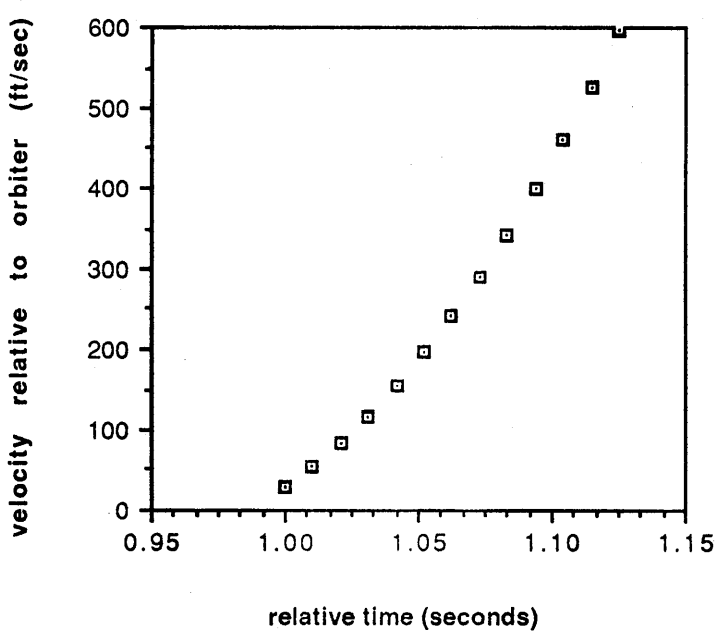
See attached

Image Analysis Tools & Techniques

STS-43 Task 11
Velocity of Debris at 43 seconds
08/07/91

The Film Motion Analyzer and the PAST software stored on the VDAS computer were used to measure the velocity relative to the orbiter of the piece of debris (currently expected to be a piece of the thermal blanket around SSME #2) at approximately 43 seconds after liftoff. Frames 4845-4859 of film E223 were used. The aft tip of the vertical stabilizer and the nose of the orbiter were used as stationary points. The film was assumed to have a frame rate of 96 frames per second. The diameter of the SRB was used as a scaling object. The SRB has a known diameter of 12.17 feet and was measured to have a diameter of 9.482 fmaus to produce a scaling factor of 0.7792 fmaus per foot. The following graph is the relative velocity of the debris found from cubic least squares fits of the positional data in both the x and y coordinates. The graph data is determined functionally and therefore shows no experimental error. The debris was found by this method to have a velocity ranging from 29 ft/sec at aquisition 600 ft/sec prior to exiting sight. This same measurement made using video ET212 and LIPS software found the debris to have a velocity range from 323.11ft/sec at aquisition and 883.89 ft/sec prior to exiting site. **NOTE:** Both measured velocities are in two-dimensions and no compensation is made for motion parallel to the camera's optical axis. The difference in measured velocities is likely due to the different viewing angles and possible differences in the viewing times.

STS 43 - Debris at 43 Seconds MET



File Storage: FMA digitization : S43E223_BLA.LOG
1)tail tip 2)nose tip 3)debris

Summary of Analysis of Visual Events
STS-43
09/17/91

Task Number
11.02

Title : Characterize debris aft of vertical stabilizer - 43 sec

Analysts : M. Watson
Date : 09/11/91

Camera Number : E220
Frame Number : *
GMT :

Requestor : MER/Cochran
Phone : 483-4912
Mail Code :

Description of Analysis

*4621-4629

Using FMA, points were taken in an attempt to determine the size of the debris at 43 seconds. These points were saved in [WATSON.STS43] 43SEC_DEBRIS_SIZE.LOG. They were then re-formatted and saved as STS43_RAW.DAT in order to used Excel on them. Using Excel, the sizes ranged from 33.28 sq. inches (max) to 22.72 sq. inches (min). The average was 28.15 sq. inches. This information was saved as (43 Second Debris Final) on the Mac. The debris appeared white in color.

See attached

Image Analysis Tools & Techniques

Size of 43 sec Debris

FRAME	PT. NUMBER	X	Y	SPEED BRAKE	ACTUAL (in)	SCALING FACTOR	DIST 1-4	AREA	AREA (sq in)
4621	1	252.54	136.16	19.44629528	199.2	10.24359638			
4621	2	239.34	150.44						
4621	3	229.66	142.56				2.62030533	2.77932429	28.4702762
4621	4	229.7	139.94				1.46164291		
4621	5	231.1	140.36				1.18270876		
4621	6	231.02	141.54				1.7		
4629	1	251.2	138.5	19.23065262	199.2	10.35846281			
4629	2	238.08	152.56						
4629	3	208.68	116.22				3.1141612	2.71564127	28.1298691
4629	4	208.22	113.14				1.10163515		
4629	5	209.32	113.08				1.81603965		
4629	6	210.1	114.72				2.06552657		
4626	1	251.68	137.32	19.44037037	199.2	10.24671836			
4626	2	238.36	151.48						
4626	3	219.14	127.8				2.66908224	2.21666222	22.7135135
4626	4	218.92	125.14				0.95707889		
4626	5	219.86	125.32				1.96305884		
4626	6	220.16	127.26				1.15412304		
4623	1	252.12	136.7	19.28921979	199.2	10.32701178			
4623	2	239	150.84						
4623	3	227.26	137.94				3.13438989	3.22270582	33.2809209
4623	4	226.96	134.82				1.06733313		
4623	5	228	134.58				2.90441044		**AVERAGE**
4623	6	228.16	137.48				1.0107423		28.1486449

Camera E220

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 12

Request Date : 08/05/91
Completion Date : 08/13/91

Requestor : D. Pitts
Phone : 483-5066
Mail Code : SN15

Analyst Name	Phone Number	Assignment
S. Israel	244-5106	

Task Title

Measurement of dislodged blanket on SSME #2

Objectives

Hypothesis

Reporting

Analysis Strategy

Goal: Determine length and depth of detachment of SSME #2 thermal blanket at the 10 o'clock position.

Steps: Determine the actual distance of an object in the field of view. Primary thrust RCS set = 10.5". Measure known object along same axes as the dimensions of the dislodged part of B blanket. Solve for dislodge dimensions according to

$$\text{Actual Dimensions} = \frac{\text{Known target (actual)} * \text{unknown target (digitized)}}{\text{Known target (digitized)}}$$

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
12

Title : Measurement of dislodged blanket on SSME #2

Analysts : S. Israel
Date : 8/12/91

Camera Number :
Frame Number :
GMT :

Requestor : D. Pitts
Phone : 483-5066
Mail Code : SN15

Description of Analysis

See attached

Image Analysis Tools & Techniques

STS-43 Task 12 Measuring the Amount of Beta Blanket Detachment

The goal of this analysis was to quantify how much the beta blanket from SSME #2 had detached from the SLV. In this case two dimension were measured, circumferential and longitudinal. The spatial information is created by using the past software and the film motion analyzer at JSC. The amount of detachment was digitized on 4 frames. The mean value for the 4 digitization was determined to be the actual dimensions.

In this analysis, the primary thrust RCS jet was in the field of view. The primary thruster is 10.5 inches in diameter. The diameter was digitally measured in the dimensions that the beta blanket appeared to be detached. The assumption is that the objects are in oriented in along parallel planes. Then knowing the aspect ratio between the objects and the actual diameter of the RCS thruster, the actual dimensions of the detached part of the blanket could be determined.

$$\text{Actual Dimension} = \frac{\text{actual distance-object} * \text{digitized distance-unkown}}{\text{digitized distance-object}}$$

Raw Data from the Film Motion Analyzer			diameter RCS jet	10.5	inches			
x values	y values	frame number	distance between		Calculated distance between			
272.5	122.18	4697	points-FMA		points- inches			
254.64	116.16	4697	18.8473		10.925			
263.16	120.16	4697						
264.95999	118.42	4697	2.5035		1.8706		Average Distance	
144.88	97.34	4697					in inches	
127.74	91.48	4697	18.1141				10.852	tangent
132.7	100.52	4697						
138.32001	87.64	4697	14.0527				1.8123	normal
272.70001	122.88	4701						
254.88	116.56	4701	18.9075		11.3629			
262.67999	120.72	4701						
264.14001	118.82	4701	2.3962		1.8311			
145.08	98.78	4701						
129.02	91.9	4701	17.4716					
132.48	100.96	4701						
139.28	89.02	4701	13.7406					
272.60001	123.56	4703						
256.5	118.06	4703	17.0135		10.5866			
263.39999	121.62	4703						
265.35999	119.86	4703	2.6342		1.9557			
144.84	99.78	4703						
129.56	92.62	4703	16.8744					
133.2	102.12	4703						
140.32001	89.9	4703	14.1429					
272.73999	125.38	4705						
256.45999	119.32	4705	17.3713		10.5333			
264.48001	123.48	4705						
265.48001	121.68	4705	2.0591		1.5917			
145.10001	101.64	4705						
129.66	93.8	4705	17.3165					
133.28	104.02	4705						
139.72	92.06	4705	13.5836					

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 13

Request Date : 08/12/91
Completion Date : 09/04/91

Requestor : Chris Dailey
Phone : 483-5336
Mail Code : C23

Analyst Name	Phone Number	Assignment
M. Snyder		
R. Bhaskar		

Task Title

Characterize SSME plume

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Time events
2) Document results

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
13

Title : Characterize SSME plume

Analysts :
Date : 08/15/91

Camera Number :
Frame Number :
GMT :

Requestor : Chris Dailey
Phone : 483-5336
Mail Code : C23

Description of Analysis

See attached

Image Analysis Tools & Techniques

Film motion analyzer
PAST software
Cricket Graph

STS - 43

8/5/91 **Camera 204:** Good all around view. Normal recirculation and plume brightening are visable. Lots of SSME-SRB pre-recirculation interaction. Good view of shock condensation - pulsation visible. Two flares seen. White debris off aft stabilizer seen.

Camera 212: Good close-in view. Can see searchlight effect. Great early launch plume view. Can see Mach diamonds form. Good later view of SSME deforming SRB plumes. Little recirculation viewed. Six (6) flares seen.

Camera 222: Great close-in view. Good color, Digital Timing, short film. Can see several flares. Orange color on SSME #2 prior to SRB ignition (and Liftoff). Can see SSMEs turn on one at a time (pretty neat).

Camera 205: Bad lighting, Hazy. Saw ascent past SRB separation. No timing

Camera 206: Hazy. Recirculation seen, plume brightening up to SRB separation. Camera stayed with on of the boosters for quite a long time after Separation. Soft Focus.

Camera 208: Bad view of recirculation. Soft, Close In, Normal Events.

Camera 213: Close-in, Soft, overexposed.

8/6/91 **Camera E-2:** Close View of SSMEs prior to and just after lift off. Viewed on film analyzer. 8 Orange flashes noted,s specifics are:

EVENT		FRAME #	TIME SPAN
Flash 1	Start End	2636 2660	0.0625
Flash 2	Start End	2726 2737	0.0300
Flash 3	Start End	2933 2939	0.0175
Flash 4	Start End	2981 2984	0.0100
Flash 5	Start End	3059 3067	0.0225
Flash 6	Start End	3122 3127	0.0150
Flash 7	Start End	3288 3290	0.0075
Flash 8	Start End	3426 3436	0.0275
SRB Ignition		3574	2.35 seconds from first flash

N.B. film speed is 400 fps.

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 14

Request Date : 08/09/91
Completion Date : 08/27/91

Requestor : Hal Loden
Phone : 483-0503
Mail Code :

Analyst Name	Phone Number	Assignment
S. Israel		

Task Title

Measure height of vehicle above the threshold

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Assess landing films and video to determine which would be best to determine height above the threshold
2) Determine height of vehicle from runway as vehicle crosses the threshold
3) Report results to Hal Loden and in final report

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
14

Title : Measure height of vehicle above the threshold

Analysts : S. Israel
Date : 09/11/91

Camera Number :
Frame Number :
GMT :

Requestor : Hal Loden
Phone : 483-0503
Mail Code :

Description of Analysis

See attached

Image Analysis Tools & Techniques

STS-43 Task 14 Measurement of the Height of Vehicle Above the Threshold

The goal in this analysis is to determine the height of the vehicle above the threshold at landing. The photographic information is determined by using a Fowler caliper accurate to 1000th of an inch. The actual sizes were taken from the drawings of the Space Shuttle (Structures and Systems Location Right Side Basic Revision C, 1981). The photographic distance measured was the nose of the vehicle to the aft of the body flap. This distance was found to be 1377 inches in the Space Shuttle Coordinate System x direction and 50 inches in the z direction. As a check, the analysis was also performed with the speed break as reference. The speed brake is 201 inches in the Space Shuttle Coordinate System z direction.

This distance was determined by scaling distances from the photograph to actual sizes.

$$\frac{\text{distance of the orbiter on the photograph}}{\text{actual length of the orbiter}} = \frac{\text{height of vehicle above threshold}}{\text{actual height of vehicle}}$$

1. $$\text{actual height-vehicle} = \frac{\text{actual length of the orbiter*photographic height of vehicle}}{\text{distance of the orbiter on the photograph}}$$

2. $$\text{actual height-speed brake} = \frac{\text{actual length of the orbiter*photographic height of vehicle}}{\text{distance of the speed brake on the photograph}}$$

The length of the orbiter measured from an enlarged print was 5.897 inches and the corresponding length of the speed brake was measured as 0.820 inches. The distance from the threshold to the bottom of the right

main gear tire (the lowest point on the orbiter) was measured as 0.476 inches.

In the first case:

$$\text{actual height of the vechicle} = \frac{1377.098 \text{ inches} * 0.476 \text{ inches}}{5.897 \text{ inches}}$$

$$= 111.223 \text{ inches}$$

$$\text{actual height of the vechicle} = \frac{201.00 \text{ inches} * 0.476 \text{ inches}}{0.820 \text{ inches}}$$

$$= 116.678 \text{ inches}$$

Photo/TV Analysis Group Request Form
STS-43
09/11/91

Task Number --> 15

Request Date : 08/29/91
Completion Date : 09/03/91

Requestor : Chris Dailey
Phone : 483-5336
Mail Code : C23

Analyst Name	Phone Number	Assignment
B. Gastineau	244-5378	

Task Title

Analyze white cloud prior to HAC maneuver

Objectives

Hypothesis

Reporting

Analysis Strategy

1) Search for possible sources
2) Consult with engineers
3) Document findings

Summary of Analysis of Visual Events
STS-43
09/11/91

Task Number
15

Title : Analyze white cloud prior to HAC maneuver

Analysts : B. Gastineau
Date : 8/21/91

Camera Number :
Frame Number :
GMT :

Requestor : Chris Dailey
Phone : 483-5336
Mail Code : C23

Description of Analysis

See attached

Image Analysis Tools & Techniques

STS-43
White Cloud Prior to HAC Maneuver
08/23/91

A white cloud seeming to emanate from the orbiter was noted during landing footage from NASA Select video transmission (a yet unknown camera) at 223:12:18:40 (approximately 4 minutes 45 seconds before main gear touchdown). A white cloud was also visible in film E845. The audio accompanying NASA Select video in this time period is thought to say:

Ground Personnel: *"Atlantis, Houston. For Baks on R-4, landing gear isol valve two open."*
Onboard Personnel: *"Roger. Complete."*
with the white cloud's appearance occurring just prior to the onboard personnel's statement. The accuracy of this conversation has not been confirmed.

Through discussion with Karen Frank (#3-8297) it was learned that due to APU #2 being down, this landing gear valve had to be opened manually. She discussed this action with another NASA engineer and determined that there was no relation between this isolation valve being opened and the appearance of the white cloud. This conclusion came due to the forespoken valve being part of a closed system. She did inform me that the appearance of the white cloud also coincided with the firing of 2 left yaw jets. Her impression was that the cloud would be more likely to be related to these RCS firings than the isolation valve opening.

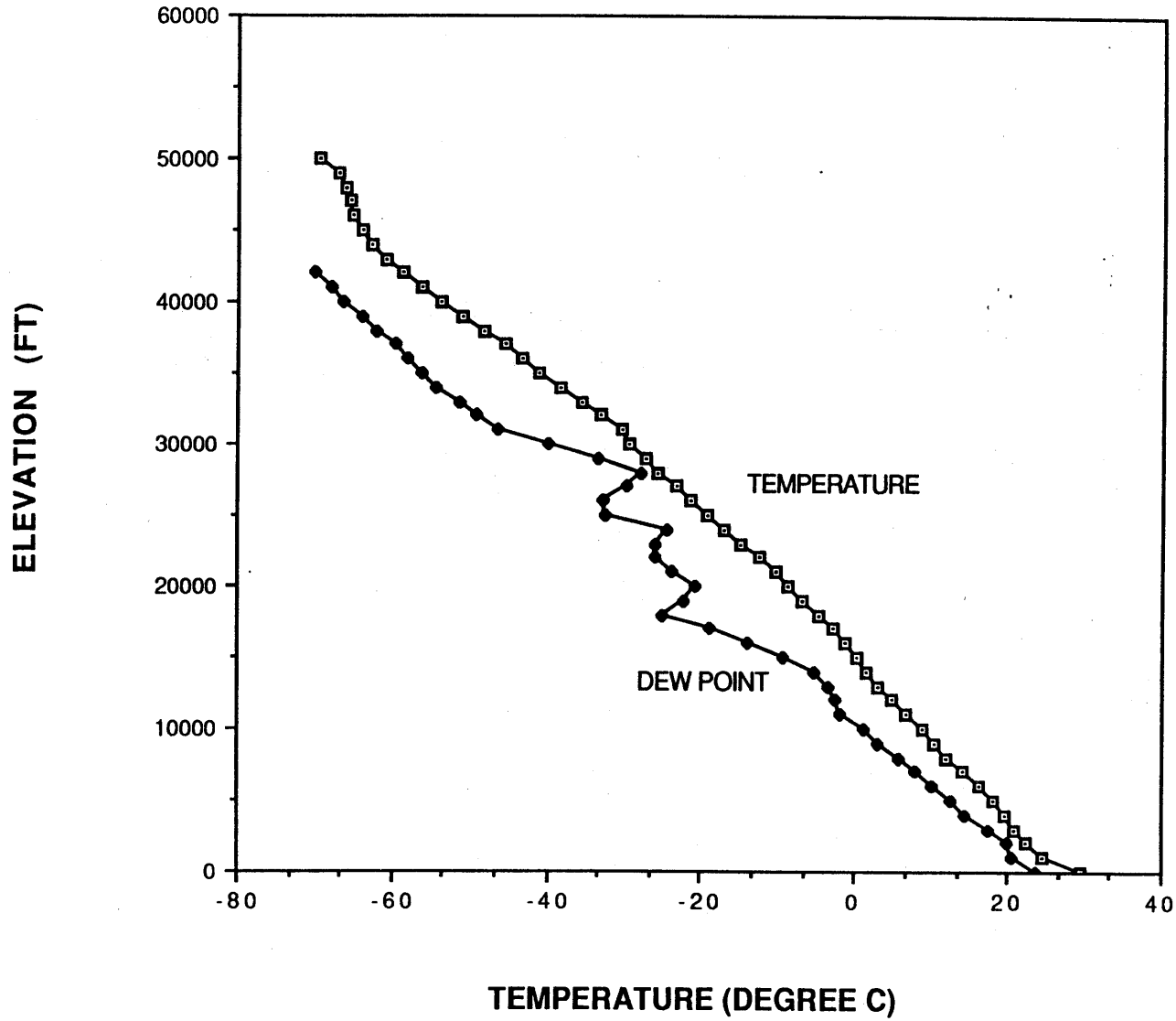
Other circumstances surrounding the landing which might be related include:
1) a large amount of liquid (expected to be condensation) noticed on the oxygen umbilical during post-landing inspection, and
2) a red liquid (expected to be hydraulic fluid) was seen on the left main landing gear during post-landing inspection.

CONCLUSION

Data available at this time indicates that the white cloud was due to the firing of the two left rear RCS jets.

Rawinsonde Data

STS-43 LAUNCH SOUNDING



STS-43 LNCH SPRD SHT

Mon, Sep 9, 1991 6:51 PM

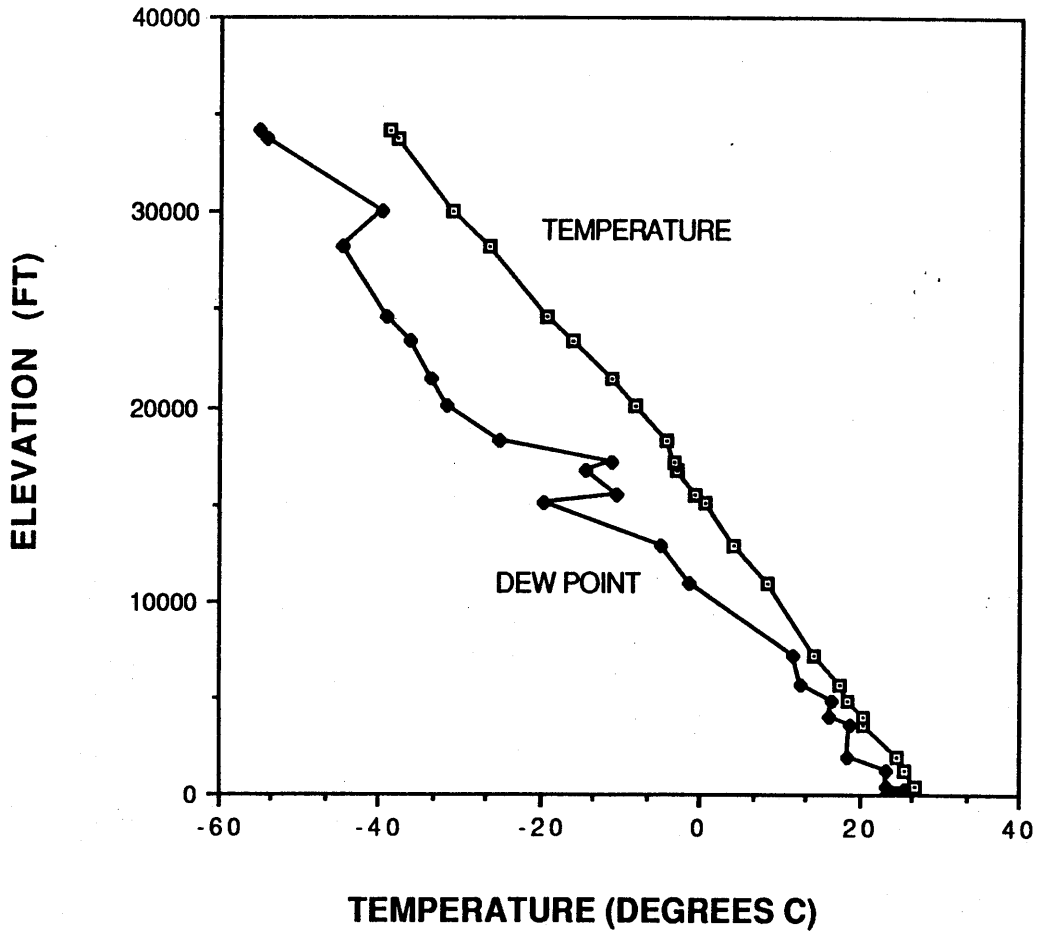
	ALT (FT)	DIR	SPD (KT)	SHR	TEMP (C)	DPT (C)	PRESS (MB)
1	16.000	170.000	8.000	0.000	29.500	23.800	1018.700
2	1000.000	181.000	15.300	0.013	24.600	20.600	984.850
3	2000.000	185.000	15.300	0.002	22.300	20.100	951.270
4	3000.000	198.000	13.900	0.006	20.800	17.600	918.600
5	4000.000	212.000	13.700	0.006	19.500	14.400	886.880
6	5000.000	215.000	13.800	0.001	18.200	12.400	856.090
7	6000.000	212.000	13.300	0.001	16.300	10.200	826.200
8	7000.000	212.000	12.800	0.001	14.100	8.000	797.120
9	8000.000	214.000	12.700	0.001	11.800	5.800	768.840
10	9000.000	219.000	13.900	0.003	10.500	3.000	741.380
11	10000.000	219.000	14.700	0.001	8.800	1.200	714.760
12	11000.000	216.000	14.000	0.002	6.800	-1.900	688.910
13	12000.000	206.000	14.000	0.004	4.800	-2.500	663.810
14	13000.000	193.000	15.000	0.006	3.100	-3.400	639.480
15	14000.000	186.000	15.100	0.003	1.300	-5.400	615.890
16	15000.000	184.000	14.400	0.002	0.100	-9.400	593.040
17	16000.000	183.000	13.800	0.001	-1.400	-13.900	570.920
18	17000.000	179.000	13.200	0.002	-2.800	-18.800	549.500
19	18000.000	172.000	11.800	0.003	-4.600	-25.200	528.760
20	19000.000	167.000	10.000	0.004	-6.900	-22.300	508.660
21	20000.000	157.000	9.100	0.003	-8.600	-20.800	489.180
22	21000.000	146.000	8.100		-10.400	-23.800	470.320
23	22000.000	131.000	7.100	0.004	-12.400	-26.100	452.070
24	23000.000	114.000	8.600	0.004	-14.900	-26.000	434.370
25	24000.000	103.000	11.800	0.006	-17.200	-24.500	417.210
26	25000.000	94.000	13.700	0.005	-19.100	-32.600	400.600
27	26000.000	85.000	15.900	0.005	-21.400	-32.800	384.520
28	27000.000	80.000	18.500	0.005	-23.200	-29.700	368.960
29	28000.000	80.000	21.800	0.006	-25.600	-28.000	353.920
30	29000.000	81.000	26.400	0.008	-27.100	-33.300	339.370
31	30000.000	80.000	30.800	0.007	-29.300	-40.000	325.320
32	31000.000	78.000	32.800	0.004	-30.400	-46.300	311.760
33	32000.000	81.000	34.100	0.003	-33.100	-49.100	298.670
34	33000.000	83.000	34.900	0.003	-35.700	-51.200	285.990
35	34000.000	85.000	35.600	0.002	-38.500	-54.300	273.710
36	35000.000	85.000	37.300	0.003	-41.100	-56.400	261.820
37	36000.000	84.000	39.700	0.004	-43.400	-58.200	250.340
38	37000.000	81.000	40.700	0.005	-45.500	-59.700	239.260
39	38000.000	77.000	39.900	0.004	-48.300	-62.000	228.560
40	39000.000	76.000	40.300	0.002	-51.000	-64.100	218.220
41	40000.000	70.000	40.000	0.007	-53.900	-66.300	208.220
42	41000.000	62.000	39.600	0.009	-56.100	-68.000	198.570

STS-43 LNCH SPRD SHT

Mon, Sep 9, 1991 6:51 PM

	ALT (FT)	DIR	SPD (KT)	SHR	TEMP (C)	DPT (C)	PRESS (MB)
43	42000.000	62.000	39.100	0.001	-58.800	-70.200	189.260
44	43000.000	70.000	37.400	0.010	-60.900		180.300
45	44000.000	80.000	33.200	0.013	-62.600		171.680
46	45000.000	84.000	28.500	0.009	-64.100		163.430
47	46000.000	82.000	23.300	0.009	-65.100		155.510
48	47000.000	83.000	19.000	0.007	-65.400		147.970
49	48000.000	88.000	15.700	0.006	-66.100		140.770
50	49000.000	89.000	12.600	0.005	-67.100		133.900
51	50000.000	82.000	10.800	0.004	-69.600		127.310

STS-43 LANDING SOUNDING



sts43lndg sprd sht1

Mon, Sep 9, 1991 6:53 PM

Column 9

	elevation(ft)	wind direction	velocity(kt)	temp (c)	dew point(c)	pressure(mb)	i r	relative hum
1	16.000	170.000	4.000	24.200	23.300	1018.500	387.000	95.000
2	151.000	189.000	8.000	26.500	25.700	1013.800	400.000	95.000
3	285.000	204.000	6.000	26.600	25.600	1009.100	398.000	94.000
4	420.000	214.000	5.000	27.100	23.400	1004.500	379.000	80.000
5	1228.000	221.000	4.000	25.800	23.500	977.000	375.000	87.000
6	1971.000	228.000	5.000	24.600	18.400	952.300	337.000	68.000
7	3604.000	224.000	6.000	20.600	18.700	899.700	331.000	89.000
8	4036.000	224.000	7.000	20.300	16.300	886.200	315.000	78.000
9	4801.000	222.000	8.000	18.500	16.400	862.600	312.000	88.000
10	5610.000	212.000	9.000	17.600	12.700	838.200	289.000	73.000
11	7206.000	193.000	11.000	14.300	11.700	791.800	276.000	84.000
12	10882.000	209.000	5.000	8.500	-1.400	692.800	217.000	50.000
13	12818.000	213.000	7.000	4.200	-5.000	644.900	201.000	51.000
14	15042.000	222.000	7.000	0.600	-19.600	593.200	175.000	20.000
15	15513.000	217.000	6.000	-0.700	-10.500	582.700	180.000	47.000
16	16732.000	196.000	2.000	-3.100	-14.400	556.200	170.000	41.000
17	17184.000	177.000	2.000	-3.300	-11.200	546.700	171.000	54.000
18	18201.000	142.000	1.000	-4.300	-25.000	525.700	156.000	18.000
19	20074.000	229.000	3.000	-8.300	-31.500	488.800	146.000	13.000
20	21401.000	223.000	6.000	-11.200	-33.600	463.900	139.000	14.000
21	23397.000	201.000	12.000	-16.100	-36.200	428.400	131.000	16.000
22	24609.000	190.000	10.000	-19.200	-39.000	407.800	126.000	15.000
23	28188.000	261.000	5.000	-26.500	-44.600	351.600	111.000	16.000
24	29969.000	318.000	4.000	-30.900	-39.700	326.000	106.000	41.000
25	33727.000			-37.900	-54.200	227.000	91.000	
26	34190.000			-38.700	-55.200	271.400	90.000	
27								
28								
29								
30								

STS-43 Day of Launch First Stage Trajectory Data

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
AERODYNAMIC SUMMARY

TIME (SEC)	MACH (ND)	ALPHA (DEG)	BETA (DEG)	BANK (DEG)	DYN PRESS (PSF)	QALPHA (PSF-DEG)	QBETA (PSF-DEG)	VE (FPS)	GAME (DEG)	AZE (DEG)	VI (FPS)	GAMI (DEG)	AZI (DEG)	SURFACE RANGE (NM)
.00	.00	-90.00	21.43	179.94	.0	-3.	1.	0.	14.171	56.90	1341.	.000	90.00	.0
.96	.01	-18.81	9.66	153.44	.2	-3.	2.	11.	83.104	.25	1341.	.486	89.94	.0
1.92	.02	-3.82	4.06	130.12	.9	-3.	4.	29.	82.914	-.74	1341.	1.211	89.85	.0
2.88	.04	.19	2.41	74.57	2.4	0.	6.	46.	82.824	-1.26	1341.	1.949	89.75	.0
3.84	.06	1.91	1.61	33.37	4.6	3.	7.	64.	82.969	-1.76	1342.	2.711	89.67	.0
4.80	.07	2.82	1.11	17.61	7.7	21.	9.	83.	83.121	-2.10	1343.	3.515	89.58	.0
5.76	.09	3.34	.77	10.16	11.7	39.	9.	103.	83.248	-2.36	1344.	4.355	89.48	.0
6.72	.11	3.66	.52	5.92	16.9	62.	9.	123.	83.379	-2.52	1346.	5.224	89.39	.0
7.68	.13	3.90	.28	2.76	23.1	90.	6.	144.	83.469	-2.85	1348.	6.114	89.30	.0
8.64	.15	4.72	-.31	1.92	30.4	144.	-9.	166.	83.493	-3.76	1350.	7.021	89.20	.0
9.60	.16	6.26	-1.02	10.18	38.8	243.	-40.	188.	83.867	-2.70	1353.	7.941	89.14	.0
10.56	.18	8.40	-1.31	32.08	48.3	406.	-63.	210.	84.754	3.35	1358.	8.862	89.18	.0
11.52	.20	10.19	-.84	79.25	58.8	599.	-50.	232.	85.759	23.00	1367.	9.752	89.33	.0
12.48	.22	11.10	-.25	133.34	70.2	779.	-18.	254.	85.532	54.76	1380.	10.589	89.52	.0
13.44	.24	11.39	.00	163.47	82.6	941.	0.	277.	83.695	75.46	1398.	11.362	89.68	.0
14.40	.26	11.09	.02	179.87	96.2	1067.	2.	300.	81.041	82.97	1418.	12.061	89.76	.0
15.36	.29	9.80	-.32	-172.72	111.0	1087.	-36.	324.	78.296	84.70	1442.	12.708	89.75	.0
16.32	.31	7.69	-.75	-171.96	127.3	980.	-95.	349.	75.841	84.74	1465.	13.338	89.69	.0
17.28	.33	5.13	-.81	-175.28	145.3	746.	-117.	374.	73.786	84.73	1489.	13.971	89.62	.1
18.24	.35	2.64	-.49	-178.83	164.9	435.	-80.	401.	72.196	85.07	1512.	14.625	89.59	.1
19.20	.38	.74	-.08	179.08	186.0	137	-14.	428.	70.983	85.57	1534.	15.298	89.58	.1
20.16	.40	-.59	.07	178.61	208.4	-122.	15.	456.	70.008	86.02	1557.	15.978	89.59	.1
21.12	.43	-1.55	.08	178.87	232.2	-359.	20.	484.	69.195	86.37	1579.	16.659	89.59	.1
22.08	.45	-2.27	.03	179.17	257.0	-582.	8.	513.	68.503	86.62	1601.	17.330	89.58	.2
23.04	.48	-2.87	.02	179.34	282.1	-810.	4.	541.	67.905	86.81	1623.	17.976	89.58	.2
24.00	.51	-3.41	.00	179.37	307.0	-1047.	-1.	568.	67.386	86.95	1645.	18.589	89.57	.2
24.96	.53	-3.75	.01	179.37	330.7	-1242.	3.	594.	66.913	87.07	1666.	19.149	89.57	.3
25.92	.55	-3.85	-.04	179.43	352.8	-1360.	-13.	619.	66.436	87.16	1686.	19.654	89.56	.3
26.88	.58	-3.83	-.07	179.50	374.9	-1436.	-26.	643.	65.962	87.23	1707.	20.130	89.55	.3
27.84	.60	-3.79	-.09	179.59	397.0	-1504.	-37.	668.	65.483	87.28	1728.	20.579	89.53	.4
28.80	.62	-3.78	-.11	179.66	419.0	-1583.	-44.	692.	65.008	87.33	1749.	21.003	89.52	.4
29.76	.64	-3.82	-.11	179.75	440.8	-1685.	-49.	716.	64.539	87.37	1771.	21.405	89.51	.5
30.72	.67	-3.92	-.12	179.83	462.1	-1812.	-57.	740.	64.087	87.40	1792.	21.790	89.50	.5
31.68	.69	-4.04	-.12	179.92	482.9	-1951.	-59.	763.	63.655	87.43	1814.	22.159	89.48	.6
32.64	.71	-4.17	-.13	-179.99	503.0	-2098.	-67.	787.	63.245	87.45	1835.	22.514	89.47	.6
33.60	.74	-4.24	-.12	-179.91	522.3	-2214.	-60.	810.	62.854	87.47	1857.	22.856	89.45	.7
34.56	.76	-4.27	-.12	-179.87	541.0	-2311.	-63.	834.	62.475	87.49	1878.	23.184	89.44	.8
35.52	.78	-4.28	-.10	-179.85	559.0	-2393.	-53.	857.	62.103	87.51	1900.	23.497	89.43	.8
36.48	.80	-4.34	-.09	-179.86	576.3	-2499.	-49.	880.	61.740	87.53	1921.	23.798	89.41	.9
37.44	.83	-4.38	-.06	-179.82	592.9	-2600.	-33.	903.	61.391	87.55	1943.	24.088	89.40	.9
38.40	.85	-4.39	-.06	-179.75	608.7	-2670.	-34.	926.	61.056	87.57	1965.	24.367	89.39	1.0
39.36	.87	-4.32	-.05	-179.66	623.5	-2692.	-34.	949.	60.724	87.59	1986.	24.632	89.38	1.1

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
AERODYNAMIC SUMMARY

TIME (SEC)	MACH (ND)	ALPHA (DEG)	BETA (DEG)	BANK (DEG)	DYN PRESS (PSF)	QALPHA (PSF-DEG)	QBETA (PSF-DEG)	VE (FPS)	GAME (DEG)	AZE (DEG)	VI (FPS)	GAMI (DEG)	AZI (DEG)	SURFACE RANGE (NM)
40.32	.90	-4.25	-.09	-179.57	637.6	-2710.	-60.	972.	60.391	87.61	2008.	24.884	89.37	1.2
41.28	.92	-4.20	-.13	-179.41	650.7	-273[illegible]	-82.	994.	60.055	87.62	2030.	25.120	89.36	1.2
42.24	.95	-4.25	-.16	-179.28	662.8	-281[illegible]	-103.	1017.	59.725	87.62	2052.	25.345	89.34	1.3
43.20	.97	-4.34	-.15	-179.13	673.8	-292[illegible]	-101.	1039.	59.409	87.62	2073.	25.563	89.33	1.4
44.16	.99	-4.43	-.12	-179.09	684.0	-302[illegible]	-85.	1062.	59.109	87.62	2095.	25.774	89.31	1.5
45.12	1.02	-4.49	-.07	-179.15	693.1	-311[illegible]	-52.	1084.	58.823	87.63	2117.	25.979	89.30	1.6
46.08	1.04	-4.53	-.02	-179.29	701.1	-317[illegible]	-15.	1106.	58.546	87.64	2138.	26.176	89.29	1.7
47.04	1.07	-4.54	.02	-179.46	707.9	-321[illegible]	11.	1127.	58.274	87.65	2159.	26.363	89.28	1.8
48.00	1.09	-4.61	.03	-179.47	713.3	-328[illegible]	23.	1148.	58.006	87.67	2180.	26.538	89.27	1.8
48.96	1.11	-4.71	.00	-179.33	717.4	-338[illegible]	-1.	1169.	57.750	87.69	2201.	26.706	89.27	1.9
49.92	1.14	-4.81	-.04	-179.20	720.5	-346[illegible]	-32.	1190.	57.501	87.71	2221.	26.868	89.26	2.0
50.88	1.16	-4.82	-.08	-179.07	723.0	-348[illegible]	-56.	1211.	57.250	87.72	2242.	27.023	89.25	2.1
51.84	1.19	-4.79	-.06	-179.06	724.0	-347[illegible]	-42.	1231.	56.976	87.73	2263.	27.152	89.24	2.3
52.80	1.21	-4.78	-.04	-179.10	723.5	-34[illegible]	-30.	1251.	56.678	87.74	2283.	27.254	89.23	2.4
53.76	1.24	-4.75	.00	-179.17	722.5	-34[illegible]	-1.	1271.	56.371	87.75	2304.	27.349	89.22	2.5
54.72	1.27	-4.70	.03	-179.28	721.6	-3356.	18.	1292.	56.061	87.76	2325.	27.443	89.22	2.6
55.68	1.29	-4.68	.05	-179.41	720.8	-337[illegible]	35.	1313.	55.753	87.77	2347.	27.540	89.21	2.7
56.64	1.32	-4.69	.03	-179.53	720.0	-338[illegible]	22.	1335.	55.447	87.78	2370.	27.640	89.20	2.8
57.60	1.35	-4.73	.01	-179.55	719.3	-3403.	7.	1358.	55.149	87.78	2394.	27.746	89.19	2.9
58.56	1.38	-4.76	-.04	-179.50	718.5	-3419.	-32.	1382.	54.860	87.78	2418.	27.859	89.17	3.1
59.52	1.42	-4.81	-.09	-179.36	718.4	-345[illegible]	-63.	1408.	54.599	87.78	2444.	27.998	89.16	3.2
60.48	1.46	-4.81	-.10	-179.16	719.3	-3462.	-71.	1435.	54.368	87.77	2472.	28.167	89.14	3.3
61.44	1.50	-4.77	-.08	-178.95	720.7	-3436.	-56.	1465.	54.158	87.77	2501.	28.360	89.13	3.4
62.40	1.54	-4.73	-.04	-178.77	722.5	-3415.	-31.	1498.	53.964	87.77	2532.	28.571	89.12	3.6
63.36	1.58	-4.74	.00	-178.71	723.3	-3429.	3.	1530.	53.774	87.78	2564.	28.784	89.11	3.7
64.32	1.63	-4.59	.01	-178.75	722.8	-3320.	4.	1564.	53.596	87.80	2597.	29.000	89.10	3.9
65.28	1.68	-4.12	-.04	-178.82	720.7	-2967.	-27.	1599.	53.398	87.80	2631.	29.204	89.09	4.0
66.24	1.72	-3.54	-.11	-178.80	716.9	-2537.	-78.	1635.	53.160	87.79	2666.	29.385	89.07	4.2
67.20	1.77	-3.08	-.13	-178.70	711.1	-2187.	-93.	1672.	52.884	87.78	2703.	29.543	89.05	4.3
68.16	1.82	-2.78	-.18	-178.53	703.2	-1956.	-124.	1709.	52.585	87.76	2742.	29.685	89.02	4.5
69.12	1.87	-2.58	-.18	-178.39	693.0	-1790.	-124.	1748.	52.273	87.74	2781.	29.815	89.00	4.7
70.08	1.91	-2.33	-.16	-178.31	680.3	-1588.	-111.	1788.	51.950	87.73	2822.	29.936	88.98	4.8
71.04	1.96	-1.99	-.15	-178.28	665.5	-1324.	-100.	1830.	51.607	87.72	2864.	30.040	88.96	5.0
72.00	2.00	-1.62	-.13	-178.29	649.0	-1050.	-87.	1872.	51.241	87.72	2908.	30.126	88.94	5.2
72.96	2.05	-1.23	-.08	-178.38	631.9	-780	-54.	1915.	50.854	87.72	2953.	30.194	88.92	5.4
73.92	2.09	-.82	-.05	-178.51	613.9	-505.	-31.	1960.	50.445	87.72	3000.	30.243	88.90	5.6
74.88	2.14	-.39	-.05	-178.62	595.7	-231.	-29.	2005.	50.013	87.73	3048.	30.271	88.89	5.8
75.84	2.19	.04	-.06	-178.66	577.1	23.	-34.	2052.	49.558	87.74	3097.	30.278	88.88	6.0
76.80	2.23	.48	-.07	-178.67	558.3	270.	-38.	2100.	49.084	87.75	3148.	30.265	88.86	6.2
77.76	2.28	.98	-.05	-178.69	539.2	526.	-27.	2148.	48.593	87.76	3200.	30.232	88.85	6.4
78.72	2.32	1.50	-.03	-178.72	520.0	782.	-13.	2197.	48.079	87.76	3253.	30.173	88.83	6.6
79.68	2.37	1.93	.01	-178.75	500.9	967.	7.	2246.	47.546	87.77	3306.	30.089	88.82	6.9

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
AERODYNAMIC SUMMARY

TIME (SEC)	MACH (ND)	ALPHA (DEG)	BETA (DEG)	BANK (DEG)	DYN PRESS (PSF)	QALPHA (PSF-DEG)	QBETA (PSF-DEG)	VE (FPS)	GAME (DEG)	AZE (DEG)	VI (FPS)	GAMI (DEG)	AZI (DEG)	SURFACE RANGE (NM)
80.64	2.42	2.23	.04	-178.79	482.0	1076.	18.	2296.	47.004	87.78	3360.	29.989	88.81	7.1
81.60	2.47	2.40	.05	-178.82	463.4	1113.	23.	2347.	46.455	87.80	3415.	29.874	88.80	7.4
82.56	2.51	2.44	.05	-178.83	445.2	1087.	21.	2397.	45.911	87.81	3470.	29.752	88.79	7.6
83.52	2.56	2.36	.03	-178.84	427.3	1007.	13.	2448.	45.375	87.82	3525.	29.623	88.78	7.9
84.48	2.61	2.16	.02	-178.86	409.7	886	7.	2500.	44.855	87.83	3581.	29.496	88.77	8.2
85.44	2.66	2.00	-.01	-178.85	392.4	784	-4.	2551.	44.351	87.84	3637.	29.369	88.76	8.4
86.40	2.71	1.91	-.04	-178.81	375.3	716	-15.	2603.	43.860	87.85	3692.	29.242	88.75	8.7
87.36	2.76	1.85	-.08	-178.75	358.5	664.	-28.	2655.	43.379	87.86	3748.	29.110	88.74	9.0
88.32	2.80	1.80	-.10	-178.71	342.0	617.	-35.	2707.	42.907	87.86	3804.	28.976	88.73	9.3
89.28	2.85	1.77	-.08	-178.70	325.9	577.	-27.	2758.	42.444	87.87	3859.	28.839	88.72	9.7
90.24	2.90	1.75	-.05	-178.75	310.4	544.	-16.	2811.	41.988	87.87	3916.	28.700	88.71	10.0
91.20	2.95	1.76	-.03	-178.79	295.4	521.	-8.	2864.	41.538	87.88	3973.	28.560	88.70	10.3
92.16	3.00	1.79	-.02	-178.85	280.8	503.	-7.	2918.	41.093	87.89	4030.	28.416	88.69	10.7
93.12	3.05	1.81	-.02	-178.90	266.7	482.	-6.	2972.	40.654	87.90	4088.	28.270	88.68	11.0
94.08	3.10	1.82	-.01	-178.96	253.1	462.	-3.	3026.	40.221	87.91	4146.	28.122	88.68	11.4
95.04	3.15	1.84	-.02	-179.00	240.0	442.	-6.	3080.	39.795	87.91	4204.	27.970	88.67	11.7
96.00	3.20	1.85	-.06	-179.01	227.5	421.	-14.	3135.	39.374	87.92	4262.	27.816	88.66	12.1
96.96	3.25	1.85	-.08	-179.00	215.5	400.	-18.	3189.	38.959	87.92	4320.	27.659	88.65	12.5
97.92	3.30	1.86	-.08	-179.01	203.8	379.	-17.	3244.	38.550	87.93	4378.	27.501	88.65	12.9
98.88	3.34	1.89	-.09	-179.02	192.1	362.	-17.	3299.	38.146	87.94	4436.	27.341	88.64	13.3
99.84	3.39	1.92	-.10	-179.04	180.7	346.	-18.	3354.	37.747	87.95	4495.	27.180	88.64	13.7
100.80	3.43	1.93	-.13	-179.04	169.8	328.	-22.	3409.	37.354	87.95	4553.	27.016	88.63	14.1
101.76	3.47	1.94	-.16	-179.00	159.6	309.	-25.	3463.	36.966	87.96	4611.	26.851	88.63	14.6
102.72	3.52	1.95	-.17	-178.96	150.1	292.	-26.	3518.	36.584	87.97	4669.	26.684	88.62	15.0
103.68	3.56	1.94	-.20	-178.94	141.3	274.	-28.	3572.	36.208	87.97	4727.	26.517	88.62	15.4
104.64	3.61	1.91	-.21	-178.91	132.9	254.	-28.	3627.	35.837	87.98	4784.	26.348	88.61	15.9
105.60	3.66	1.87	-.21	-178.91	124.9	234.	-27.	3680.	35.472	87.98	4841.	26.178	88.61	16.4
106.56	3.70	1.85	-.19	-178.95	117.3	217.	-22.	3734.	35.112	87.99	4898.	26.009	88.60	16.8
107.52	3.74	1.84	-.16	-178.98	110.0	203.	-18.	3788.	34.757	88.00	4955.	25.839	88.60	17.3
108.48	3.79	1.85	-.15	-178.99	103.1	191.	-16.	3842.	34.407	88.00	5012.	25.668	88.60	17.8
109.44	3.83	1.86	-.23	-178.90	96.5	179.	-22.	3895.	34.061	88.01	5068.	25.495	88.60	18.3
110.40	3.86	1.84	-.37	-178.70	90.3	166.	-34.	3945.	33.723	88.01	5121.	25.321	88.59	18.8
111.36	3.90	1.77	-.57	-178.41	84.4	150.	-48.	3992.	33.394	88.01	5171.	25.145	88.58	19.4
112.32	3.93	1.78	-.79	-178.14	78.7	140.	-62.	4033.	33.076	88.00	5215.	24.965	88.57	19.9
113.28	3.96	1.83	-.92	-177.84	73.1	134.	-67.	4067.	32.768	87.99	5252.	24.781	88.56	20.4
114.24	3.97	1.92	-.82	-177.68	67.7	130.	-55.	4096.	32.467	87.98	5283.	24.592	88.55	21.0
115.20	3.99	2.05	-.52	-177.76	62.7	128.	-32.	4120.	32.172	87.98	5310.	24.401	88.55	21.5
116.16	4.00	2.19	-.18	-177.93	58.0	127.	-10.	4141.	31.879	87.99	5334.	24.206	88.55	22.1
117.12	4.01	2.34	.11	-178.10	53.6	126.	6.	4160.	31.590	88.00	5356.	24.009	88.55	22.6
118.08	4.02	2.44	.29	-178.22	49.7	121.	14.	4176.	31.302	88.01	5375.	23.809	88.56	23.2
119.04	4.03	2.38	.32	-178.26	46.0	109.	15.	4190.	31.016	88.03	5392.	23.608	88.57	23.7
120.00	4.03	2.16	.24	-178.23	42.6	92.	10.	4203.	30.734	88.04	5407.	23.407	88.57	24.3

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
AERODYNAMIC SUMMARY

TIME (SEC)	MACH (ND)	ALPHA (DEG)	BETA (DEG)	BANK (DEG)	DYN PRESS (PSF)	QALPHA (PSF-DEG)	QBETA (PSF-DEG)	VE (FPS)	GAME (DEG)	AZE (DEG)	VI (FPS)	GAMI (DEG)	AZI (DEG)	SURFACE RANGE (NM)
120.96	4.04	1.83	.12	-178.18	39.4	72.	5.	4214.	30.456	88.05	5421.	23.208	88.58	24.9
121.92	4.05	1.47	.00	-178.13	36.6	54	0.	4225.	30.183	88.07	5434.	23.010	88.59	25.4
122.88	4.05	1.10	-.09	-178.04	33.9	37	-3.	4234.	29.913	88.08	5446.	22.814	88.60	26.0
123.84	4.06	.78	-.14	-178.01	31.5	25	-4.	4243.	29.646	88.09	5457.	22.619	88.60	26.6
124.52	4.07	.57	-.14	-178.00	29.9	17	-4.	4249.	29.459	88.10	5465.	22.482	88.61	27.0
SRB SEP AT 124.52 SEC														
124.52	4.07	.57	-.14	-178.00	29.9	17	-4.	4249.	29.459	88.10	5465.	22.482	88.61	27.0
125.12	4.07	.93	-.09	-178.12	28.6	27	-3.	4258.	29.300	88.11	5475.	22.370	88.61	27.4
126.08	4.09	.96	-.01	-177.79	26.7	26	0.	4272.	29.031	88.13	5492.	22.179	88.62	27.9
127.04	4.11	.49	.01	-177.27	24.9	12.	0.	4286.	28.769	88.14	5508.	21.993	88.63	28.5
128.00	4.13	.09	.01	-176.94	23.3	2	0.	4300.	28.509	88.16	5524.	21.810	88.64	29.1
128.96	4.15	-.34	-.02	-176.78	21.8	-8.	0.	4314.	28.255	88.18	5541.	21.630	88.66	29.7
129.92	4.17	-.69	-.03	-176.73	20.4	-14	-1.	4329.	28.004	88.20	5558.	21.452	88.67	30.3
130.88	4.19	-.96	-.06	-176.69	19.1	-1[illegible]	-1.	4344.	27.754	88.21	5575.	21.275	88.68	30.9
131.84	4.21	-1.14	.01	-176.75	17.9	-2[illegible]	0.	4358.	27.510	88.23	5591.	21.103	88.69	31.5
132.80	4.22	-.66	.55	-177.37	16.8	-1[illegible]	9.	4373.	27.265	88.25	5608.	20.929	88.70	32.1
133.76	4.24	.11	1.29	-178.31	15.7	[illegible]	20.	4389.	27.013	88.27	5626.	20.751	88.71	32.7
134.72	4.26	.74	1.90	-179.22	14.7	1[illegible]	28.	4404.	26.756	88.30	5644.	20.568	88.73	33.4
135.68	4.29	1.13	2.27	-179.87	13.8	16.	31.	4420.	26.495	88.33	5661.	20.382	88.75	34.0
136.64	4.31	1.28	2.39	179.83	13.0	17.	31.	4436.	26.234	88.36	5680.	20.196	88.78	34.6
137.60	4.33	1.32	2.40	179.75	12.2	16	29.	4452.	25.972	88.39	5698.	20.010	88.80	35.2
138.56	4.35	1.10	2.36	179.74	11.4	12.	27.	4468.	25.713	88.42	5717.	19.824	88.82	35.8
139.52	4.38	.84	2.26	179.81	10.7	9.	24.	4485.	25.457	88.45	5735.	19.642	88.84	36.5
140.48	4.40	.64	2.15	179.87	10.1	6.	22.	4502.	25.203	88.48	5754.	19.460	88.86	37.1
141.44	4.42	.50	2.08	179.88	9.4	5.	20.	4519.	24.950	88.51	5773.	19.280	88.88	37.8
142.40	4.44	.41	2.00	179.89	8.9	4.	18.	4536.	24.700	88.53	5792.	19.101	88.89	38.4
143.36	4.47	.35	1.91	179.91	8.3	3.	16.	4553.	24.450	88.56	5811.	18.922	88.91	39.0
144.32	4.49	.27	1.85	179.86	7.8	2.	15.	4570.	24.201	88.58	5830.	18.744	88.93	39.7
145.28	4.53	.18	1.81	179.83	7.4	1.	13.	4588.	23.954	88.61	5850.	18.567	88.95	40.3
146.24	4.56	.11	1.78	179.80	7.0	1.	12.	4606.	23.707	88.63	5870.	18.390	88.96	41.0
147.20	4.59	.01	1.76	179.76	6.6	0.	11.	4624.	23.462	88.66	5889.	18.215	88.98	41.7
148.16	4.62	-.09	1.73	179.71	6.2	-1.	11.	4642.	23.219	88.68	5909.	18.040	89.00	42.3
149.12	4.65	-.18	1.71	179.69	5.8	-1.	10.	4660.	22.977	88.70	5929.	17.867	89.01	43.0
150.08	4.68	-.27	1.69	179.64	5.5	-1.	9.	4679.	22.737	88.73	5950.	17.694	89.03	43.7
151.04	4.71	-.37	1.69	179.61	5.2	-2.	9.	4697.	22.498	88.75	5970.	17.522	89.05	44.4
152.00	4.75	-.44	1.69	179.59	4.9	-2.	8.	4716.	22.261	88.77	5991.	17.351	89.06	45.0
152.96	4.78	-.53	1.69	179.56	4.6	-2.	8.	4735.	22.025	88.79	6011.	17.181	89.08	45.7
153.92	4.81	-.62	1.70	179.53	4.3	-3.	7.	4754.	21.790	88.82	6032.	17.012	89.09	46.4
154.88	4.84	-.72	1.70	179.51	4.1	-3.	7.	4774.	21.557	88.84	6053.	16.843	89.11	47.1
155.84	4.88	-.81	1.70	179.49	3.8	-3.	7.	4793.	21.326	88.86	6074.	16.676	89.13	47.8
156.80	4.91	-.93	1.68	179.46	3.6	-3.	6.	4813.	21.096	88.89	6095.	16.510	89.14	48.5
157.76	4.95	-1.05	1.66	179.45	3.4	-4.	6.	4832.	20.868	88.91	6117.	16.345	89.16	49.2

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
AERODYNAMIC SUMMARY

TIME (SEC)	MACH (ND)	ALPHA (DEG)	BETA (DEG)	BANK (DEG)	DYN PRESS (PSF)	QALPHA (PSF-DEG)	QBETA (PSF-DEG)	VE (FPS)	GAME (DEG)	AZE (DEG)	VI (FPS)	GAMI (DEG)	AZI (DEG)	SURFACE RANGE (NM)
239.36	7.50	-6.91	.72	179.93	.0	0.	0.	7081.	7.032	90.58	8433.	5.900	90.49	124.9
240.32	7.52	-6.93	.72	179.92	.0	0.	0.	7114.	6.925	90.60	8466.	5.814	90.50	126.0
241.28	7.54	-6.96	.72	179.93	.0	0.	0.	7147.	6.819	90.62	8500.	5.730	90.52	127.1
242.24	7.56	-6.98	.73	179.92	.0	0.	0.	7180.	6.714	90.63	8533.	5.646	90.53	128.2
243.20	7.58	-6.99	.73	179.91	.0	0.	0.	7213.	6.611	90.65	8567.	5.563	90.55	129.3
244.16	7.60	-7.01	.71	179.90	.0	0.	0.	7246.	6.508	90.67	8600.	5.480	90.56	130.4
245.12	7.62	-7.04	.70	179.90	.0	0.	0.	7280.	6.407	90.69	8634.	5.399	90.58	131.5
246.08	7.64	-7.06	.67	179.92	.0	0.	0.	7314.	6.306	90.71	8668.	5.318	90.59	132.7
247.04	7.65	-7.06	.65	179.94	.0	0.	0.	7348.	6.207	90.72	8702.	5.238	90.61	133.8
248.00	7.67	-7.05	.63	179.94	.0	0.	0.	7382.	6.108	90.74	8736.	5.158	90.63	134.9
248.96	7.68	-7.05	.61	179.94	.0	0.	0.	7416.	6.010	90.76	8771.	5.079	90.64	136.1
249.92	7.70	-7.07	.60	179.92	.0	0.	0.	7450.	5.914	90.78	8805.	5.001	90.66	137.2
250.88	7.71	-7.09	.59	179.92	.0	0.	0.	7485.	5.818	90.79	8840.	4.923	90.67	138.4
251.84	7.73	-7.10	.59	179.94	.0	0.	0.	7519.	5.723	90.81	8875.	4.847	90.69	139.5
252.80	7.74	-7.12	.59	179.97	.0	0.	0.	7554.	5.630	90.83	8910.	4.771	90.70	140.7
253.76	7.76	-7.13	.58	179.98	.0	0.	0.	7589.	5.537	90.85	8945.	4.695	90.72	141.9
254.72	7.78	-7.15	.57	179.96	.0	0.	0.	7624.	5.445	90.86	8980.	4.621	90.73	143.0
255.68	7.79	-7.15	.55	179.94	.0	0.	0.	7659.	5.355	90.88	9016.	4.547	90.75	144.2
256.64	7.81	-7.16	.54	179.93	.0	0.	0.	7694.	5.265	90.90	9051.	4.474	90.76	145.4
257.60	7.83	-7.17	.52	179.94	.0	0.	0.	7730.	5.176	90.92	9087.	4.401	90.78	146.6
258.56	7.85	-7.17	.50	179.96	.0	0.	0.	7766.	5.088	90.93	9123.	4.330	90.79	147.8
259.52	7.87	-7.17	.49	179.99	.0	0.	0.	7801.	5.001	90.95	9159.	4.258	90.81	149.0
260.48	7.89	-7.16	.49	179.99	.0	0.	0.	7837.	4.915	90.97	9195.	4.188	90.83	150.2
261.44	7.91	-7.15	.50	179.96	.0	0.	0.	7873.	4.830	90.99	9231.	4.118	90.84	151.4
262.40	7.93	-7.14	.49	179.93	.0	0.	0.	7910.	4.745	91.01	9268.	4.049	90.86	152.7
263.36	7.95	-7.15	.48	179.91	.0	0.	0.	7946.	4.662	91.02	9304.	3.980	90.87	153.9
264.32	7.97	-7.15	.45	179.92	.0	0.	0.	7983.	4.579	91.04	9341.	3.912	90.89	155.1
265.28	7.99	-7.16	.44	179.95	.0	0.	0.	8020.	4.497	91.06	9378.	3.845	90.90	156.4
266.24	8.01	-7.16	.42	179.98	.0	0.	0.	8056.	4.417	91.07	9415.	3.778	90.92	157.6
267.20	8.03	-7.15	.40	-180.00	.0	0.	0.	8093.	4.337	91.09	9452.	3.712	90.93	158.9
268.16	8.05	-7.14	.40	-179.98	.0	0.	0.	8131.	4.258	91.11	9490.	3.647	90.95	160.1
269.12	8.07	-7.12	.41	-179.98	.0	0.	0.	8168.	4.179	91.13	9527.	3.582	90.97	161.4
270.08	8.10	-7.11	.41	179.99	.0	0.	0.	8206.	4.102	91.15	9565.	3.518	90.98	162.7
271.04	8.12	-7.10	.39	179.95	.0	0.	0.	8243.	4.025	91.16	9603.	3.454	91.00	163.9
272.00	8.14	-7.10	.38	179.93	.0	0.	0.	8281.	3.949	91.18	9641.	3.391	91.01	165.2
272.96	8.16	-7.10	.36	179.94	.0	0.	0.	8319.	3.874	91.20	9679.	3.329	91.03	166.5
273.92	8.19	-7.09	.34	179.97	.0	0.	0.	8357.	3.800	91.21	9717.	3.267	91.04	167.8
274.88	8.21	-7.08	.32	179.99	.0	0.	0.	8396.	3.726	91.23	9756.	3.206	91.06	169.1
275.84	8.23	-7.07	.31	-179.99	.0	0.	0.	8434.	3.654	91.25	9794.	3.146	91.08	170.4
276.80	8.26	-7.06	.31	-179.99	.0	0.	0.	8473.	3.582	91.27	9833.	3.086	91.09	171.7
277.76	8.28	-7.05	.32	180.00	.0	0.	0.	8512.	3.511	91.28	9872.	3.027	91.11	173.0
278.72	8.31	-7.03	.33	179.98	.0	0.	0.	8550.	3.441	91.30	9911.	2.968	91.12	174.3

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
AERODYNAMIC SUMMARY

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279.68	8.33	-7.00	.32	179.95	.0	0.	0.	8590.	3.371	91.32	9950.	2.910	91.14	175.7
280.64	8.36	-6.99	.31	179.92	.0	0.	0.	8629.	3.303	91.34	9990.	2.852	91.15	177.0
281.60	8.38	-6.98	.28	179.95	.0	0.	0.	8668.	3.235	91.35	10029.	2.796	91.17	178.4
282.56	8.41	-6.98	.26	179.97	.0	0.	0.	8708.	3.168	91.37	10069.	2.739	91.19	179.7
283.52	8.44	-6.96	.25	-180.00	.0	0.	0.	8748.	3.102	91.39	10109.	2.684	91.20	181.1
284.48	8.46	-6.96	.22	-179.98	.0	0.	0.	8788.	3.036	91.41	10149.	2.628	91.22	182.4
285.44	8.49	-6.94	.21	-179.98	.0	0.	0.	8828.	2.971	91.42	10189.	2.574	91.23	183.8
286.40	8.52	-6.93	.21	-180.00	.0	0.	0.	8868.	2.907	91.44	10229.	2.520	91.25	185.2
287.36	8.55	-6.92	.21	179.98	.0	0.	0.	8908.	2.844	91.46	10270.	2.467	91.27	186.5
288.32	8.58	-6.90	.21	179.95	.0	0.	0.	8949.	2.782	91.48	10311.	2.414	91.28	187.9
289.28	8.61	-6.88	.20	179.94	.0	0.	0.	8990.	2.720	91.49	10351.	2.362	91.30	189.3
290.24	8.64	-6.84	.19	179.96	.0	0.	0.	9031.	2.659	91.51	10392.	2.310	91.31	190.7
291.20	8.67	-6.80	.17	179.99	.0	0.	0.	9072.	2.598	91.53	10434.	2.259	91.33	192.1
292.16	8.70	-6.77	.15	-179.99	.0	0.	0.	9113.	2.539	91.55	10475.	2.208	91.35	193.5
293.12	8.73	-6.76	.14	-179.98	.0	0.	0.	9155.	2.480	91.57	10516.	2.158	91.36	194.9
294.08	8.76	-6.74	.15	-179.98	.0	0.	0.	9196.	2.421	91.58	10558.	2.109	91.38	196.4
295.04	8.80	-6.72	.16	-180.00	.0	0.	0.	9238.	2.364	91.60	10600.	2.060	91.39	197.8
296.00	8.83	-6.70	.17	179.97	.0	0.	0.	9280.	2.307	91.62	10642.	2.011	91.41	199.2
296.96	8.86	-6.68	.16	179.96	.0	0.	0.	9322.	2.251	91.64	10684.	1.964	91.43	200.7
297.92	8.89	-6.66	.15	179.97	.0	0.	0.	9364.	2.195	91.65	10727.	1.916	91.44	202.1
298.88	8.92	-6.62	.12	-180.00	.0	0.	0.	9407.	2.140	91.67	10769.	1.870	91.46	203.6
299.84	8.95	-6.58	.11	-179.98	.0	0.	0.	9450.	2.086	91.69	10812.	1.823	91.48	205.0
300.80	8.98	-6.53	.09	-179.97	.0	0.	0.	9492.	2.032	91.71	10855.	1.777	91.49	206.5
301.76	9.01	-6.50	.07	-179.96	.0	0.	0.	9535.	1.979	91.72	10898.	1.732	91.51	208.0
302.72	9.04	-6.47	.07	-179.98	.0	0.	0.	9579.	1.927	91.74	10941.	1.687	91.53	209.5
303.68	9.07	-6.45	.06	179.99	.0	0.	0.	9622.	1.875	91.76	10985.	1.643	91.54	211.0
304.64	9.10	-6.42	.05	179.95	.0	0.	0.	9666.	1.824	91.78	11028.	1.599	91.56	212.5
305.60	9.13	-6.39	.03	179.94	.0	0.	0.	9709.	1.774	91.80	11072.	1.556	91.57	214.0
306.56	9.16	-6.37	.02	179.97	.0	0.	0.	9753.	1.724	91.81	11116.	1.513	91.59	215.5
307.52	9.18	-6.33	.02	-180.00	.0	0.	0.	9797.	1.675	91.83	11160.	1.471	91.61	217.0
308.48	9.21	-6.28	.03	-179.97	.0	0.	0.	9842.	1.627	91.85	11204.	1.429	91.62	218.5
309.44	9.24	-6.24	.04	-179.96	.0	0.	0.	9886.	1.579	91.87	11249.	1.388	91.64	220.1
310.40	9.27	-6.21	.04	-179.97	.0	0.	0.	9931.	1.531	91.89	11294.	1.347	91.66	221.6
311.36	9.30	-6.18	.04	-179.99	.0	0.	0.	9976.	1.485	91.90	11338.	1.306	91.67	223.1
312.32	9.33	-6.15	.03	179.98	.0	0.	0.	10021.	1.439	91.92	11384.	1.267	91.69	224.7
313.28	9.36	-6.11	.01	179.97	.0	0.	0.	10066.	1.393	91.94	11429.	1.227	91.71	226.2
314.24	9.39	-6.08	-.01	180.00	.0	0.	0.	10111.	1.349	91.96	11474.	1.188	91.73	227.8
315.20	9.42	-6.05	-.03	-179.98	.0	0.	0.	10157.	1.304	91.98	11520.	1.150	91.74	229.4
316.16	9.45	-6.01	-.04	-179.97	.0	0.	0.	10203.	1.261	91.99	11566.	1.112	91.76	231.0
317.12	9.48	-5.96	-.06	-179.99	.0	0.	0.	10249.	1.218	92.01	11612.	1.075	91.78	232.6
318.08	9.51	-5.90	-.07	179.99	.0	0.	0.	10295.	1.175	92.03	11658.	1.038	91.79	234.2
319.04	9.54	-5.85	-.08	179.98	.0	0.	0.	10341.	1.133	92.05	11704.	1.001	91.81	235.8

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
AERODYNAMIC SUMMARY

TIME (SEC)	MACH (ND)	ALPHA (DEG)	BETA (DEG)	BANK (DEG)	DYN PRESS (PSF)	QALPHA (PSF-DEG)	QBETA (PSF-DEG)	VE (FPS)	GAME (DEG)	AZE (DEG)	VI (FPS)	GAMI (DEG)	AZI (DEG)	SURFACE RANGE (NM)
320.00	9.57	-5.82	-.08	179.99	.0	0.	0.	10388.	1.092	92.07	11751.	.965	91.83	237.4
320.96	9.61	-5.79	-.07	-179.98	.0	0.	0.	10434.	1.051	92.08	11798.	.929	91.84	239.0
321.92	9.64	-5.76	-.07	-179.98	.0	0.	0.	10481.	1.011	92.10	11845.	.894	91.86	240.6
322.88	9.67	-5.72	-.08	-179.99	.0	0.	0.	10528.	.971	92.12	11892.	.860	91.88	242.2
323.84	9.71	-5.70	-.09	179.99	.0	0.	0.	10576.	.932	92.14	11939.	.826	91.89	243.9
324.80	9.74	-5.65	-.11	179.99	.0	0.	0.	10623.	.894	92.16	11987.	.792	91.91	245.5
325.76	9.78	-5.60	-.12	-179.98	.0	0.	0.	10671.	.856	92.18	12034.	.759	91.93	247.2
326.72	9.81	-5.55	-.12	-179.95	.0	0.	0.	10719.	.818	92.19	12082.	.726	91.95	248.8
327.68	9.85	-5.50	-.12	-179.95	.0	0.	0.	10767.	.781	92.21	12131.	.693	91.96	250.5
328.64	9.88	-5.47	-.12	-179.98	.0	0.	0.	10815.	.745	92.23	12179.	.662	91.98	252.2
329.60	9.92	-5.43	-.14	-180.00	.0	0.	0.	10864.	.709	92.25	12227.	.630	92.00	253.9
330.56	9.96	-5.39	-.15	179.99	.0	0.	0.	10913.	.674	92.27	12276.	.599	92.02	255.5
331.52	9.99	-5.35	-.16	179.98	.0	0.	0.	10962.	.639	92.29	12325.	.569	92.03	257.2
332.48	10.03	-5.32	-.18	179.99	.0	0.	0.	11011.	.605	92.31	12374.	.539	92.05	259.0
333.44	10.07	-5.26	-.18	-179.98	.0	0.	0.	11060.	.572	92.32	12424.	.509	92.07	260.7
334.40	10.11	-5.20	-.18	-179.95	.0	0.	0.	11110.	.539	92.34	12473.	.480	92.09	262.4
335.36	10.15	-5.14	-.16	-179.94	.0	0.	0.	11160.	.506	92.36	12523.	.451	92.10	264.1
336.32	10.19	-5.08	-.16	-179.97	.0	0.	0.	11210.	.474	92.38	12573.	.422	92.12	265.8
337.28	10.23	-5.05	-.17	-180.00	.0	0.	0.	11260.	.442	92.40	12623.	.394	92.14	267.6
338.24	10.27	-5.01	-.18	179.97	.0	0.	0.	11310.	.411	92.42	12674.	.367	92.16	269.3
339.20	10.31	-4.97	-.20	179.97	.0	0.	0.	11361.	.380	92.44	12725.	.340	92.18	271.1
340.16	10.35	-4.93	-.22	179.99	.0	0.	0.	11412.	.350	92.46	12775.	.313	92.19	272.9
341.12	10.40	-4.89	-.24	-179.98	.0	0.	0.	11463.	.321	92.47	12827.	.287	92.21	274.6
342.08	10.44	-4.83	-.25	-179.97	.0	0.	0.	11514.	.292	92.49	12878.	.261	92.23	276.4
343.04	10.48	-4.78	-.25	-179.98	.0	0.	0.	11566.	.263	92.51	12929.	.236	92.25	278.2
344.00	10.53	-4.72	-.25	-179.99	.0	0.	0.	11618.	.235	92.53	12981.	.211	92.27	280.0
344.96	10.57	-4.66	-.24	179.99	.0	0.	0.	11670.	.208	92.55	13033.	.186	92.28	281.8
345.92	10.62	-4.61	-.24	179.98	.0	0.	0.	11722.	.180	92.57	13085.	.162	92.30	283.6
346.88	10.66	-4.57	-.25	179.98	.0	0.	0.	11774.	.154	92.59	13138.	.138	92.32	285.5
347.84	10.71	-4.53	-.27	179.99	.0	0.	0.	11827.	.128	92.61	13190.	.114	92.34	287.3
348.80	10.75	-4.49	-.28	-179.99	.0	0.	0.	11880.	.102	92.63	13243.	.091	92.36	289.1
349.76	10.80	-4.45	-.28	-179.98	.0	0.	0.	11933.	.077	92.65	13297.	.069	92.37	291.0
350.72	10.85	-4.40	-.29	-179.97	.0	0.	0.	11986.	.052	92.67	13350.	.047	92.39	292.9
351.68	10.90	-4.35	-.29	-179.99	.0	0.	0.	12040.	.028	92.68	13403.	.025	92.41	294.7
352.64	10.95	-4.31	-.29	179.98	.0	0.	0.	12094.	.005	92.70	13457.	.004	92.43	296.6
353.60	11.00	-4.25	-.29	179.95	.0	0.	0.	12148.	-.018	92.72	13511.	-.017	92.45	298.5
354.56	11.04	-4.19	-.31	179.94	.0	0.	0.	12202.	-.041	92.74	13566.	-.037	92.47	300.4
355.52	11.09	-4.14	-.32	179.97	.0	0.	0.	12257.	-.063	92.76	13620.	-.057	92.49	302.3
356.48	11.15	-4.10	-.34	179.99	.0	0.	0.	12311.	-.085	92.78	13675.	-.077	92.50	304.2
357.44	11.20	-4.05	-.35	-179.99	.0	0.	0.	12366.	-.106	92.80	13730.	-.096	92.52	306.1
358.40	11.25	-3.99	-.36	-179.97	.0	0.	0.	12422.	-.127	92.82	13785.	-.115	92.54	308.0
359.36	11.30	-3.92	-.34	-179.97	.0	0.	0.	12477.	-.148	92.84	13841.	-.133	92.56	309.9

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
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TIME (SEC)	MACH (ND)	ALPHA (DEG)	BETA (DEG)	BANK (DEG)	DYN PRESS (PSF)	QALPHA (PSF-DEG)	QBETA (PSF-DEG)	VE (FPS)	GAME (DEG)	AZE (DEG)	VI (FPS)	GAMI (DEG)	AZI (DEG)	SURFACE RANGE (NM)
360.32	11.35	-3.86	-.33	-180.00	.0	0.	0.	12533.	-.168	92.86	13897.	-.151	92.58	311.9
361.28	11.41	-3.81	-.34	179.98	.0	0.	0.	12589.	-.187	92.88	13953.	-.169	92.60	313.8
362.24	11.46	-3.76	-.35	179.96	.0	0.	0.	12645.	-.206	92.90	14009.	-.186	92.62	315.8
363.20	11.51	-3.71	-.36	179.96	.0	0.	0.	12702.	-.225	92.92	14065.	-.203	92.64	317.8
364.16	11.57	-3.67	-.38	179.99	.0	0.	0.	12759.	-.243	92.94	14122.	-.220	92.66	319.7
365.12	11.63	-3.62	-.39	-179.99	.0	0.	0.	12816.	-.261	92.96	14179.	-.236	92.67	321.7
366.08	11.68	-3.56	-.38	-179.96	.0	0.	0.	12873.	-.278	92.98	14237.	-.251	92.69	323.7
367.04	11.74	-3.51	-.37	-179.95	.0	0.	0.	12931.	-.295	93.00	14294.	-.267	92.71	325.7
368.00	11.80	-3.47	-.37	-179.98	.0	0.	0.	12988.	-.311	93.02	14352.	-.282	92.73	327.7
368.96	11.85	-3.41	-.38	179.99	.0	0.	0.	13047.	-.327	93.04	14410.	-.296	92.75	329.8
369.92	11.91	-3.34	-.39	179.98	.0	0.	0.	13105.	-.342	93.06	14468.	-.310	92.77	331.8
370.88	11.97	-3.26	-.41	180.00	.0	0.	0.	13164.	-.358	93.08	14527.	-.324	92.79	333.8
371.84	12.03	-3.19	-.41	-179.99	.0	0.	0.	13222.	-.372	93.10	14586.	-.338	92.81	335.9
372.80	12.09	-3.14	-.41	-179.97	.0	0.	0.	13282.	-.387	93.12	14645.	-.351	92.83	337.9
373.76	12.15	-3.09	-.40	-179.97	.0	0.	0.	13341.	-.401	93.14	14705.	-.364	92.85	340.0
374.72	12.21	-3.04	-.40	180.00	.0	0.	0.	13401.	-.414	93.16	14764.	-.376	92.87	342.1
375.68	12.27	-3.00	-.41	179.98	.0	0.	0.	13461.	-.427	93.18	14824.	-.388	92.89	344.2
376.64	12.34	-2.95	-.43	179.98	.0	0.	0.	13521.	-.440	93.20	14885.	-.400	92.91	346.2
377.60	12.40	-2.89	-.43	179.99	.0	0.	0.	13582.	-.452	93.22	14945.	-.411	92.93	348.4
378.56	12.46	-2.84	-.43	-179.99	.0	0.	0.	13643.	-.464	93.25	15006.	-.422	92.95	350.5
379.52	12.53	-2.79	-.43	-179.98	.0	0.	0.	13704.	-.475	93.27	15067.	-.432	92.97	352.6
380.48	12.59	-2.73	-.44	-179.99	.0	0.	0.	13765.	-.486	93.29	15129.	-.442	92.99	354.7
381.44	12.66	-2.68	-.44	179.98	.0	0.	0.	13827.	-.496	93.31	15190.	-.452	93.01	356.9
382.40	12.72	-2.63	-.46	179.98	.0	0.	0.	13889.	-.506	93.33	15252.	-.461	93.03	359.0
383.36	12.79	-2.58	-.47	179.99	.0	0.	0.	13951.	-.516	93.35	15315.	-.470	93.05	361.2
384.32	12.86	-2.54	-.47	-180.00	.0	0.	0.	14014.	-.525	93.37	15377.	-.478	93.07	363.3
385.28	12.92	-2.49	-.48	-180.00	.0	0.	0.	14077.	-.534	93.39	15440.	-.486	93.09	365.5
386.24	12.99	-2.44	-.49	179.99	.0	0.	0.	14140.	-.542	93.41	15504.	-.494	93.11	367.7
387.20	13.06	-2.39	-.49	179.97	.0	0.	0.	14204.	-.549	93.43	15567.	-.501	93.13	369.9
388.16	13.13	-2.35	-.51	179.95	.0	0.	0.	14268.	-.557	93.46	15631.	-.508	93.15	372.1
389.12	13.20	-2.30	-.52	179.97	.0	0.	0.	14332.	-.564	93.48	15695.	-.515	93.17	374.4
390.08	13.27	-2.24	-.51	180.00	.0	0.	0.	14396.	-.570	93.50	15759.	-.521	93.20	376.6
391.04	13.34	-2.18	-.50	-179.98	.0	0.	0.	14461.	-.576	93.52	15824.	-.527	93.22	378.8
392.00	13.41	-2.13	-.48	-179.98	.0	0.	0.	14526.	-.582	93.54	15889.	-.532	93.24	381.1
392.96	13.48	-2.06	-.48	180.00	.0	0.	0.	14591.	-.587	93.56	15955.	-.537	93.26	383.3
393.92	13.56	-2.00	-.49	179.98	.0	0.	0.	14657.	-.592	93.59	16020.	-.542	93.28	385.6
394.88	13.63	-1.95	-.51	179.98	.0	0.	0.	14723.	-.596	93.61	16087.	-.546	93.30	387.9
395.84	13.70	-1.88	-.52	179.98	.0	0.	0.	14790.	-.601	93.63	16153.	-.550	93.32	390.2
396.80	13.78	-1.81	-.53	179.99	.0	0.	0.	14856.	-.604	93.65	16220.	-.554	93.34	392.5
397.76	13.85	-1.74	-.54	-180.00	.0	0.	0.	14924.	-.608	93.67	16287.	-.557	93.37	394.8
398.72	13.93	-1.68	-.53	-179.98	.0	0.	0.	14991.	-.611	93.69	16354.	-.560	93.39	397.1
399.68	14.00	-1.62	-.52	-179.97	.0	0.	0.	15059.	-.613	93.72	16422.	-.563	93.41	399.4

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
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400.64	14.08	-1.57	-.51	179.99	.0	0.	0.	15127.	-.616	93.74	16490.	-.565	93.43	401.8
401.60	14.16	-1.51	-.53	179.97	.0	0.	0.	15195.	-.618	93.76	16558.	-.567	93.45	404.1
402.56	14.23	-1.46	-.54	179.96	.0	0.	0.	15264.	-.619	93.78	16627.	-.568	93.47	406.5
403.52	14.31	-1.39	-.55	179.97	.0	0.	0.	15333.	-.620	93.81	16696.	-.570	93.50	408.9
404.48	14.39	-1.32	-.56	180.00	.0	0.	0.	15403.	-.621	93.83	16766.	-.570	93.52	411.3
405.44	14.46	-1.23	-.57	-179.99	.0	0.	0.	15473.	-.621	93.85	16836.	-.571	93.54	413.7
406.40	14.54	-1.15	-.57	-179.98	.0	0.	0.	15543.	-.622	93.87	16906.	-.571	93.56	416.1
407.36	14.62	-1.09	-.57	-180.00	.0	0.	0.	15614.	-.621	93.90	16977.	-.572	93.58	418.5
408.32	14.70	-1.04	-.56	179.98	.0	0.	0.	15685.	-.621	93.92	17048.	-.571	93.61	420.9
409.28	14.78	-.98	-.55	179.95	.0	0.	0.	15756.	-.620	93.94	17119.	-.571	93.63	423.4
410.24	14.86	-.92	-.56	179.94	.0	0.	0.	15828.	-.619	93.96	17191.	-.570	93.65	425.8
411.20	14.94	-.86	-.57	179.96	.0	0.	0.	15900.	-.617	93.99	17263.	-.568	93.67	428.3
412.16	15.02	-.80	-.58	179.99	.0	0.	0.	15973.	-.615	94.01	17336.	-.567	93.69	430.8
413.12	15.10	-.73	-.60	-179.99	.0	0.	0.	16045.	-.613	94.03	17408.	-.565	93.72	433.2
414.08	15.18	-.67	-.61	-179.98	.0	0.	0.	16119.	-.610	94.06	17482.	-.562	93.74	435.7
415.04	15.26	-.61	-.62	-179.99	.0	0.	0.	16192.	-.607	94.08	17556.	-.560	93.76	438.3
416.00	15.34	-.56	-.61	179.98	.0	0.	0.	16267.	-.604	94.10	17630.	-.557	93.79	440.8
416.96	15.42	-.49	-.60	179.97	.0	0.	0.	16341.	-.600	94.13	17704.	-.553	93.81	443.3
417.92	15.50	-.43	-.59	179.97	.0	0.	0.	16416.	-.595	94.15	17779.	-.550	93.83	445.8
418.88	15.58	-.36	-.59	-180.00	.0	0.	0.	16491.	-.591	94.17	17854.	-.546	93.85	448.4
419.84	15.66	-.29	-.61	-179.96	.0	0.	0.	16567.	-.586	94.20	17930.	-.542	93.88	451.0
420.80	15.75	-.23	-.61	-179.96	.0	0.	0.	16643.	-.581	94.22	18006.	-.537	93.90	453.5
421.76	15.83	-.17	-.61	-179.99	.0	0.	0.	16720.	-.575	94.24	18083.	-.532	93.92	456.1
422.72	15.91	-.11	-.62	179.98	.0	0.	0.	16797.	-.570	94.27	18160.	-.527	93.95	458.7
423.68	15.99	-.05	-.62	179.96	.0	0.	0.	16875.	-.563	94.29	18238.	-.521	93.97	461.4
424.64	16.07	.01	-.62	179.95	.0	0.	0.	16953.	-.557	94.32	18316.	-.515	93.99	464.0
425.60	16.16	.07	-.62	179.96	.0	0.	0.	17031.	-.550	94.34	18394.	-.509	94.02	466.6
426.56	16.24	.12	-.61	179.99	.0	0.	0.	17110.	-.543	94.36	18473.	-.503	94.04	469.3
427.52	16.32	.18	-.62	-180.00	.0	0.	0.	17189.	-.535	94.39	18552.	-.496	94.07	471.9
428.48	16.41	.23	-.62	179.99	.0	0.	0.	17269.	-.527	94.41	18632.	-.488	94.09	474.6
429.44	16.49	.27	-.63	179.98	.0	0.	0.	17349.	-.518	94.44	18712.	-.481	94.11	477.3
430.40	16.57	.29	-.64	179.96	.0	0.	0.	17430.	-.509	94.46	18793.	-.472	94.14	480.0
431.36	16.66	.32	-.66	179.97	.0	0.	0.	17511.	-.500	94.49	18874.	-.464	94.16	482.7
432.32	16.74	.36	-.67	-179.99	.0	0.	0.	17592.	-.490	94.51	18955.	-.455	94.19	485.4
433.28	16.83	.41	-.67	-179.98	.0	0.	0.	17675.	-.480	94.54	19037.	-.445	94.21	488.2
434.24	16.91	.46	-.65	-179.97	.0	0.	0.	17757.	-.469	94.56	19120.	-.435	94.24	490.9
435.20	17.00	.52	-.63	-179.99	.0	0.	0.	17840.	-.458	94.59	19203.	-.425	94.26	493.7
436.16	17.09	.57	-.63	179.99	.0	0.	0.	17924.	-.446	94.61	19287.	-.415	94.28	496.5
437.12	17.17	.62	-.62	179.98	.0	0.	0.	18008.	-.435	94.64	19371.	-.404	94.31	499.3
438.08	17.26	.68	-.64	179.98	.0	0.	0.	18092.	-.422	94.66	19455.	-.393	94.33	502.1
439.04	17.35	.74	-.65	179.99	.0	0.	0.	18177.	-.410	94.69	19540.	-.381	94.36	504.9
440.00	17.43	.80	-.66	-179.98	.0	0.	0.	18263.	-.397	94.71	19626.	-.369	94.38	507.7

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
AERODYNAMIC SUMMARY

TIME (SEC)	MACH (ND)	ALPHA (DEG)	BETA (DEG)	BANK (DEG)	DYN PRESS (PSF)	QALPHA (PSF-DEG)	QBETA (PSF-DEG)	VE (FPS)	GAME (DEG)	AZE (DEG)	VI (FPS)	GAMI (DEG)	AZI (DEG)	SURFACE RANGE (NM)
440.96	17.52	.86	-.66	-179.97	.0	0.	0.	18349.	-.384	94.74	19712.	-.357	94.41	510.6
441.92	17.61	.92	-.66	-179.98	.0	0.	0.	18436.	-.370	94.76	19799.	-.345	94.44	513.4
442.88	17.70	.98	-.67	179.99	.0	0.	0.	18523.	-.357	94.79	19886.	-.332	94.46	516.3
443.84	17.79	1.04	-.67	179.97	.0	0.	0.	18611.	-.343	94.82	19974.	-.319	94.49	519.2
444.80	17.88	1.11	-.66	179.99	.0	0.	0.	18699.	-.328	94.84	20062.	-.306	94.51	522.1
445.76	17.96	1.17	-.64	-179.98	.0	0.	0.	18788.	-.313	94.87	20151.	-.292	94.54	525.0
446.72	18.06	1.23	-.63	-179.96	.0	0.	0.	18878.	-.298	94.89	20241.	-.278	94.56	527.9
447.68	18.15	1.22	-.62	-179.98	.0	0.	0.	18968.	-.284	94.92	20331.	-.265	94.59	530.9
448.64	18.24	1.22	-.64	-179.97	.0	0.	0.	19058.	-.267	94.95	20421.	-.249	94.62	533.8
449.60	18.33	1.33	-.66	-179.94	.0	0.	0.	19149.	-.250	94.97	20511.	-.234	94.64	536.8
450.56	18.42	1.45	-.68	-179.93	.0	0.	0.	19239.	-.235	95.00	20601.	-.220	94.67	539.8
451.52	18.51	1.49	-.70	-179.91	.0	0.	0.	19329.	-.220	95.03	20692.	-.205	94.69	542.7
452.48	18.60	1.50	-.71	-179.92	.0	0.	0.	19419.	-.204	95.05	20782.	-.191	94.72	545.8
453.44	18.69	1.49	-.73	-179.95	.0	0.	0.	19509.	-.188	95.08	20872.	-.176	94.75	548.8
454.40	18.78	1.47	-.74	-179.98	.0	0.	0.	19600.	-.172	95.11	20962.	-.161	94.77	551.8
455.36	18.86	1.46	-.75	179.99	.1	0.	0.	19690.	-.155	95.13	21053.	-.145	94.80	554.9
456.32	18.95	1.45	-.75	179.97	.1	0.	0.	19781.	-.138	95.16	21144.	-.129	94.83	557.9
457.28	19.04	1.46	-.75	179.98	.1	0.	0.	19871.	-.120	95.19	21234.	-.112	94.85	561.0
458.24	19.13	1.48	-.73	-180.00	.1	0.	0.	19961.	-.103	95.21	21324.	-.096	94.88	564.1
459.20	19.22	1.51	-.71	-179.97	.1	0.	0.	20051.	-.085	95.24	21414.	-.080	94.91	567.2
460.16	19.31	1.56	-.69	-179.99	.1	0.	0.	20141.	-.067	95.27	21504.	-.063	94.93	570.3
461.12	19.39	1.63	-.67	179.98	.1	0.	0.	20231.	-.050	95.30	21594.	-.046	94.96	573.5
462.08	19.48	1.69	-.66	179.96	.1	0.	0.	20322.	-.032	95.32	21685.	-.030	94.99	576.6
463.04	19.57	1.76	-.64	179.94	.1	0.	0.	20412.	-.014	95.35	21775.	-.013	95.02	579.8
464.00	19.66	1.84	-.63	179.93	.1	0.	0.	20503.	.003	95.38	21865.	.003	95.04	583.0
464.96	19.74	1.90	-.61	179.94	.1	0.	0.	20593.	.021	95.41	21956.	.020	95.07	586.2
465.92	19.83	1.96	-.59	179.97	.1	0.	0.	20684.	.039	95.44	22047.	.036	95.10	589.4
466.88	19.92	2.03	-.58	179.99	.1	0.	0.	20775.	.056	95.47	22138.	.053	95.13	592.6
467.84	20.00	2.10	-.56	179.98	.1	0.	0.	20866.	.074	95.50	22228.	.069	95.16	595.8
468.80	20.09	2.16	-.56	179.94	.1	0.	0.	20957.	.092	95.53	22319.	.086	95.19	599.1
469.76	20.17	2.22	-.56	179.91	.1	0.	0.	21048.	.109	95.55	22411.	.103	95.22	602.3
470.72	20.26	2.27	-.57	179.90	.1	0.	0.	21139.	.127	95.58	22501.	.119	95.25	605.6
471.68	20.34	2.32	-.59	179.88	.1	0.	0.	21229.	.144	95.61	22592.	.135	95.27	608.9
472.64	20.43	2.34	-.60	179.90	.1	0.	0.	21319.	.161	95.64	22682.	.151	95.30	612.2
473.60	20.51	2.36	-.60	179.94	.1	0.	0.	21409.	.179	95.67	22772.	.168	95.33	615.5
474.56	20.60	2.38	-.60	179.97	.1	0.	0.	21500.	.197	95.70	22863.	.185	95.36	618.9
475.52	20.68	2.40	-.60	179.97	.1	0.	0.	21592.	.215	95.73	22954.	.202	95.39	622.2
476.48	20.76	2.45	-.60	179.94	.1	0.	0.	21683.	.233	95.76	23046.	.219	95.42	625.6
477.44	20.85	2.51	-.62	179.92	.1	0.	0.	21773.	.251	95.79	23136.	.236	95.45	628.9
478.40	20.93	2.56	-.64	179.90	.1	0.	0.	21864.	.269	95.82	23227.	.253	95.48	632.3
479.36	21.01	2.63	-.65	179.88	.1	0.	0.	21955.	.286	95.85	23317.	.270	95.51	635.7
480.32	21.09	2.69	-.67	179.90	.1	0.	0.	22045.	.304	95.88	23408.	.286	95.54	639.2

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
AERODYNAMIC SUMMARY

TIME (SEC)	MACH (ND)	ALPHA (DEG)	BETA (DEG)	BANK (DEG)	DYN PRESS (PSF)	QALPHA (PSF-DEG)	QBETA (PSF-DEG)	VE (FPS)	GAME (DEG)	AZE (DEG)	VI (FPS)	GAMI (DEG)	AZI (DEG)	SURFACE RANGE (NM)
481.28	21.17	2.76	-.68	179.93	.1	0.	0.	22136.	.322	95.91	23499.	.303	95.57	642.6
482.24	21.25	2.84	-.69	179.95	.1	0.	0.	22227.	.339	95.94	23590.	.320	95.60	646.0
483.20	21.33	2.93	-.70	179.94	.1	0.	0.	22318.	.356	95.97	23680.	.336	95.63	649.5
484.16	21.41	3.01	-.70	179.93	.1	0.	0.	22408.	.373	96.01	23771.	.352	95.66	653.0
485.12	21.49	3.06	-.68	179.90	.1	0.	0.	22499.	.390	96.04	23862.	.368	95.69	656.5
486.08	21.57	3.10	-.66	179.89	.1	0.	0.	22590.	.407	96.07	23953.	.384	95.72	660.0
487.04	21.65	3.13	-.64	179.89	.1	0.	0.	22681.	.425	96.10	24044.	.401	95.75	663.5
488.00	21.73	3.16	-.62	179.93	.1	0.	0.	22772.	.442	96.13	24135.	.417	95.78	667.0
488.96	21.81	3.20	-.60	179.95	.1	0.	0.	22863.	.459	96.16	24226.	.433	95.81	670.6
489.92	21.88	3.23	-.58	179.96	.1	0.	0.	22954.	.476	96.19	24317.	.449	95.84	674.1
490.88	21.96	3.27	-.57	179.94	.1	0.	0.	23045.	.493	96.22	24408.	.466	95.88	677.7
491.84	22.03	3.30	-.56	179.91	.1	0.	0.	23136.	.511	96.26	24499.	.482	95.91	681.3
492.80	22.11	3.30	-.54	179.88	.1	0.	0.	23227.	.528	96.29	24590.	.499	95.94	684.9
493.76	22.18	3.26	-.53	179.87	.1	0.	0.	23318.	.545	96.32	24681.	.515	95.97	688.5
494.72	22.26	3.18	-.51	179.89	.1	0.	0.	23409.	.563	96.35	24772.	.532	96.00	692.1
495.68	22.33	3.08	-.49	179.91	.1	0.	0.	23500.	.582	96.39	24863.	.550	96.04	695.8
496.64	22.40	2.99	-.51	179.93	.1	0.	0.	23591.	.600	96.42	24954.	.568	96.07	699.4
497.12	22.43	2.96	-.53	179.94	.1	0.	0.	23636.	.610	96.44	24999.	.577	96.08	701.2
497.92	22.49	2.93	-.58	179.96	.1	0.	0.	23712.	.626	96.46	25075.	.592	96.11	704.3
498.88	22.56	2.90	-.64	179.96	.1	0.	0.	23803.	.645	96.50	25166.	.610	96.14	708.0
499.84	22.62	2.87	-.70	179.94	.1	0.	0.	23892.	.664	96.53	25255.	.629	96.18	711.7
500.80	22.68	2.83	-.76	179.90	.1	0.	0.	23974.	.682	96.56	25337.	.645	96.21	715.4
501.76	22.74	2.81	-.80	179.88	.1	0.	0.	24057.	.700	96.59	25420.	.662	96.24	719.2
502.72	22.79	2.84	-.82	179.86	.1	0.	0.	24140.	.718	96.63	25503.	.680	96.27	722.9
503.68	22.84	2.91	-.80	179.84	.1	0.	0.	24223.	.736	96.66	25587.	.697	96.30	726.7
504.64	22.89	3.00	-.76	179.86	.1	0.	0.	24307.	.754	96.69	25671.	.714	96.34	730.4
505.60	22.94	3.08	-.70	179.89	.1	0.	0.	24392.	.772	96.73	25755.	.731	96.37	734.2
506.56	22.98	3.14	-.64	179.91	.1	0.	0.	24467.	.788	96.76	25830.	.746	96.40	738.0
507.52	22.97	3.06	-.61	179.84	.1	0.	0.	24492.	.794	96.80	25855.	.752	96.44	741.8
508.48	22.94	2.90	-.61	179.74	.1	0.	0.	24499.	.796	96.83	25863.	.754	96.47	745.6
509.44	22.90	2.72	-.62	179.62	.1	0.	0.	24504.	.798	96.87	25867.	.756	96.51	749.4
510.40	22.87	2.54	-.64	179.50	.1	0.	0.	24507.	.799	96.91	25870.	.757	96.54	753.2
511.36	22.83	2.34	-.66	179.39	.1	0.	0.	24510.	.801	96.94	25873.	.758	96.58	757.0
512.32	22.79	2.15	-.69	179.27	.1	0.	0.	24511.	.802	96.98	25875.	.760	96.61	760.8
513.28	22.75	1.97	-.73	179.13	.1	0.	0.	24512.	.803	97.02	25875.	.761	96.65	764.6
MECO (THRUST=0)														
514.07	22.71	1.83	-.76	179.02	.1	0.	0.	24512.	.804	97.05	25875.	.761	96.68	767.7

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
.00	28.608	-80.604	-25.	0.	0.	1341.	.0	89.8	-88.8	100.	.25	4525085.	1597444.
.96	28.608	-80.604	-21.	11.	11.	1341.	.0	89.7	-92.7	100.	1.55	4504639.	1594451.
1.92	28.608	-80.604	-2.	28.	29.	1341.	.0	89.5	-95.9	100.	1.56	4478668.	1591458.
2.88	28.608	-80.604	33.	46.	46.	1341.	.0	89.5	-99.3	100.	1.57	4452708.	1588465.
3.84	28.608	-80.604	86.	64.	64.	1342.	.0	89.6	-104.7	100.	1.59	4426644.	1585472.
4.80	28.608	-80.604	156.	82.	83.	1343.	.0	89.6	-106.8	104.	1.63	4400325.	1582383.
5.76	28.609	-80.604	244.	102.	103.	1344.	.0	89.6	-106.5	104.	1.66	4373762.	1579269.
6.72	28.609	-80.604	352.	123.	123.	1346.	.0	89.6	-105.4	104.	1.68	4346997.	1576155.
7.68	28.609	-80.604	479.	144.	144.	1348.	.0	89.7	-102.0	104.	1.70	4320111.	1573041.
8.64	28.609	-80.604	628.	165.	166.	1350.	.0	89.5	30.6	104.	1.71	4293149.	1569926.
9.60	28.609	-80.604	797.	187.	188.	1353.	139.6	87.3	40.1	104.	1.73	4266123.	1566812.
10.56	28.609	-80.604	987.	209.	210.	1358.	149.5	83.7	36.1	104.	1.74	4239066.	1563698.
11.52	28.609	-80.604	1198.	232.	232.	1367.	159.4	79.7	28.6	104.	1.75	4212002.	1560584.
12.48	28.609	-80.604	1431.	254.	254.	1380.	167.6	76.0	20.2	104.	1.77	4184942.	1557470.
13.44	28.609	-80.604	1685.	275.	277.	1398.	174.2	72.8	11.5	104.	1.78	4157884.	1554355.
14.40	28.609	-80.604	1960.	296.	300.	1418.	180.0	70.2	3.7	104.	1.79	4130822.	1551241.
15.36	28.609	-80.604	2254.	317.	324.	1442.	183.1	68.9	-1.4	104.	1.81	4103746.	1548127.
16.32	28.609	-80.603	2569.	338.	349.	1465.	183.2	68.6	-3.4	104.	1.82	4076650.	1545013.
17.28	28.609	-80.603	2904.	360.	374.	1489.	181.4	69.1	-2.7	104.	1.84	4049533.	1541899.
18.24	28.609	-80.603	3259.	382.	401.	1512.	179.7	70.0	-1.0	104.	1.85	4022398.	1538785.
19.20	28.609	-80.602	3637.	405.	428.	1534.	178.9	70.7	.2	104.	1.87	3995252.	1535670.
20.16	28.609	-80.602	4037.	429.	456.	1557.	178.8	71.0	.5	104.	1.89	3968099.	1532556.
21.12	28.609	-80.602	4460.	453.	484.	1579.	179.0	71.2	.4	104.	1.90	3940950.	1529442.
22.08	28.609	-80.601	4906.	477.	513.	1601.	179.2	71.2	.1	104.	1.90	3913903.	1526328.
23.04	28.609	-80.600	5375.	501.	541.	1623.	179.3	71.2	.0	104.	1.89	3887211.	1523214.
24.00	28.609	-80.600	5868.	524.	568.	1645.	179.3	71.2	-.2	99.	1.85	3860984.	1520135.
24.96	28.609	-80.599	6382.	546.	594.	1666.	179.3	71.1	-.3	90.	1.81	3835391.	1517312.
25.92	28.609	-80.598	6917.	567.	619.	1686.	179.2	70.7	-.5	87.	1.79	3810346.	1514700.
26.88	28.609	-80.598	7471.	588.	643.	1707.	179.2	70.2	-.6	87.	1.78	3785618.	1512099.
27.84	28.609	-80.597	8045.	607.	668.	1728.	179.3	69.7	-.7	87.	1.78	3761173.	1509498.
28.80	28.609	-80.596	8637.	627.	692.	1749.	179.3	69.2	-.8	87.	1.77	3736990.	1506897.
29.76	28.609	-80.595	9249.	646.	716.	1771.	179.4	68.7	-.8	87.	1.77	3713052.	1504296.
30.72	28.609	-80.594	9878.	665.	740.	1792.	179.5	68.4	-.9	87.	1.76	3689345.	1501695.
31.68	28.609	-80.593	10526.	684.	763.	1814.	179.6	68.1	-.9	87.	1.76	3665871.	1499094.
32.64	28.609	-80.592	11192.	703.	787.	1835.	179.7	67.8	-1.0	87.	1.76	3642625.	1496493.
33.60	28.609	-80.591	11875.	721.	810.	1857.	179.8	67.4	-.9	87.	1.75	3619597.	1493892.
34.56	28.609	-80.590	12576.	739.	834.	1878.	179.9	67.1	-1.0	87.	1.75	3596785.	1491291.
35.52	28.609	-80.589	13295.	757.	857.	1900.	180.0	66.7	-1.0	87.	1.75	3574180.	1488690.
36.48	28.610	-80.588	14031.	775.	880.	1921.	180.0	66.4	-1.0	87.	1.75	3551779.	1486089.
37.44	28.610	-80.586	14783.	793.	903.	1943.	180.1	66.0	-.9	87.	1.74	3529574.	1483488.
38.40	28.610	-80.585	15553.	811.	926.	1965.	180.2	65.7	-1.0	87.	1.74	3507565.	1480887.
39.36	28.610	-80.584	16340.	828.	949.	1986.	180.3	65.3	-1.0	87.	1.74	3485753.	1478286.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
40.32	28.610	-80.582	17143.	845.	972.	2008.	180.3	64.9	-1.1	87.	1.74	3464135.	1475685.
41.28	28.610	-80.581	17962.	862.	994.	2030.	180.4	64.5	-1.2	87.	1.74	3442691.	1473084.
42.24	28.610	-80.579	18797.	878.	1017.	2052.	180.5	64.1	-1.3	87.	1.74	3421403.	1470483.
43.20	28.610	-80.578	19648.	895.	1039.	2073.	180.7	63.9	-1.3	87.	1.74	3400259.	1467882.
44.16	28.610	-80.576	20515.	911.	1062.	2095.	180.8	63.7	-1.2	87.	1.75	3379251.	1465281.
45.12	28.610	-80.574	21398.	927.	1084.	2117.	180.8	63.4	-1.2	87.	1.75	3358369.	1462680.
46.08	28.610	-80.573	22295.	943.	1106.	2138.	180.8	63.1	-1.1	87.	1.75	3337599.	1460079.
47.04	28.610	-80.571	23208.	959.	1127.	2159.	180.6	62.9	-1.1	87.	1.75	3316986.	1457478.
48.00	28.610	-80.569	24136.	974.	1148.	2180.	180.7	62.6	-1.1	87.	1.74	3296605.	1454877.
48.96	28.610	-80.567	25078.	989.	1169.	2201.	180.8	62.5	-1.1	87.	1.74	3276425.	1452276.
49.92	28.610	-80.565	26035.	1004.	1190.	2221.	180.8	62.3	-1.2	87.	1.75	3256376.	1449675.
50.88	28.610	-80.563	27006.	1019.	1211.	2242.	180.9	62.0	-1.3	84.	1.74	3236410.	1447089.
51.84	28.610	-80.562	27991.	1033.	1231.	2263.	181.0	61.7	-1.3	74.	1.71	3216692.	1444728.
52.80	28.610	-80.559	28988.	1045.	1251.	2283.	181.0	61.4	-1.3	67.	1.70	3197239.	1442646.
53.76	28.610	-80.557	29998.	1058.	1271.	2304.	180.9	61.0	-1.3	67.	1.72	3177816.	1440645.
54.72	28.611	-80.555	31020.	1072.	1292.	2325.	180.9	60.7	-1.3	67.	1.74	3158307.	1438643.
55.68	28.611	-80.553	32056.	1085.	1313.	2347.	180.7	60.3	-1.3	67.	1.76	3138707.	1436641.
56.64	28.611	-80.551	33104.	1100.	1335.	2370.	180.6	60.0	-1.4	67.	1.79	3119017.	1434640.
57.60	28.611	-80.549	34167.	1114.	1358.	2394.	180.5	59.7	-1.5	67.	1.81	3099236.	1432638.
58.56	28.611	-80.546	35244.	1130.	1382.	2418.	180.5	59.5	-1.6	72.	1.85	3079330.	1430601.
59.52	28.611	-80.544	36337.	1147.	1408.	2444.	180.6	59.2	-1.8	81.	1.92	3059080.	1428312.
60.48	28.611	-80.541	37448.	1167.	1435.	2472.	180.8	59.0	-1.8	91.	1.99	3038453.	1425734.
61.44	28.611	-80.539	38578.	1188.	1465.	2501.	181.1	58.7	-1.8	101.	2.07	3017446.	1422868.
62.40	28.611	-80.536	39730.	1211.	1498.	2532.	181.3	58.4	-1.8	104.	2.11	2996124.	1419773.
63.36	28.611	-80.534	40903.	1235.	1530.	2564.	181.5	58.2	-1.7	104.	2.13	2974711.	1416658.
64.32	28.611	-80.531	42100.	1259.	1564.	2597.	181.4	57.9	-1.8	104.	2.15	2953236.	1413544.
65.28	28.611	-80.528	43321.	1284.	1599.	2631.	181.3	57.2	-2.0	104.	2.18	2931697.	1410430.
66.24	28.611	-80.525	44565.	1308.	1635.	2666.	181.2	56.4	-2.1	104.	2.21	2910081.	1407316.
67.20	28.612	-80.522	45833.	1333.	1672.	2703.	181.2	55.6	-2.2	104.	2.23	2888378.	1404202.
68.16	28.612	-80.519	47124.	1358.	1709.	2742.	181.3	55.0	-2.2	104.	2.26	2866609.	1401087.
69.12	28.612	-80.516	48440.	1383.	1748.	2781.	181.5	54.5	-2.2	104.	2.28	2844784.	1397973.
70.08	28.612	-80.513	49780.	1408.	1788.	2822.	181.6	53.9	-2.1	104.	2.31	2822909.	1394859.
71.04	28.612	-80.509	51144.	1434.	1830.	2864.	181.6	53.2	-2.0	104.	2.33	2800985.	1391745.
72.00	28.612	-80.506	52533.	1460.	1872.	2908.	181.6	52.4	-1.9	104.	2.36	2779019.	1388631.
72.96	28.612	-80.502	53947.	1485.	1915.	2953.	181.6	51.6	-1.7	104.	2.38	2757019.	1385517.
73.92	28.612	-80.499	55385.	1511.	1960.	3000.	181.5	50.8	-1.6	104.	2.41	2734986.	1382402.
74.88	28.612	-80.495	56848.	1537.	2005.	3048.	181.3	49.9	-1.6	104.	2.43	2712933.	1379288.
75.84	28.613	-80.491	58335.	1562.	2052.	3097.	181.3	49.0	-1.5	104.	2.45	2690860.	1376174.
76.80	28.613	-80.487	59847.	1587.	2100.	3148.	181.2	48.0	-1.5	104.	2.47	2668788.	1373060.
77.76	28.613	-80.483	61382.	1611.	2148.	3200.	181.2	47.0	-1.4	104.	2.48	2646802.	1369946.
78.72	28.613	-80.479	62941.	1635.	2197.	3253.	181.2	45.9	-1.4	104.	2.48	2625012.	1366831.
79.68	28.613	-80.474	64521.	1658.	2246.	3306.	181.2	44.9	-1.3	104.	2.48	2603421.	1363717.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
80.64	28.613	-80.470	66123.	1680.	2296.	3360.	181.2	44.0	-1.3	104.	2.49	2581990.	1360603.
81.60	28.613	-80.465	67746.	1701.	2347.	3415.	181.2	43.2	-1.2	104.	2.49	2560705.	1357489.
82.56	28.614	-80.460	69389.	1722.	2397.	3470.	181.2	42.6	-1.2	104.	2.49	2539625.	1354375.
83.52	28.614	-80.455	71052.	1743.	2448.	3525.	181.1	42.2	-1.2	104.	2.49	2518771.	1351260.
84.48	28.614	-80.450	72735.	1763.	2500.	3581.	181.1	41.8	-1.2	104.	2.49	2498111.	1348146.
85.44	28.614	-80.444	74437.	1784.	2551.	3637.	181.1	41.5	-1.2	104.	2.48	2477652.	1345032.
86.40	28.614	-80.439	76159.	1804.	2603.	3692.	181.1	41.1	-1.3	104.	2.47	2457449.	1341918.
87.36	28.614	-80.433	77901.	1824.	2655.	3748.	181.1	40.7	-1.3	104.	2.46	2437543.	1338804.
88.32	28.615	-80.427	79661.	1843.	2707.	3804.	181.2	40.2	-1.4	104.	2.45	2417932.	1335690.
89.28	28.615	-80.421	81439.	1862.	2758.	3859.	181.2	39.8	-1.4	104.	2.46	2398519.	1332575.
90.24	28.615	-80.415	83235.	1881.	2811.	3916.	181.2	39.4	-1.3	104.	2.47	2379205.	1329461.
91.20	28.615	-80.409	85050.	1899.	2864.	3973.	181.2	38.9	-1.3	104.	2.48	2359973.	1326347.
92.16	28.615	-80.402	86882.	1918.	2918.	4030.	181.1	38.5	-1.3	104.	2.48	2340847.	1323233.
93.12	28.615	-80.396	88732.	1936.	2972.	4088.	181.1	38.0	-1.3	104.	2.48	2321861.	1320119.
94.08	28.616	-80.389	90600.	1954.	3026.	4146.	181.0	37.6	-1.3	104.	2.48	2303067.	1317004.
95.04	28.616	-80.382	92485.	1972.	3080.	4204.	181.0	37.1	-1.3	104.	2.47	2284510.	1313890.
96.00	28.616	-80.375	94386.	1989.	3135.	4262.	180.9	36.7	-1.3	104.	2.46	2266178.	1310776.
96.96	28.616	-80.368	96303.	2005.	3189.	4320.	180.9	36.3	-1.3	104.	2.46	2248030.	1307662.
97.92	28.617	-80.360	98236.	2022.	3244.	4378.	180.9	35.9	-1.3	104.	2.46	2230048.	1304548.
98.88	28.617	-80.352	100185.	2038.	3299.	4436.	180.9	35.5	-1.2	104.	2.45	2212238.	1301434.
99.84	28.617	-80.345	102149.	2053.	3354.	4495.	180.9	35.1	-1.2	104.	2.44	2194621.	1298319.
100.80	28.617	-80.337	104127.	2068.	3409.	4553.	180.8	34.7	-1.3	104.	2.43	2177214.	1295205.
101.76	28.618	-80.329	106120.	2083.	3463.	4611.	180.9	34.3	-1.3	104.	2.42	2160032.	1292091.
102.72	28.618	-80.320	108126.	2097.	3518.	4669.	180.9	33.9	-1.3	104.	2.41	2143116.	1288977.
103.68	28.618	-80.312	110146.	2111.	3572.	4727.	180.9	33.5	-1.3	104.	2.39	2126541.	1285863.
104.64	28.618	-80.303	112178.	2124.	3627.	4784.	180.9	33.2	-1.4	104.	2.37	2110314.	1282748.
105.60	28.619	-80.294	114223.	2136.	3680.	4841.	180.9	32.8	-1.4	104.	2.36	2094388.	1279634.
106.56	28.619	-80.285	116279.	2148.	3734.	4898.	180.9	32.5	-1.3	104.	2.36	2078707.	1276520.
107.52	28.619	-80.276	118347.	2160.	3788.	4955.	180.9	32.2	-1.3	104.	2.36	2063184.	1273406.
108.48	28.619	-80.267	120426.	2171.	3842.	5012.	180.9	31.8	-1.3	104.	2.33	2047856.	1270292.
109.44	28.620	-80.257	122516.	2182.	3895.	5068.	180.9	31.4	-1.4	104.	2.27	2032948.	1267178.
110.40	28.620	-80.248	124615.	2191.	3945.	5121.	181.0	31.1	-1.6	104.	2.17	2018706.	1264063.
111.36	28.620	-80.238	126722.	2198.	3992.	5171.	181.2	30.8	-1.8	104.	2.01	2005459.	1260949.
112.32	28.620	-80.228	128833.	2201.	4033.	5215.	181.3	30.5	-2.1	104.	1.79	1993652.	1257835.
113.28	28.621	-80.218	130947.	2202.	4067.	5252.	181.6	30.1	-2.3	104.	1.57	1983472.	1254721.
114.24	28.621	-80.207	133060.	2199.	4096.	5283.	181.8	29.7	-2.2	104.	1.41	1974666.	1251607.
115.20	28.621	-80.197	135169.	2194.	4120.	5310.	181.9	29.3	-1.9	104.	1.29	1966881.	1248492.
116.16	28.622	-80.187	137272.	2188.	4141.	5334.	181.9	28.8	-1.5	104.	1.19	1959948.	1245378.
117.12	28.622	-80.176	139368.	2179.	4160.	5356.	181.9	28.4	-1.2	104.	1.10	1953764.	1242264.
118.08	28.622	-80.166	141456.	2170.	4176.	5375.	181.9	27.9	-.9	104.	1.03	1948228.	1239150.
119.04	28.623	-80.155	143534.	2160.	4190.	5392.	181.9	27.7	-.9	104.	.96	1943286.	1236036.
120.00	28.623	-80.144	145602.	2148.	4203.	5407.	181.9	27.6	-.9	104.	.91	1938842.	1232921.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
120.96	28.623	-80.134	147659.	2136.	4214.	5421.	181.9	27.7	-1.0	104.	.87	1934766.	1229807.
121.92	28.624	-80.123	149704.	2124.	4225.	5434.	181.8	27.7	-1.0	104.	.84	1930953.	1226693.
122.88	28.624	-80.112	151737.	2112.	4234.	5446.	181.9	27.8	-1.1	104.	.81	1927336.	1223579.
123.84	28.624	-80.101	153759.	2099.	4243.	5457.	181.9	27.9	-1.1	104.	.80	1923875.	1220465.
124.52	28.624	-80.093	155183.	2090.	4249.	5465.	181.9	27.9	-1.1	104.	.79	1921496.	1218259.
SRB SEP AT 124.52 SEC													
124.52	28.624	-80.093	155183.	2090.	4249.	5465.	181.9	27.9	-1.1	104.	.95	1543518.	1218259.
125.12	28.625	-80.086	156436.	2084.	4258.	5475.	181.8	27.4	-1.0	104.	.95	1541570.	1216313.
126.08	28.625	-80.075	158431.	2073.	4272.	5492.	182.2	27.1	-.9	104.	.95	1538455.	1213198.
127.04	28.625	-80.064	160417.	2063.	4286.	5508.	182.7	27.3	-.8	104.	.96	1535339.	1210084.
128.00	28.625	-80.053	162392.	2053.	4300.	5524.	183.1	27.4	-.8	104.	.96	1532223.	1206970.
128.96	28.626	-80.042	164358.	2043.	4314.	5541.	183.2	27.6	-.8	104.	.96	1529107.	1203856.
129.92	28.626	-80.030	166314.	2033.	4329.	5558.	183.3	27.7	-.8	104.	.96	1525991.	1200742.
130.88	28.626	-80.019	168261.	2023.	4344.	5575.	183.3	27.7	-.8	104.	.96	1522876.	1197627.
131.84	28.627	-80.008	170199.	2013.	4358.	5591.	183.3	27.7	-.7	104.	.97	1519761.	1194513.
132.80	28.627	-79.996	172127.	2004.	4373.	5608.	182.9	27.0	-.1	104.	.97	1516646.	1191399.
133.76	28.627	-79.985	174046.	1994.	4389.	5626.	182.3	25.9	.7	104.	.97	1513531.	1188285.
134.72	28.628	-79.973	175955.	1983.	4404.	5644.	181.7	25.1	1.3	104.	.97	1510417.	1185171.
135.68	28.628	-79.961	177853.	1972.	4420.	5661.	181.2	24.4	1.8	104.	.97	1507302.	1182056.
136.64	28.628	-79.949	179741.	1961.	4436.	5680.	181.0	24.1	1.9	104.	.98	1504187.	1178942.
137.60	28.628	-79.938	181618.	1950.	4452.	5698.	180.9	23.8	1.9	104.	.98	1501072.	1175828.
138.56	28.629	-79.926	183485.	1939.	4468.	5717.	180.8	23.8	1.9	104.	.98	1497957.	1172714.
139.52	28.629	-79.914	185341.	1928.	4485.	5735.	180.8	23.8	1.8	104.	.98	1494842.	1169600.
140.48	28.629	-79.902	187187.	1917.	4502.	5754.	180.8	23.7	1.7	104.	.98	1491727.	1166486.
141.44	28.629	-79.890	189022.	1906.	4519.	5773.	180.8	23.6	1.6	104.	.99	1488612.	1163371.
142.40	28.630	-79.877	190847.	1896.	4536.	5792.	180.8	23.5	1.5	104.	.99	1485497.	1160257.
143.36	28.630	-79.865	192662.	1885.	4553.	5811.	180.7	23.3	1.4	104.	.99	1482382.	1157143.
144.32	28.630	-79.853	194466.	1874.	4570.	5830.	180.7	23.2	1.3	104.	.99	1479267.	1154029.
145.28	28.631	-79.840	196260.	1863.	4588.	5850.	180.6	23.0	1.3	104.	.99	1476152.	1150915.
146.24	28.631	-79.828	198043.	1852.	4606.	5870.	180.6	22.9	1.3	104.	1.00	1473038.	1147800.
147.20	28.631	-79.815	199816.	1841.	4624.	5889.	180.5	22.7	1.3	104.	1.00	1469923.	1144686.
148.16	28.631	-79.803	201578.	1830.	4642.	5909.	180.4	22.6	1.2	104.	1.00	1466808.	1141572.
149.12	28.632	-79.790	203330.	1819.	4660.	5929.	180.4	22.5	1.2	104.	1.00	1463693.	1138458.
150.08	28.632	-79.777	205071.	1809.	4679.	5950.	180.3	22.4	1.2	104.	1.01	1460578.	1135344.
151.04	28.632	-79.765	206802.	1798.	4697.	5970.	180.3	22.3	1.2	104.	1.01	1457463.	1132230.
152.00	28.632	-79.752	208523.	1787.	4716.	5991.	180.3	22.1	1.2	104.	1.01	1454348.	1129115.
152.96	28.632	-79.739	210233.	1776.	4735.	6011.	180.2	22.0	1.2	104.	1.01	1451233.	1126001.
153.92	28.633	-79.726	211933.	1765.	4754.	6032.	180.2	21.9	1.2	104.	1.01	1448118.	1122887.
154.88	28.633	-79.713	213622.	1754.	4774.	6053.	180.2	21.8	1.3	104.	1.02	1445003.	1119773.
155.84	28.633	-79.699	215301.	1743.	4793.	6074.	180.1	21.6	1.3	104.	1.02	1441888.	1116659.
156.80	28.633	-79.686	216969.	1732.	4813.	6095.	180.1	21.6	1.3	104.	1.02	1438774.	1113544.
157.76	28.634	-79.673	218627.	1722.	4832.	6117.	180.1	21.5	1.2	104.	1.02	1435659.	1110430.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
158.72	28.634	-79.659	220274.	1711.	4852.	6138.	180.1	21.4	1.2	104.	1.03	1432544.	1107316.
159.68	28.634	-79.646	221912.	1700.	4873.	6160.	180.0	21.3	1.2	104.	1.03	1429429.	1104202.
160.64	28.634	-79.632	223539.	1689.	4893.	6182.	180.0	21.1	1.2	104.	1.03	1426314.	1101088.
161.60	28.634	-79.619	225155.	1678.	4913.	6204.	180.0	21.0	1.2	104.	1.03	1423199.	1097974.
162.56	28.635	-79.605	226761.	1668.	4934.	6226.	180.0	20.9	1.3	104.	1.03	1420084.	1094859.
163.52	28.635	-79.591	228357.	1657.	4955.	6248.	180.0	20.8	1.3	104.	1.04	1416969.	1091745.
164.48	28.635	-79.577	229942.	1646.	4976.	6271.	180.0	20.7	1.3	104.	1.04	1413854.	1088631.
165.44	28.635	-79.563	231518.	1635.	4997.	6293.	180.0	20.7	1.3	104.	1.04	1410739.	1085517.
166.40	28.635	-79.549	233082.	1625.	5018.	6316.	180.0	20.6	1.3	104.	1.04	1407624.	1082403.
167.36	28.636	-79.535	234637.	1614.	5040.	6338.	180.0	20.5	1.3	104.	1.05	1404509.	1079288.
168.32	28.636	-79.521	236181.	1603.	5061.	6361.	180.0	20.4	1.3	104.	1.05	1401395.	1076174.
169.28	28.636	-79.507	237715.	1593.	5083.	6384.	180.0	20.3	1.3	104.	1.05	1398280.	1073060.
170.24	28.636	-79.493	239239.	1582.	5105.	6408.	180.0	20.2	1.3	104.	1.05	1395165.	1069946.
171.20	28.636	-79.478	240753.	1571.	5127.	6431.	180.0	20.1	1.2	104.	1.05	1392050.	1066832.
172.16	28.636	-79.464	242256.	1561.	5149.	6454.	180.0	20.0	1.2	104.	1.06	1388935.	1063717.
173.12	28.637	-79.449	243750.	1550.	5172.	6478.	180.0	19.9	1.3	104.	1.06	1385820.	1060603.
174.08	28.637	-79.435	245233.	1540.	5194.	6502.	180.0	19.8	1.3	104.	1.06	1382705.	1057489.
175.04	28.637	-79.420	246705.	1529.	5217.	6526.	180.0	19.7	1.3	104.	1.06	1379590.	1054375.
176.00	28.637	-79.405	248168.	1518.	5240.	6550.	180.0	19.7	1.3	104.	1.07	1376475.	1051261.
176.96	28.637	-79.390	249621.	1508.	5263.	6574.	180.0	19.6	1.3	104.	1.07	1373360.	1048147.
177.92	28.637	-79.375	251064.	1497.	5286.	6598.	180.0	19.5	1.3	104.	1.07	1370245.	1045032.
178.88	28.637	-79.360	252496.	1487.	5310.	6623.	180.0	19.4	1.3	104.	1.07	1367131.	1041918.
179.84	28.638	-79.345	253918.	1476.	5333.	6647.	180.0	19.3	1.3	104.	1.08	1364016.	1038804.
180.80	28.638	-79.330	255331.	1466.	5357.	6672.	180.0	19.2	1.3	104.	1.08	1360901.	1035690.
181.76	28.638	-79.315	256733.	1456.	5381.	6697.	180.0	19.1	1.3	104.	1.08	1357786.	1032576.
182.72	28.638	-79.299	258126.	1445.	5404.	6722.	180.0	19.0	1.2	104.	1.08	1354671.	1029461.
183.68	28.638	-79.284	259508.	1435.	5429.	6747.	180.0	19.0	1.2	104.	1.09	1351556.	1026347.
184.64	28.638	-79.268	260880.	1424.	5453.	6772.	180.0	18.9	1.2	104.	1.09	1348441.	1023233.
185.60	28.638	-79.253	262243.	1414.	5477.	6797.	180.0	18.8	1.2	104.	1.09	1345326.	1020119.
186.56	28.638	-79.237	263595.	1404.	5502.	6823.	180.0	18.7	1.2	104.	1.09	1342211.	1017005.
187.52	28.638	-79.221	264938.	1393.	5527.	6848.	180.0	18.6	1.2	104.	1.10	1339096.	1013891.
188.48	28.639	-79.205	266270.	1383.	5551.	6874.	180.0	18.5	1.2	104.	1.10	1335981.	1010776.
189.44	28.639	-79.189	267593.	1373.	5576.	6900.	180.0	18.4	1.3	104.	1.10	1332866.	1007662.
190.40	28.639	-79.173	268906.	1362.	5602.	6926.	180.0	18.3	1.3	104.	1.10	1329752.	1004548.
191.36	28.639	-79.157	270209.	1352.	5627.	6952.	180.0	18.2	1.2	104.	1.11	1326637.	1001434.
192.32	28.639	-79.141	271502.	1342.	5652.	6979.	180.0	18.2	1.2	104.	1.11	1323522.	998320.
193.28	28.639	-79.125	272786.	1332.	5678.	7005.	180.1	18.1	1.2	104.	1.11	1320407.	995205.
194.24	28.639	-79.109	274059.	1322.	5704.	7032.	180.1	18.0	1.2	104.	1.11	1317292.	992091.
195.20	28.639	-79.092	275323.	1311.	5730.	7058.	180.0	17.9	1.2	104.	1.12	1314177.	988977.
196.16	28.639	-79.076	276577.	1301.	5756.	7085.	180.0	17.8	1.2	104.	1.12	1311062.	985863.
197.12	28.639	-79.059	277822.	1291.	5782.	7112.	180.0	17.7	1.2	104.	1.12	1307947.	982749.
198.08	28.639	-79.042	279056.	1281.	5808.	7139.	180.0	17.7	1.2	104.	1.13	1304832.	979635.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
199.04	28.639	-79.026	280281.	1271.	5835.	7167.	180.0	17.6	1.2	104.	1.13	1301717.	976520.
200.00	28.639	-79.009	281497.	1261.	5862.	7194.	180.0	17.5	1.2	104.	1.13	1298602.	973406.
200.96	28.639	-78.992	282702.	1251.	5888.	7222.	180.0	17.4	1.2	104.	1.13	1295488.	970292.
201.92	28.639	-78.975	283898.	1241.	5915.	7249.	180.0	17.3	1.1	104.	1.14	1292373.	967178.
202.88	28.639	-78.958	285085.	1231.	5942.	7277.	180.0	17.2	1.1	104.	1.14	1289258.	964064.
203.84	28.639	-78.940	286262.	1221.	5970.	7305.	180.0	17.1	1.2	104.	1.14	1286143.	960949.
204.80	28.639	-78.923	287429.	1211.	5997.	7333.	180.0	17.0	1.2	104.	1.14	1283028.	957835.
205.76	28.639	-78.906	288587.	1201.	6025.	7361.	180.0	17.0	1.2	104.	1.15	1279913.	954721.
206.72	28.639	-78.888	289735.	1191.	6052.	7389.	180.0	16.9	1.2	104.	1.15	1276798.	951607.
207.68	28.639	-78.871	290873.	1181.	6080.	7418.	180.0	16.8	1.2	104.	1.15	1273683.	948493.
208.64	28.639	-78.853	292002.	1171.	6108.	7446.	180.0	16.7	1.1	104.	1.16	1270568.	945378.
209.60	28.639	-78.835	293122.	1161.	6136.	7475.	180.0	16.6	1.1	104.	1.16	1267453.	942264.
210.56	28.639	-78.817	294232.	1152.	6165.	7504.	180.0	16.5	1.1	104.	1.16	1264338.	939150.
211.52	28.639	-78.800	295333.	1142.	6193.	7533.	180.0	16.4	1.1	104.	1.16	1261223.	936036.
212.48	28.639	-78.782	296424.	1132.	6222.	7562.	180.0	16.4	1.1	104.	1.17	1258109.	932922.
213.44	28.639	-78.763	297506.	1122.	6250.	7591.	180.0	16.3	1.1	104.	1.17	1254994.	929808.
214.40	28.639	-78.745	298579.	1112.	6279.	7621.	180.0	16.2	1.1	104.	1.17	1251879.	926693.
215.36	28.639	-78.727	299642.	1103.	6308.	7650.	180.0	16.1	1.1	104.	1.18	1248764.	923579.
216.32	28.639	-78.709	300696.	1093.	6337.	7680.	179.9	16.0	1.0	104.	1.18	1245649.	920465.
217.28	28.639	-78.690	301741.	1083.	6367.	7710.	179.9	15.9	1.0	104.	1.18	1242534.	917351.
218.24	28.639	-78.672	302776.	1074.	6396.	7740.	180.0	15.8	1.1	104.	1.18	1239419.	914237.
219.20	28.639	-78.653	303802.	1064.	6426.	7770.	180.0	15.7	1.1	104.	1.19	1236304.	911122.
220.16	28.639	-78.634	304819.	1054.	6455.	7800.	180.0	15.6	1.1	104.	1.19	1233189.	908008.
221.12	28.639	-78.615	305827.	1045.	6485.	7830.	180.0	15.6	1.1	104.	1.19	1230074.	904894.
222.08	28.639	-78.596	306825.	1035.	6515.	7861.	180.0	15.5	1.1	104.	1.20	1226959.	901780.
223.04	28.639	-78.577	307814.	1026.	6546.	7892.	180.0	15.4	1.1	104.	1.20	1223845.	898666.
224.00	28.639	-78.558	308794.	1016.	6576.	7922.	180.0	15.3	1.0	104.	1.20	1220730.	895552.
224.96	28.639	-78.539	309765.	1007.	6606.	7953.	180.0	15.2	1.0	104.	1.21	1217615.	892437.
225.92	28.638	-78.520	310727.	997.	6637.	7984.	180.0	15.1	1.0	104.	1.21	1214500.	889323.
226.88	28.638	-78.500	311679.	988.	6668.	8015.	180.0	15.1	1.0	104.	1.21	1211385.	886209.
227.84	28.638	-78.481	312623.	978.	6699.	8047.	180.0	15.0	1.0	104.	1.22	1208270.	883095.
228.80	28.638	-78.461	313557.	969.	6730.	8078.	180.0	14.9	1.0	104.	1.22	1205155.	879981.
229.76	28.638	-78.442	314483.	959.	6761.	8110.	180.0	14.8	1.0	104.	1.22	1202040.	876866.
230.72	28.638	-78.422	315399.	950.	6792.	8141.	180.1	14.7	1.0	104.	1.22	1198925.	873752.
231.68	28.638	-78.402	316307.	941.	6824.	8173.	180.1	14.6	1.0	104.	1.23	1195810.	870638.
232.64	28.638	-78.382	317205.	931.	6855.	8205.	180.0	14.6	1.0	104.	1.23	1192695.	867524.
233.60	28.637	-78.362	318095.	922.	6887.	8237.	180.0	14.5	1.0	104.	1.23	1189580.	864410.
234.56	28.637	-78.342	318975.	913.	6919.	8270.	180.0	14.4	1.0	104.	1.24	1186466.	861296.
235.52	28.637	-78.322	319847.	903.	6951.	8302.	180.0	14.3	1.0	104.	1.24	1183351.	858181.
236.48	28.637	-78.301	320710.	894.	6983.	8335.	180.0	14.2	.9	104.	1.24	1180236.	855067.
237.44	28.637	-78.281	321564.	885.	7016.	8367.	180.0	14.1	.9	104.	1.25	1177121.	851953.
238.40	28.637	-78.260	322409.	876.	7048.	8400.	180.0	14.0	.9	104.	1.25	1174006.	848839.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
239.36	28.636	-78.239	323246.	867.	7081.	8433.	180.0	13.9	.9	104.	1.25	1170891.	845725.
240.32	28.636	-78.219	324073.	857.	7114.	8466.	180.0	13.9	.9	104.	1.26	1167776.	842610.
241.28	28.636	-78.198	324892.	848.	7147.	8500.	180.0	13.8	.9	104.	1.26	1164661.	839496.
242.24	28.636	-78.177	325702.	839.	7180.	8533.	180.0	13.7	.9	104.	1.26	1161546.	836382.
243.20	28.636	-78.156	326503.	830.	7213.	8567.	180.0	13.6	.9	104.	1.27	1158431.	833268.
244.16	28.635	-78.135	327296.	821.	7246.	8600.	180.0	13.5	.9	104.	1.27	1155316.	830154.
245.12	28.635	-78.113	328080.	812.	7280.	8634.	180.0	13.4	.9	104.	1.27	1152202.	827039.
246.08	28.635	-78.092	328855.	803.	7314.	8668.	180.0	13.4	.9	104.	1.28	1149087.	823925.
247.04	28.635	-78.071	329622.	794.	7348.	8702.	180.0	13.3	.9	104.	1.28	1145972.	820811.
248.00	28.634	-78.049	330380.	785.	7382.	8736.	180.0	13.2	.9	104.	1.28	1142857.	817697.
248.96	28.634	-78.027	331129.	776.	7416.	8771.	180.0	13.1	.8	104.	1.29	1139742.	814583.
249.92	28.634	-78.006	331870.	767.	7450.	8805.	180.0	13.0	.8	104.	1.29	1136627.	811469.
250.88	28.634	-77.984	332602.	758.	7485.	8840.	180.0	12.9	.8	104.	1.30	1133512.	808354.
251.84	28.633	-77.962	333326.	750.	7519.	8875.	180.0	12.8	.8	104.	1.30	1130397.	805240.
252.80	28.633	-77.940	334042.	741.	7554.	8910.	180.0	12.7	.8	104.	1.30	1127282.	802126.
253.76	28.633	-77.917	334749.	732.	7589.	8945.	180.0	12.7	.8	104.	1.31	1124167.	799012.
254.72	28.632	-77.895	335447.	723.	7624.	8980.	180.0	12.6	.8	104.	1.31	1121052.	795898.
255.68	28.632	-77.873	336137.	714.	7659.	9016.	180.0	12.5	.8	104.	1.31	1117937.	792783.
256.64	28.632	-77.850	336819.	706.	7694.	9051.	180.0	12.4	.8	104.	1.32	1114823.	789669.
257.60	28.631	-77.828	337492.	697.	7730.	9087.	180.0	12.3	.8	104.	1.32	1111708.	786555.
258.56	28.631	-77.805	338157.	688.	7766.	9123.	180.0	12.3	.8	104.	1.32	1108593.	783441.
259.52	28.631	-77.782	338814.	680.	7801.	9159.	180.0	12.2	.8	104.	1.33	1105478.	780327.
260.48	28.630	-77.759	339462.	671.	7837.	9195.	180.0	12.1	.8	104.	1.33	1102363.	777213.
261.44	28.630	-77.736	340102.	663.	7873.	9231.	180.0	12.0	.8	104.	1.34	1099248.	774098.
262.40	28.630	-77.713	340734.	654.	7910.	9268.	180.0	11.9	.8	104.	1.34	1096133.	770984.
263.36	28.629	-77.690	341358.	645.	7946.	9304.	179.9	11.8	.8	104.	1.34	1093018.	767870.
264.32	28.629	-77.666	341973.	637.	7983.	9341.	180.0	11.7	.8	104.	1.35	1089903.	764756.
265.28	28.629	-77.643	342581.	628.	8020.	9378.	180.0	11.7	.8	104.	1.35	1086788.	761642.
266.24	28.628	-77.619	343180.	620.	8056.	9415.	180.0	11.6	.7	104.	1.36	1083673.	758527.
267.20	28.628	-77.595	343771.	612.	8093.	9452.	180.0	11.5	.7	104.	1.36	1080559.	755413.
268.16	28.627	-77.572	344354.	603.	8131.	9490.	180.1	11.4	.7	104.	1.36	1077444.	752299.
269.12	28.627	-77.548	344929.	595.	8168.	9527.	180.0	11.3	.7	104.	1.37	1074329.	749185.
270.08	28.627	-77.524	345496.	586.	8206.	9565.	180.0	11.2	.7	104.	1.37	1071214.	746071.
271.04	28.626	-77.500	346055.	578.	8243.	9603.	180.0	11.1	.7	104.	1.37	1068099.	742957.
272.00	28.626	-77.475	346606.	570.	8281.	9641.	180.0	11.0	.7	104.	1.38	1064984.	739842.
272.96	28.625	-77.451	347149.	562.	8319.	9679.	180.0	11.0	.7	104.	1.38	1061869.	736728.
273.92	28.625	-77.426	347684.	553.	8357.	9717.	180.0	10.9	.7	104.	1.39	1058754.	733614.
274.88	28.624	-77.402	348212.	545.	8396.	9756.	180.0	10.8	.7	104.	1.39	1055639.	730500.
275.84	28.624	-77.377	348731.	537.	8434.	9794.	180.0	10.7	.7	104.	1.40	1052524.	727386.
276.80	28.623	-77.352	349243.	529.	8473.	9833.	180.0	10.6	.7	104.	1.40	1049409.	724271.
277.76	28.623	-77.327	349746.	521.	8512.	9872.	180.0	10.6	.7	104.	1.40	1046295.	721157.
278.72	28.622	-77.302	350243.	513.	8550.	9911.	180.0	10.5	.7	104.	1.41	1043180.	718043.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
279.68	28.622	-77.277	350731.	505.	8590.	9950.	180.0	10.4	.7	104.	1.41	1040065.	714929.
280.64	28.621	-77.252	351211.	497.	8629.	9990.	179.9	10.3	.7	104.	1.42	1036950.	711815.
281.60	28.621	-77.227	351684.	489.	8668.	10029.	180.0	10.2	.7	104.	1.42	1033835.	708700.
282.56	28.620	-77.201	352149.	481.	8708.	10069.	180.0	10.1	.6	104.	1.42	1030720.	705586.
283.52	28.620	-77.175	352607.	473.	8748.	10109.	180.0	10.1	.6	104.	1.43	1027605.	702472.
284.48	28.619	-77.150	353057.	465.	8788.	10149.	180.0	10.0	.6	104.	1.43	1024490.	699358.
285.44	28.619	-77.124	353499.	457.	8828.	10189.	180.0	9.9	.6	104.	1.44	1021375.	696244.
286.40	28.618	-77.098	353934.	449.	8868.	10229.	180.0	9.8	.6	104.	1.44	1018260.	693130.
287.36	28.617	-77.072	354362.	441.	8908.	10270.	180.0	9.8	.6	104.	1.45	1015145.	690015.
288.32	28.617	-77.045	354782.	434.	8949.	10311.	180.0	9.7	.6	104.	1.45	1012030.	686901.
289.28	28.616	-77.019	355194.	426.	8990.	10351.	179.9	9.6	.6	104.	1.46	1008916.	683787.
290.24	28.616	-76.993	355600.	418.	9031.	10392.	180.0	9.5	.6	104.	1.46	1005801.	680673.
291.20	28.615	-76.966	355998.	411.	9072.	10434.	180.0	9.4	.6	104.	1.46	1002686.	677559.
292.16	28.614	-76.939	356388.	403.	9113.	10475.	180.0	9.3	.6	104.	1.47	999571.	674444.
293.12	28.614	-76.912	356771.	395.	9155.	10516.	180.0	9.2	.6	104.	1.47	996456.	671330.
294.08	28.613	-76.885	357147.	388.	9196.	10558.	180.0	9.2	.6	104.	1.48	993341.	668216.
295.04	28.612	-76.858	357516.	380.	9238.	10600.	180.0	9.1	.6	104.	1.48	990226.	665102.
296.00	28.612	-76.831	357877.	373.	9280.	10642.	180.0	9.0	.6	104.	1.49	987111.	661988.
296.96	28.611	-76.804	358232.	365.	9322.	10684.	180.0	8.9	.6	104.	1.49	983996.	658874.
297.92	28.610	-76.776	358579.	358.	9364.	10727.	180.0	8.9	.6	104.	1.50	980881.	655759.
298.88	28.610	-76.749	358919.	351.	9407.	10769.	180.0	8.8	.6	104.	1.50	977766.	652645.
299.84	28.609	-76.721	359252.	343.	9450.	10812.	180.0	8.7	.5	104.	1.51	974652.	649531.
300.80	28.608	-76.693	359578.	336.	9492.	10855.	180.0	8.6	.5	104.	1.51	971537.	646417.
301.76	28.607	-76.665	359897.	329.	9535.	10898.	180.0	8.5	.5	104.	1.52	968422.	643303.
302.72	28.607	-76.637	360209.	321.	9579.	10941.	180.0	8.4	.5	104.	1.52	965307.	640188.
303.68	28.606	-76.609	360514.	314.	9622.	10985.	180.0	8.3	.5	104.	1.53	962192.	637074.
304.64	28.605	-76.581	360812.	307.	9666.	11028.	180.0	8.2	.5	104.	1.53	959077.	633960.
305.60	28.604	-76.552	361103.	300.	9709.	11072.	179.9	8.2	.5	104.	1.54	955962.	630846.
306.56	28.604	-76.524	361387.	293.	9753.	11116.	180.0	8.1	.5	104.	1.54	952847.	627732.
307.52	28.603	-76.495	361665.	286.	9797.	11160.	180.0	8.0	.5	104.	1.55	949732.	624617.
308.48	28.602	-76.466	361936.	278.	9842.	11204.	180.0	7.9	.5	104.	1.55	946617.	621503.
309.44	28.601	-76.437	362200.	271.	9886.	11249.	180.0	7.8	.5	104.	1.56	943502.	618389.
310.40	28.600	-76.408	362457.	264.	9931.	11294.	180.0	7.7	.5	104.	1.56	940387.	615275.
311.36	28.599	-76.379	362707.	258.	9976.	11338.	180.0	7.7	.5	104.	1.57	937273.	612161.
312.32	28.599	-76.349	362951.	251.	10021.	11384.	180.0	7.6	.5	104.	1.57	934158.	609047.
313.28	28.598	-76.320	363189.	244.	10066.	11429.	180.0	7.5	.5	104.	1.58	931043.	605932.
314.24	28.597	-76.290	363419.	237.	10111.	11474.	180.0	7.4	.5	104.	1.58	927928.	602818.
315.20	28.596	-76.260	363644.	230.	10157.	11520.	180.0	7.4	.4	104.	1.59	924813.	599704.
316.16	28.595	-76.231	363862.	223.	10203.	11566.	180.0	7.3	.4	104.	1.59	921698.	596590.
317.12	28.594	-76.201	364073.	217.	10249.	11612.	180.0	7.2	.4	104.	1.60	918583.	593476.
318.08	28.593	-76.170	364278.	210.	10295.	11658.	180.0	7.1	.4	104.	1.60	915468.	590361.
319.04	28.592	-76.140	364476.	203.	10341.	11704.	180.0	7.0	.4	104.	1.61	912353.	587247.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
320.00	28.591	-76.110	364669.	197.	10388.	11751.	180.0	6.9	.4	104.	1.61	909238.	584133.
320.96	28.590	-76.079	364854.	190.	10434.	11798.	180.0	6.8	.4	104.	1.62	906123.	581019.
321.92	28.589	-76.048	365034.	184.	10481.	11845.	180.0	6.8	.4	104.	1.63	903009.	577905.
322.88	28.588	-76.017	365207.	177.	10528.	11892.	180.0	6.7	.4	104.	1.63	899894.	574791.
323.84	28.587	-75.986	365374.	171.	10576.	11939.	180.0	6.6	.4	104.	1.64	896779.	571676.
324.80	28.586	-75.955	365535.	165.	10623.	11987.	180.0	6.5	.4	104.	1.64	893664.	568562.
325.76	28.585	-75.924	365690.	158.	10671.	12034.	180.0	6.5	.4	104.	1.65	890549.	565448.
326.72	28.584	-75.893	365839.	152.	10719.	12082.	180.0	6.4	.4	104.	1.65	887434.	562334.
327.68	28.583	-75.861	365982.	146.	10767.	12131.	180.1	6.3	.4	104.	1.66	884319.	559220.
328.64	28.582	-75.829	366119.	139.	10815.	12179.	180.0	6.2	.4	104.	1.67	881204.	556105.
329.60	28.581	-75.798	366250.	133.	10864.	12227.	180.0	6.1	.4	104.	1.67	878089.	552991.
330.56	28.580	-75.766	366375.	127.	10913.	12276.	180.0	6.1	.3	104.	1.68	874974.	549877.
331.52	28.579	-75.733	366494.	121.	10962.	12325.	180.0	6.0	.3	104.	1.68	871859.	546763.
332.48	28.577	-75.701	366607.	115.	11011.	12374.	180.0	5.9	.3	104.	1.69	868744.	543649.
333.44	28.576	-75.669	366715.	109.	11060.	12424.	180.0	5.8	.3	104.	1.70	865630.	540535.
334.40	28.575	-75.636	366817.	103.	11110.	12473.	180.0	5.7	.3	104.	1.70	862515.	537420.
335.36	28.574	-75.604	366913.	97.	11160.	12523.	180.1	5.6	.3	104.	1.71	859400.	534306.
336.32	28.573	-75.571	367004.	91.	11210.	12573.	180.0	5.6	.4	104.	1.71	856285.	531192.
337.28	28.571	-75.538	367089.	86.	11260.	12623.	180.0	5.5	.3	104.	1.72	853170.	528078.
338.24	28.570	-75.505	367168.	80.	11310.	12674.	180.0	5.4	.3	104.	1.73	850055.	524964.
339.20	28.569	-75.471	367242.	74.	11361.	12725.	180.0	5.4	.3	104.	1.73	846940.	521849.
340.16	28.568	-75.438	367310.	68.	11412.	12775.	180.0	5.3	.3	104.	1.74	843825.	518735.
341.12	28.566	-75.404	367373.	63.	11463.	12827.	180.0	5.2	.3	104.	1.75	840710.	515621.
342.08	28.565	-75.370	367431.	57.	11514.	12878.	180.0	5.1	.3	104.	1.75	837595.	512507.
343.04	28.564	-75.337	367483.	52.	11566.	12929.	180.0	5.0	.3	104.	1.76	834480.	509393.
344.00	28.563	-75.303	367530.	46.	11618.	12981.	180.0	5.0	.3	104.	1.77	831366.	506278.
344.96	28.561	-75.268	367572.	41.	11670.	13033.	180.0	4.9	.3	104.	1.77	828251.	503164.
345.92	28.560	-75.234	367609.	35.	11722.	13085.	180.0	4.8	.3	104.	1.78	825136.	500050.
346.88	28.558	-75.200	367640.	30.	11774.	13138.	180.0	4.7	.3	104.	1.79	822021.	496936.
347.84	28.557	-75.165	367667.	25.	11827.	13190.	180.0	4.7	.2	104.	1.79	818906.	493822.
348.80	28.556	-75.130	367688.	20.	11880.	13243.	180.0	4.6	.2	104.	1.80	815791.	490708.
349.76	28.554	-75.095	367704.	14.	11933.	13297.	180.0	4.5	.2	104.	1.81	812676.	487593.
350.72	28.553	-75.060	367716.	9.	11986.	13350.	180.0	4.5	.2	104.	1.81	809561.	484479.
351.68	28.551	-75.025	367722.	4.	12040.	13403.	180.0	4.4	.2	104.	1.82	806446.	481365.
352.64	28.550	-74.989	367724.	-1.	12094.	13457.	180.0	4.3	.2	104.	1.83	803331.	478251.
353.60	28.548	-74.954	367721.	-6.	12148.	13511.	180.0	4.2	.2	104.	1.83	800216.	475137.
354.56	28.547	-74.918	367714.	-10.	12202.	13566.	179.9	4.2	.2	104.	1.84	797101.	472022.
355.52	28.545	-74.882	367701.	-15.	12257.	13620.	180.0	4.1	.2	104.	1.85	793987.	468908.
356.48	28.544	-74.846	367684.	-20.	12311.	13675.	180.0	4.0	.2	104.	1.86	790872.	465794.
357.44	28.542	-74.810	367663.	-25.	12366.	13730.	180.0	3.9	.2	104.	1.86	787757.	462680.
358.40	28.541	-74.774	367637.	-29.	12422.	13785.	180.0	3.9	.2	104.	1.87	784642.	459566.
359.36	28.539	-74.737	367607.	-34.	12477.	13841.	180.0	3.8	.2	104.	1.88	781527.	456452.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
360.32	28.537	-74.700	367572.	-38.	12533.	13897.	180.0	3.7	.2	104.	1.89	778412.	453337.
361.28	28.536	-74.663	367533.	-43.	12589.	13953.	180.0	3.6	.2	104.	1.89	775297.	450223.
362.24	28.534	-74.626	367490.	-47.	12645.	14009.	180.0	3.6	.2	104.	1.90	772182.	447109.
363.20	28.533	-74.589	367442.	-52.	12702.	14065.	180.0	3.5	.2	104.	1.91	769067.	443995.
364.16	28.531	-74.552	367391.	-56.	12759.	14122.	180.0	3.4	.1	104.	1.92	765952.	440881.
365.12	28.529	-74.514	367335.	-60.	12816.	14179.	180.0	3.4	.1	104.	1.92	762837.	437766.
366.08	28.527	-74.477	367275.	-64.	12873.	14237.	180.0	3.3	.1	104.	1.93	759723.	434652.
367.04	28.526	-74.439	367211.	-68.	12931.	14294.	180.0	3.2	.2	104.	1.94	756608.	431538.
368.00	28.524	-74.401	367144.	-72.	12988.	14352.	180.0	3.2	.2	104.	1.95	753493.	428424.
368.96	28.522	-74.363	367072.	-76.	13047.	14410.	180.0	3.1	.1	104.	1.96	750378.	425310.
369.92	28.520	-74.324	366997.	-80.	13105.	14468.	180.0	3.0	.1	104.	1.97	747263.	422196.
370.88	28.518	-74.286	366918.	-84.	13164.	14527.	180.0	2.9	.1	104.	1.97	744148.	419081.
371.84	28.517	-74.247	366836.	-88.	13222.	14586.	180.0	2.8	.1	104.	1.98	741033.	415967.
372.80	28.515	-74.208	366749.	-92.	13282.	14645.	180.0	2.8	.1	104.	1.99	737918.	412853.
373.76	28.513	-74.169	366660.	-95.	13341.	14705.	180.0	2.7	.1	104.	2.00	734803.	409739.
374.72	28.511	-74.130	366566.	-99.	13401.	14764.	180.0	2.6	.1	104.	2.01	731688.	406625.
375.68	28.509	-74.091	366470.	-102.	13461.	14824.	180.0	2.6	.1	104.	2.02	728573.	403510.
376.64	28.507	-74.051	366370.	-106.	13521.	14885.	180.0	2.5	.1	104.	2.02	725458.	400396.
377.60	28.505	-74.011	366266.	-109.	13582.	14945.	180.0	2.4	.1	104.	2.03	722344.	397282.
378.56	28.503	-73.971	366160.	-113.	13643.	15006.	180.0	2.4	.1	104.	2.04	719229.	394168.
379.52	28.501	-73.931	366050.	-116.	13704.	15067.	180.0	2.3	.1	104.	2.05	716114.	391054.
380.48	28.499	-73.891	365938.	-119.	13765.	15129.	180.0	2.2	.1	104.	2.06	712999.	387939.
381.44	28.497	-73.850	365822.	-122.	13827.	15190.	180.0	2.2	.1	104.	2.07	709884.	384825.
382.40	28.495	-73.810	365703.	-125.	13889.	15252.	180.0	2.1	.1	104.	2.08	706769.	381711.
383.36	28.493	-73.769	365582.	-128.	13951.	15315.	180.0	2.1	.1	104.	2.09	703654.	378597.
384.32	28.491	-73.728	365458.	-131.	14014.	15377.	180.0	2.0	.1	104.	2.10	700539.	375483.
385.28	28.489	-73.687	365331.	-133.	14077.	15440.	180.0	2.0	.0	104.	2.11	697424.	372369.
386.24	28.486	-73.645	365202.	-136.	14140.	15504.	180.0	1.9	.0	104.	2.11	694309.	369254.
387.20	28.484	-73.604	365070.	-139.	14204.	15567.	180.0	1.8	.0	104.	2.12	691194.	366140.
388.16	28.482	-73.562	364936.	-141.	14268.	15631.	180.0	1.8	.0	104.	2.13	688080.	363026.
389.12	28.480	-73.520	364799.	-143.	14332.	15695.	180.0	1.7	.0	104.	2.14	684965.	359912.
390.08	28.477	-73.478	364661.	-146.	14396.	15759.	180.0	1.7	.0	104.	2.15	681850.	356798.
391.04	28.475	-73.436	364520.	-148.	14461.	15824.	180.0	1.6	.0	104.	2.16	678735.	353683.
392.00	28.473	-73.393	364377.	-150.	14526.	15889.	180.0	1.5	.0	104.	2.17	675620.	350569.
392.96	28.471	-73.351	364232.	-152.	14591.	15955.	180.0	1.5	.0	104.	2.18	672505.	347455.
393.92	28.468	-73.308	364085.	-154.	14657.	16020.	180.0	1.4	.0	104.	2.19	669390.	344341.
394.88	28.466	-73.265	363936.	-156.	14723.	16087.	180.0	1.4	.0	104.	2.20	666275.	341227.
395.84	28.463	-73.222	363786.	-158.	14790.	16153.	180.0	1.3	.0	104.	2.21	663160.	338113.
396.80	28.461	-73.178	363634.	-159.	14856.	16220.	180.0	1.2	.0	104.	2.22	660045.	334998.
397.76	28.458	-73.134	363480.	-161.	14924.	16287.	180.0	1.1	.0	104.	2.24	656930.	331884.
398.72	28.456	-73.091	363325.	-163.	14991.	16354.	180.0	1.1	.0	104.	2.25	653815.	328770.
399.68	28.453	-73.047	363168.	-164.	15059.	16422.	180.0	1.0	.0	104.	2.26	650701.	325656.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
400.64	28.451	-73.002	363010.	-165.	15127.	16490.	180.0	1.0	.0	104.	2.27	647586.	322542.
401.60	28.448	-72.958	362851.	-167.	15195.	16558.	180.0	.9	.0	104.	2.28	644471.	319427.
402.56	28.446	-72.913	362690.	-168.	15264.	16627.	180.0	.8	.0	104.	2.29	641356.	316313.
403.52	28.443	-72.869	362529.	-169.	15333.	16696.	180.0	.8	.0	104.	2.30	638241.	313199.
404.48	28.440	-72.823	362366.	-170.	15403.	16766.	180.0	.7	.0	104.	2.31	635126.	310085.
405.44	28.438	-72.778	362203.	-171.	15473.	16836.	180.0	.6	-.1	104.	2.32	632011.	306971.
406.40	28.435	-72.733	362039.	-172.	15543.	16906.	180.0	.5	-.1	104.	2.33	628896.	303857.
407.36	28.432	-72.687	361874.	-172.	15614.	16977.	180.0	.5	-.1	104.	2.35	625781.	300742.
408.32	28.430	-72.641	361708.	-173.	15685.	17048.	180.0	.4	.0	104.	2.36	622666.	297628.
409.28	28.427	-72.595	361542.	-174.	15756.	17119.	180.0	.4	.0	104.	2.37	619551.	294514.
410.24	28.424	-72.549	361375.	-174.	15828.	17191.	179.9	.3	.0	104.	2.38	616437.	291400.
411.20	28.421	-72.503	361208.	-174.	15900.	17263.	180.0	.2	-.1	104.	2.39	613322.	288286.
412.16	28.418	-72.456	361040.	-175.	15973.	17336.	180.0	.2	-.1	104.	2.41	610207.	285171.
413.12	28.415	-72.409	360872.	-175.	16045.	17408.	180.0	.1	-.1	104.	2.42	607092.	282057.
414.08	28.412	-72.362	360705.	-175.	16119.	17482.	180.0	.1	-.1	104.	2.43	603977.	278943.
415.04	28.409	-72.315	360537.	-175.	16192.	17556.	180.0	.0	-.1	104.	2.44	600862.	275829.
416.00	28.406	-72.267	360369.	-175.	16267.	17630.	180.0	360.0	-.1	104.	2.46	597747.	272715.
416.96	28.403	-72.219	360202.	-174.	16341.	17704.	180.0	359.9	-.1	104.	2.47	594632.	269600.
417.92	28.400	-72.171	360035.	-174.	16416.	17779.	180.0	359.8	-.1	104.	2.48	591517.	266486.
418.88	28.397	-72.123	359868.	-173.	16491.	17854.	180.0	359.8	-.1	104.	2.50	588402.	263372.
419.84	28.394	-72.075	359702.	-173.	16567.	17930.	180.0	359.7	-.1	104.	2.51	585287.	260258.
420.80	28.391	-72.026	359536.	-172.	16643.	18006.	180.0	359.7	-.1	104.	2.52	582172.	257144.
421.76	28.388	-71.977	359371.	-171.	16720.	18083.	180.0	359.6	-.1	104.	2.54	579058.	254030.
422.72	28.384	-71.928	359207.	-171.	16797.	18160.	180.0	359.5	-.1	104.	2.55	575943.	250915.
423.68	28.381	-71.879	359044.	-169.	16875.	18238.	180.0	359.5	-.1	104.	2.56	572828.	247801.
424.64	28.378	-71.830	358882.	-168.	16953.	18316.	180.0	359.4	-.1	104.	2.58	569713.	244687.
425.60	28.375	-71.780	358721.	-167.	17031.	18394.	180.0	359.4	-.1	104.	2.59	566598.	241573.
426.56	28.371	-71.730	358561.	-166.	17110.	18473.	180.0	359.3	-.1	104.	2.61	563483.	238459.
427.52	28.368	-71.680	358403.	-164.	17189.	18552.	180.0	359.3	-.1	104.	2.62	560368.	235344.
428.48	28.364	-71.629	358246.	-163.	17269.	18632.	180.0	359.2	-.1	104.	2.64	557253.	232230.
429.44	28.361	-71.579	358091.	-161.	17349.	18712.	180.0	359.2	-.1	104.	2.65	554138.	229116.
430.40	28.357	-71.528	357938.	-159.	17430.	18793.	180.0	359.2	-.2	104.	2.66	551023.	226002.
431.36	28.354	-71.477	357787.	-157.	17511.	18874.	180.0	359.2	-.2	104.	2.68	547908.	222888.
432.32	28.350	-71.425	357637.	-154.	17592.	18955.	180.0	359.2	-.2	104.	2.70	544794.	219774.
433.28	28.347	-71.374	357491.	-152.	17675.	19037.	180.0	359.1	-.2	104.	2.71	541679.	216659.
434.24	28.343	-71.322	357346.	-149.	17757.	19120.	180.0	359.1	-.2	104.	2.73	538564.	213545.
435.20	28.339	-71.270	357204.	-147.	17840.	19203.	180.0	359.0	-.2	104.	2.74	535449.	210431.
436.16	28.336	-71.218	357065.	-144.	17924.	19287.	180.0	359.0	-.2	104.	2.76	532334.	207317.
437.12	28.332	-71.165	356928.	-141.	18008.	19371.	180.0	358.9	-.2	104.	2.77	529219.	204203.
438.08	28.328	-71.112	356795.	-137.	18092.	19455.	180.0	358.9	-.2	104.	2.79	526104.	201088.
439.04	28.324	-71.059	356665.	-134.	18177.	19540.	180.0	358.9	-.2	104.	2.81	522989.	197974.
440.00	28.320	-71.006	356538.	-131.	18263.	19626.	180.0	358.8	-.2	104.	2.82	519874.	194860.

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
AERODYNAMIC SUMMARY

TIME (SEC)	MACH (ND)	ALPHA (DEG)	BETA (DEG)	BANK (DEG)	DYN PRESS (PSF)	QALPHA (PSF-DEG)	QBETA (PSF-DEG)	VE (FPS)	GAME (DEG)	AZE (DEG)	VI (FPS)	GAMI (DEG)	AZI (DEG)	SURFACE RANGE (NM)
440.96	17.52	.86	-.66	-179.97	.0	0.	0.	18349.	-.384	94.74	19712.	-.357	94.41	510.6
441.92	17.61	.92	-.66	-179.98	.0	0.	0.	18436.	-.370	94.76	19799.	-.345	94.44	513.4
442.88	17.70	.98	-.67	179.99	.0	0.	0.	18523.	-.357	94.79	19886.	-.332	94.46	516.3
443.84	17.79	1.04	-.67	179.97	.0	0.	0.	18611.	-.343	94.82	19974.	-.319	94.49	519.2
444.80	17.88	1.11	-.66	179.99	.0	0.	0.	18699.	-.328	94.84	20062.	-.306	94.51	522.1
445.76	17.96	1.17	-.64	-179.98	.0	0.	0.	18788.	-.313	94.87	20151.	-.292	94.54	525.0
446.72	18.06	1.23	-.63	-179.96	.0	0.	0.	18878.	-.298	94.89	20241.	-.278	94.56	527.9
447.68	18.15	1.22	-.62	-179.98	.0	0.	0.	18968.	-.284	94.92	20331.	-.265	94.59	530.9
448.64	18.24	1.22	-.64	-179.97	.0	0.	0.	19058.	-.267	94.95	20421.	-.249	94.62	533.8
449.60	18.33	1.33	-.66	-179.94	.0	0.	0.	19149.	-.250	94.97	20511.	-.234	94.64	536.8
450.56	18.42	1.45	-.68	-179.93	.0	0.	0.	19239.	-.235	95.00	20601.	-.220	94.67	539.8
451.52	18.51	1.49	-.70	-179.91	.0	0.	0.	19329.	-.220	95.03	20692.	-.205	94.69	542.7
452.48	18.60	1.50	-.71	-179.92	.0	0.	0.	19419.	-.204	95.05	20782.	-.191	94.72	545.8
453.44	18.69	1.49	-.73	-179.95	.0	0.	0.	19509.	-.188	95.08	20872.	-.176	94.75	548.8
454.40	18.78	1.47	-.74	-179.98	.0	0.	0.	19600.	-.172	95.11	20962.	-.161	94.77	551.8
455.36	18.86	1.46	-.75	179.99	.1	0.	0.	19690.	-.155	95.13	21053.	-.145	94.80	554.9
456.32	18.95	1.45	-.75	179.97	.1	0.	0.	19781.	-.138	95.16	21144.	-.129	94.83	557.9
457.28	19.04	1.46	-.75	179.98	.1	0.	0.	19871.	-.120	95.19	21234.	-.112	94.85	561.0
458.24	19.13	1.48	-.73	-180.00	.1	0.	0.	19961.	-.103	95.21	21324.	-.096	94.88	564.1
459.20	19.22	1.51	-.71	-179.97	.1	0.	0.	20051.	-.085	95.24	21414.	-.080	94.91	567.2
460.16	19.31	1.56	-.69	-179.99	.1	0.	0.	20141.	-.067	95.27	21504.	-.063	94.93	570.3
461.12	19.39	1.63	-.67	179.98	.1	0.	0.	20231.	-.050	95.30	21594.	-.046	94.96	573.5
462.08	19.48	1.69	-.66	179.96	.1	0.	0.	20322.	-.032	95.32	21685.	-.030	94.99	576.6
463.04	19.57	1.76	-.64	179.94	.1	0.	0.	20412.	-.014	95.35	21775.	-.013	95.02	579.8
464.00	19.66	1.84	-.63	179.93	.1	0.	0.	20503.	.003	95.38	21865.	.003	95.04	583.0
464.96	19.74	1.90	-.61	179.94	.1	0.	0.	20593.	.021	95.41	21956.	.020	95.07	586.2
465.92	19.83	1.96	-.59	179.97	.1	0.	0.	20684.	.039	95.44	22047.	.036	95.10	589.4
466.88	19.92	2.03	-.58	179.99	.1	0.	0.	20775.	.056	95.47	22138.	.053	95.13	592.6
467.84	20.00	2.10	-.56	179.98	.1	0.	0.	20866.	.074	95.50	22228.	.069	95.16	595.8
468.80	20.09	2.16	-.56	179.94	.1	0.	0.	20957.	.092	95.53	22319.	.086	95.19	599.1
469.76	20.17	2.22	-.56	179.91	.1	0.	0.	21048.	.109	95.55	22411.	.103	95.22	602.3
470.72	20.26	2.27	-.57	179.90	.1	0.	0.	21139.	.127	95.58	22501.	.119	95.25	605.6
471.68	20.34	2.32	-.59	179.88	.1	0.	0.	21229.	.144	95.61	22592.	.135	95.27	608.9
472.64	20.43	2.34	-.60	179.90	.1	0.	0.	21319.	.161	95.64	22682.	.151	95.30	612.2
473.60	20.51	2.36	-.60	179.94	.1	0.	0.	21409.	.179	95.67	22772.	.168	95.33	615.5
474.56	20.60	2.38	-.60	179.97	.1	0.	0.	21500.	.197	95.70	22863.	.185	95.36	618.9
475.52	20.68	2.40	-.60	179.97	.1	0.	0.	21592.	.215	95.73	22954.	.202	95.39	622.2
476.48	20.76	2.45	-.60	179.94	.1	0.	0.	21683.	.233	95.76	23046.	.219	95.42	625.6
477.44	20.85	2.51	-.62	179.92	.1	0.	0.	21773.	.251	95.79	23136.	.236	95.45	628.9
478.40	20.93	2.56	-.64	179.90	.1	0.	0.	21864.	.269	95.82	23227.	.253	95.48	632.3
479.36	21.01	2.63	-.65	179.88	.1	0.	0.	21955.	.286	95.85	23317.	.270	95.51	635.7
480.32	21.09	2.69	-.67	179.90	.1	0.	0.	22045.	.304	95.88	23408.	.286	95.54	639.2

NOMINAL DISPLAY DATA FOR STS-43 CYCLE 2
TRAJECTORY SUMMARY

TIME (SEC)	GEOD LATD (DEG)	LONG (DEG)	ALT (FT)	ALT RATE (FPS)	VE (FPS)	VI (FPS)	ROLL ANGLE (DEG)	PITCH ANGLE (DEG)	YAW ANGLE (DEG)	THRT LEVEL (%)	SENSED ACC (G)	TOTAL WT (LBS)	ET MPS WT (LBS)
481.28	28.112	-68.472	355734.	118.	22136.	23499.	179.9	357.6	-.3	84.	2.98	396944.	71961.
482.24	28.106	-68.408	355850.	125.	22227.	23590.	179.9	357.5	-.3	83.	2.96	394445.	69463.
483.20	28.100	-68.343	355974.	132.	22318.	23680.	179.9	357.4	-.3	83.	2.98	391964.	66982.
484.16	28.094	-68.278	356105.	140.	22408.	23771.	179.9	357.4	-.3	82.	2.96	389495.	64515.
485.12	28.088	-68.212	356242.	147.	22499.	23862.	179.9	357.3	-.3	82.	2.98	387044.	62064.
486.08	28.081	-68.147	356387.	154.	22590.	23953.	179.9	357.3	-.3	81.	2.96	384605.	59626.
487.04	28.075	-68.081	356538.	161.	22681.	24044.	179.9	357.3	-.3	81.	2.98	382184.	57205.
488.00	28.069	-68.015	356697.	169.	22772.	24135.	179.9	357.3	-.2	80.	2.96	379775.	54797.
488.96	28.063	-67.948	356863.	176.	22863.	24226.	179.9	357.3	-.2	80.	2.98	377383.	52406.
489.92	28.056	-67.882	357036.	184.	22954.	24317.	180.0	357.2	-.2	79.	2.96	375005.	50029.
490.88	28.050	-67.815	357216.	191.	23045.	24408.	179.9	357.2	-.2	79.	2.98	372643.	47668.
491.84	28.043	-67.748	357403.	199.	23136.	24499.	179.9	357.2	-.2	78.	2.96	370295.	45320.
492.80	28.037	-67.680	357599.	207.	23227.	24590.	179.9	357.2	-.2	78.	2.98	367963.	42989.
493.76	28.030	-67.613	357801.	215.	23318.	24681.	179.9	357.3	-.1	77.	2.96	365644.	40671.
494.72	28.023	-67.545	358011.	223.	23409.	24772.	179.9	357.4	-.1	77.	2.98	363343.	38370.
495.68	28.016	-67.476	358229.	231.	23500.	24863.	179.9	357.5	-.1	76.	2.96	361054.	36082.
496.64	28.010	-67.408	358455.	240.	23591.	24954.	179.9	357.6	-.1	76.	2.98	358782.	33811.
497.12	28.006	-67.374	358572.	244.	23636.	24999.	179.9	357.6	-.1	76.	2.99	357647.	32676.
497.92	28.000	-67.316	358770.	252.	23712.	25075.	180.0	357.7	-.2	75.	2.96	355776.	30806.
498.88	27.994	-67.247	359016.	261.	23803.	25166.	180.0	357.7	-.3	75.	2.98	353535.	28565.
499.84	27.986	-67.178	359271.	269.	23892.	25255.	179.9	357.8	-.3	69.	2.76	351351.	26383.
500.80	27.979	-67.109	359533.	278.	23974.	25337.	179.9	357.9	-.4	67.	2.69	349342.	24374.
501.76	27.972	-67.039	359804.	286.	24057.	25420.	179.9	357.9	-.4	67.	2.71	347339.	22372.
502.72	27.965	-66.969	360083.	295.	24140.	25503.	179.8	357.9	-.4	67.	2.72	345337.	20370.
503.68	27.958	-66.899	360371.	304.	24223.	25587.	179.8	357.8	-.4	67.	2.74	343334.	18369.
504.64	27.950	-66.828	360666.	312.	24307.	25671.	179.9	357.8	-.4	67.	2.76	341332.	16367.
505.60	27.943	-66.757	360970.	321.	24392.	25755.	179.9	357.7	-.3	67.	2.77	339330.	14365.
506.56	27.936	-66.687	361283.	329.	24467.	25830.	179.9	357.6	-.3	67.	1.50	337561.	12597.
507.52	27.928	-66.616	361600.	331.	24492.	25855.	179.8	357.7	-.2	67.	.49	336949.	11986.
508.48	27.921	-66.544	361918.	332.	24499.	25863.	179.7	357.9	-.2	67.	.17	336754.	11792.
509.44	27.913	-66.473	362238.	333.	24504.	25867.	179.6	358.0	-.2	67.	.14	336645.	11683.
510.40	27.905	-66.402	362558.	334.	24507.	25870.	179.5	358.2	-.3	67.	.11	336556.	11595.
511.36	27.898	-66.331	362878.	334.	24510.	25873.	179.5	358.2	-.3	67.	.08	336487.	11527.
512.32	27.890	-66.260	363200.	335.	24511.	25875.	179.5	358.2	-.3	67.	.05	336439.	11480.
513.28	27.882	-66.189	363521.	335.	24512.	25875.	179.5	358.2	-.3	67.	.02	336412.	11453.
MECO	(THRUST=0)												
514.07	27.876	-66.131	363785.	335.	24512.	25875.	179.5	358.2	-.3	67.	.00	336404.	11446.

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 1                                                    IV97U4306C
 2  ADINIT        =  +9.42E+01                        IV97U4306C
 3                =                                   IV97U4308C
 4  ALIM1         =  +9.2000000E+01                   IV97U4308C
 5                =                                   IV97U4309C
 6  ALIM2         =  +9.47E+01                        IV97U4309C
 7                =                                   IV97U4307C
 8  ALL           =  +9.5500000E+01                   IV97U4307C
 9  ALS1G         =  +5.0000000E+00                   IV97U1402C
10  AZMTHL        =  90.55
11  CINT          =  +1.0E-02                         IV97U4418C
12  CPROP         =  +1.5E-01                         IV97U4419C
13  DTFCD         =  +3.20E-01
14  DTMAXX        =  +1.00E+20                        IV97U4369C
15  DTMINK        =  +6.871E+00                       IV97U4350C
16  DTMINN        =  +2.0E+00                         IV97U4370C
17                =                                   IV97U4371C
18  DTRD          =  +4.0000000E+01                   IV97U4371C
19                =                                   IV96U8335C
20                =                                   IV96U8334C
21  DTTAIL(1)     =  +8.76E-01                        IV96U8335C
22  DTTAIL(2)     =  +8.71E-01                        IV96U8334C
23  EFMFED(1)     =  +5.82295441106D-01               IV97U5738C
24  EFMFED(4)(7)  =  -8.12973783803D-01               IV97U5739C
25  EFMFED(7)(3)  =  -2.37615595736D-03               IV97U5740C
26  EFMFED(2)(3)  =  +8.12967053218D-01               IV97U5741C
27  EFMFED(5)(9)  =  +5.82300289215D-01               IV97U5742C
28  EFMFED(8)(15) =  -3.30810536594D-03               IV97U5743C
29  EFMFED(3)(5)  =  +4.07303923776D-03               IV97U5744C
30  EFMFED(6)(10) =  -5.44183336212D-06               IV97U5745C
31  EFMFED(9)(11) =  +9.99991705126D-01               IV97U5746C
32  EFPSW         =  .TRUE.                           IV99U7441C
33  EPSTP         =  +4.0E-02                         IV97U4381C
34  EPSX          =  +2.0E-02                         IV97U4380C
35  ETB           =  +5.0000000E+00                   IV97U4382C
36                =                                   IV97U4389C
37  FTFACT        =  +9.98E-01                        IV97U4389C
38  FTFMIN        =  +6.5E-01                         IV97U4838C
39                =                                   IV97U4390C
40  FTOMS         =  +6.0000000E+03                   IV97U4390C
41                =                                   IV97U4391C
42  FTRCS         =  +8.772E+02                       IV97U4391C
43                =                                   IV97U4392C
44  FTSSME        =  +4.7000000E+05                   IV97U4392C
45  GAMD          =  +1.3840461E-02                   IV97U4394C
46  GAMDN         =  +1.3840461E-02                   IV97U4396C
47                =                                   IV99U7442C
48  GMTLRF        =  +0.0D+00                         IV99U7442C
49  IPRLNM        =  1                                IV99U7557C
50  KCMD          =  +100
51  KMAX          =  +104                             IV97U4424C
52  KMAX2         =  +109                             IV99U7107C
53  KMINAL        =  +75                              IV99U7558C
54  KMIN          =  +67                              IV97U4425C
55  LTHRT         =  +2                               IV99U7559C
56  LTHRTL        =  +2                               IV99U7560C
57                =                                   IV97U4445C
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 58   NMAX          =  +1                          !V97U4445C
 59                                                !V97U4447C1
 60                 -                              !V97U4447C3
 61   NSEG          =  +10                         !V97U4447C1
 62   NSEG          =  +20                         !V97U4447C3
 63   PHIG(2)       =  +1.0E+00                    !V97U4452C
 64   PHIG(3)       =  +1.0E+00                    !V97U4453C
 65   PHIG(4)       =  +1.0E+00                    !V97U4454C
 66   PHIG(5)       =  +1.0E+00                    !V97U4455C
 67   PHIG(6)       =  +1.0E+00                    !V97U4456C
 68   PHIG(7)       =  +1.0E+00                    !V97U4457C
 69   PHIG(8)       =  +1.0E+00                    !V97U4458C
 70   PHIG(9)       =  +1.0E+00                    !V97U4459C
 71   PHIG(10)      =  +1.0E+00                    !V97U4460C
 72   PHIG(11)      =  +1.0E+00                    !V97U4461C
 73   PHIG(12)      =  +1.0E+00                    !V97U4462C
 74   PHIG(13)      =  +1.0E+00                    !V97U4463C
 75   PHIG(14)      =  +1.0E+00                    !V97U4464C
 76   PHIG(15)      =  +1.0E+00                    !V97U4465C
 77   PHIG(1)       =  +0.0E+00                    !V97U4451C
 78   PHICMD        =  +3.141593E+00               !V97U4481C
 79                 -                              !V97U9003C
 80   PHIDMX        =  +3.5E-02                    !V97U9003C
 81   PHI2ND        =  +3.141593E+00               !V97U4482C
 82   PIETAB(1)     =  +1.0E+01                    !V97U1667C
 83   PIETAB(2)     =  +1.0E+01                    !V97U1668C
 84   PIETAB(3)     =  +1.0E+01                    !V97U1669C
 85   PIETAB(4)     =  +1.0E+01                    !V97U1670C
 86   PIETAB(5)     =  +1.0E+01                    !V97U1671C
 87   PIETAB(6)     =  +1.43E+00                   !V97U1672C
 88   PIETAB(7)     =  +0.0E+00                    !V97U1673C
 89   PIETAB(8)     =  +0.0E+00                    !V97U1674C
 90   POETAB(1)     =  +9.0E+00                    !V97U1677C
 91   POETAB(2)     =  +9.0E+00                    !V97U1678C
 92   POETAB(3)     =  +1.5E+00                    !V97U1679C
 93   POETAB(4)     =  -5.0E+00                    !V97U1680C
 94   POETAB(5)     =  -5.0E+00                    !V97U1681C
 95   POETAB(6)     =  -5.0E+00                    !V97U1682C
 96   POETAB(7)     =  -2.5E+00                    !V97U1683C
 97   POETAB(8)     =  +0.0E+00                    !V97U1684C
 98   PPOLY2(1)     =  +0.0E+00                    !V97U4486C
 99   PPOLY2(2)     =  +1.27E+02                   !V97U4487C
100   PPOLY2(3)     =  +3.41E+02                   !V97U4488C
101   PPOLY2(4)     =  +3.67E+02                   !V97U4489C
102   PPOLY2(5)     =  +3.93E+02                   !V97U4490C
103   PPOLY2(6)     =  +4.47E+02                   !V97U4491C
104   PPOLY2(7)     =  +5.52E+02                   !V97U4492C
105   PPOLY2(8)     =  +5.98E+02                   !V97U4493C
106   PPOLY2(9)     =  +6.71E+02                   !V97U4494C
107   PPOLY2(10)    =  +7.66E+02                   !V97U4495C
108   PPOLY2(11)    =  +8.36E+02                   !V97U4496C
109   PPOLY2(12)    =  +9.45E+02                   !V97U4497C
110   PPOLY2(13)    =  +1.036E+03                  !V97U4498C
111   PPOLY2(14)    =  +1.159E+03                  !V97U4499C
112   PPOLY2(15)    =  +1.332E+03                  !V97U4500C
113   PPOLY2(16)    =  +1.418E+03                  !V97U4501C
114   PPOLY2(17)    =  +1.512E+03                  !V97U4502C
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115	PPOLY2(18)	=	+1.687E+03	IV97U4503C
116	PPOLY2(19)	=	+1.803E+03	IV97U4504C
117	PPOLY2(20)	=	+1.93E+03	IV97U4505C
118	PPOLY2(21)	=	+2.163E+03	IV97U4506C
119	PPOLY2(22)	=	+2.262E+03	IV97U4507C
120	PPOLY2(23)	=	+2.312E+03	IV97U4508C
121	PPOLY2(24)	=	+2.362E+03	IV97U4509C
122	PPOLY2(25)	=	+2.631E+03	IV97U4510C
123	PPOLY2(26)	=	+2.845E+03	IV97U4511C
124	PPOLY2(27)	=	+3.066E+03	IV97U4512C
125	PPOLY2(28)	=	+3.289E+03	IV97U4513C
126	PPOLY2(29)	=	+3.737E+03	IV97U4514C
127	PPOLY2(30)	=	+5.00E+03	IV97U4515C
128	PSI(1)	=	+0.0E+00	IV97U4516C
129	PSI(2)	=	+4.1168E-01	IV97U4520C
130	PSI(3)	=	+4.1168E-01	IV97U4524C
131	PSI(4)	=	+4.1421E-01	IV97U4528C
132	PSI(5)	=	+4.1524E-01	IV97U4532C
133	PSI(6)	=	+4.1384E-01	IV97U4536C
134	PSI(7)	=	+4.121E-01	IV97U4540C
135	PSI(8)	=	+4.1073E-01	IV97U4544C
136	PSI(9)	=	+4.0938E-01	IV97U4548C
137	PSI(10)	=	+4.0749E-01	IV97U4552C
138	PSI(11)	=	+4.0615E-01	IV97U4556C
139	PSI(12)	=	+4.0353E-01	IV97U4560C
140	PSI(13)	=	+4.007E-01	IV97U4564C
141	PSI(14)	=	+3.9904E-01	IV97U4568C
142	PSI(15)	=	+3.9835E-01	IV97U4572C
143	PSI(16)	=	+3.9811E-01	IV97U4576C
144	PSI(17)	=	+3.9754E-01	IV97U4580C
145	PSI(18)	=	+3.969E-01	IV97U4584C
146	PSI(19)	=	+3.9795E-01	IV97U4588C
147	PSI(20)	=	+4.0071E-01	IV97U4592C
148	PSI(21)	=	+4.0385E-01	IV97U4596C
149	PSI(22)	=	+4.0428E-01	IV97U4600C
150	PSI(23)	=	+4.044E-01	IV97U4604C
151	PSI(24)	=	+4.0448E-01	IV97U4608C
152	PSI(25)	=	+4.0348E-01	IV97U4612C
153	PSI(26)	=	+4.0335E-01	IV97U4616C
154	PSI(27)	=	+4.0376E-01	IV97U4620C
155	PSI(28)	=	+4.0403E-01	IV97U4624C
156	PSI(29)	=	+4.0371E-01	IV97U4628C
157	PSI(30)	=	+4.0371E-01	IV97U4632C
158	PTCHF	=	+5.5E-03	IV99U7561C
159	PTCHFL	=	+4.5E-03	IV99U7562C
160	PTCHP	=	+1.0E-01	IV99U7563C
161	QPOLY(1)	=	+6.0E+01	IV97U4640C
162	QPOLY(2)	=	+5.52E+02	IV97U4641C
163	QPOLY(3)	=	+1.202E+03	IV97U4642C
164	QPOLY(4)	=	+1.367E+03	IV97U4643C
165	RDMAG	=	+2.1272079E+07	IV97U4647C
166	RDNOM	=	+2.1272079E+07	IV97U4645C
167	RHOMAG	=	+1.0000000E+00	IV97U4650C
168	SLOPEN	=	-1.616E-06	IV99U7443C
169	TAOA	=	+1.000E+03	IV97U4661C
170	TABORT	=	+1.0E+01	IV98U7961C
171	TFAIL	=	+0.0E+00	IV96U9384C

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THETT(1,1)   =  +4.1421E-01                    !V97U4667C
THETT(2,1)   =  +3.1347E-01                    !V97U4671C
THETT(3,1)   =  +3.1347E-01                    !V97U4675C
THETT(4,1)   =  +3.1681E-01                    !V97U4679C
THETT(5,1)   =  +3.1833E-01                    !V97U4683C
THETT(6,1)   =  +3.1943E-01                    !V97U4687C
THETT(7,1)   =  +3.1948E-01                    !V97U4691C
THETT(8,1)   =  +3.1578E-01                    !V97U4695C
THETT(9,1)   =  +3.0934E-01                    !V97U4699C
THETT(10,1   =  +3.024E-01                     !V97U4703C
THETT(11,1   =  +2.9616E-01                    !V97U4707C
THETT(12,1   =  +2.8769E-01                    !V97U4711C
THETT(13,1   =  +2.8187E-01                    !V97U4715C
THETT(14,1   =  +2.7623E-01                    !V97U4719C
THETT(15,1   =  +2.6476E-01                    !V97U4723C
THETT(16,1   =  +2.6074E-01                    !V97U4727C
THETT(17,1   =  +2.5859E-01                    !V97U4731C
THETT(18,1   =  +2.4444E-01                    !V97U4735C
THETT(19,1   =  +2.3395E-01                    !V97U4739C
THETT(20,1   =  +2.2232E-01                    !V97U4743C
THETT(21,1   =  +2.0038E-01                    !V97U4747C
THETT(22,1   =  +1.9328E-01                    !V97U4751C
THETT(23,1   =  +1.897E-01                     !V97U4755C
THETT(24,1   =  +1.8611E-01                    !V97U4759C
THETT(25,1   =  +1.744E-01                     !V97U4763C
THETT(26,1   =  +1.6587E-01                    !V97U4767C
THETT(27,1   =  +1.5793E-01                    !V97U4771C
THETT(28,1   =  +1.5051E-01                    !V97U4775C
THETT(29,1   =  +1.3658E-01                    !V97U4779C
THETT(30,1   =  +9.807E-02                     !V97U4783C
THETT(1,2)   =  +4.142E-01                     !V99U6401C
THETT(2,2)   =  +3.08E-01                      !V99U6402C
THETT(3,2)   =  +3.08E-01                      !V99U6403C
THETT(4,2)   =  +3.114E-01                     !V99U6404C
THETT(5,2)   =  +3.129E-01                     !V99U6405C
THETT(6,2)   =  +3.153E-01                     !V99U6406C
THETT(7,2)   =  +3.183E-01                     !V99U6407C
THETT(8,2)   =  +3.154E-01                     !V99U6408C
THETT(9,2)   =  +3.097E-01                     !V99U6409C
THETT(10,2   =  +3.04E-01                      !V99U6410C
THETT(11,2   =  +2.993E-01                     !V99U6411C
THETT(12,2   =  +2.942E-01                     !V99U6412C
THETT(13,2   =  +2.865E-01                     !V99U6413C
THETT(14,2   =  +2.729E-01                     !V99U6414C
THETT(15,2   =  +2.575E-01                     !V99U6415C
THETT(16,2   =  +2.524E-01                     !V99U6416C
THETT(17,2   =  +2.496E-01                     !V99U6417C
THETT(18,2   =  +2.401E-01                     !V99U6418C
THETT(19,2   =  +2.29E-01                      !V99U6419C
THETT(20,2   =  +2.182E-01                     !V99U6420C
THETT(21,2   =  +2.071E-01                     !V99U6421C
THETT(22,2   =  +2.077E-01                     !V99U6422C
THETT(23,2   =  +2.055E-01                     !V99U6423C
THETT(24,2   =  +2.027E-01                     !V99U6424C
THETT(25,2   =  +1.865E-01                     !V99U6425C
THETT(26,2   =  +1.74E-01                      !V99U6426C
THETT(27,2   =  +1.636E-01                     !V99U6427C
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THETT(28,2    =  +1.548E-01                    !V99U6428C
THETT(29,2    =  +1.409E-01                    !V99U6429C
THETT(30,2    =  +1.023E-01                    !V99U6430C
THETT(1,3)    =  +4.142E-01                    !V99U6431C
THETT(2,3)    =  +3.03E-01                     !V99U6432C
THETT(3,3)    =  +3.03E-01                     !V99U6433C
THETT(4,3)    =  +3.063E-01                    !V99U6434C
THETT(5,3)    =  +3.078E-01                    !V99U6435C
THETT(6,3)    =  +3.114E-01                    !V99U6436C
THETT(7,3)    =  +3.17E-01                     !V99U6437C
THETT(8,3)    =  +3.144E-01                    !V99U6438C
THETT(9,3)    =  +3.076E-01                    !V99U6439C
THETT(10,3    =  +3.014E-01                    !V99U6440C
THETT(11,3    =  +2.962E-01                    !V99U6441C
THETT(12,3    =  +2.905E-01                    !V99U6442C
THETT(13,3    =  +2.84E-01                     !V99U6443C
THETT(14,3    =  +2.73E-01                     !V99U6444C
THETT(15,3    =  +2.604E-01                    !V99U6445C
THETT(16,3    =  +2.567E-01                    !V99U6446C
THETT(17,3    =  +2.553E-01                    !V99U6447C
THETT(18,3    =  +2.502E-01                    !V99U6448C
THETT(19,3    =  +2.395E-01                    !V99U6449C
THETT(20,3    =  +2.292E-01                    !V99U6450C
THETT(21,3    =  +2.133E-01                    !V99U6451C
THETT(22,3    =  +2.104E-01                    !V99U6452C
THETT(23,3    =  +2.085E-01                    !V99U6453C
THETT(24,3    =  +2.046E-01                    !V99U6454C
THETT(25,3    =  +1.881E-01                    !V99U6455C
THETT(26,3    =  +1.766E-01                    !V99U6456C
THETT(27,3    =  +1.661E-01                    !V99U6457C
THETT(28,3    =  +1.571E-01                    !V99U6458C
THETT(29,3    =  +1.432E-01                    !V99U6459C
THETT(30,3    =  +1.047E-01                    !V99U6460C
THROTT(1)     =  +1.04E+02                     !V97U4808C
THROTT(2)     =  +8.7E+01                      !V97U4809C
THROTT(3)     =  +6.7E+01                      !V97U4810C
THROTT(4)     =  +1.04E+02                     !V97U4811C
THRTF         =  +5.416E+03                    !V99U7564C
THRTFL        =  +4.063E+03                    !V99U7565C
TLAG          =  +5.0000000E-01                !V97U4834C
TNZRFO(1)     =  -6.02E-02                     !V97U2138C
TNZRFO(2)     =  -6.17E-02                     !V97U2139C
TNZRFO(3)     =  -4.26E-02                     !V97U2140C
TNZRFO(4)     =  -1.024E-01                    !V97U2141C
TNZRFO(5)     =  -9.24E-02                     !V97U2142C
TNZRFO(6)     =  -1.827E-01                    !V97U2143C
TNZRFO(7)     =  -2.234E-01                    !V97U2144C
TNZRFO(8)     =  -2.362E-01                    !V97U2145C
TNZRFO(9)     =  -2.349E-01                    !V97U2146C
TNZRFO(10)    =  -1.961E-01                    !V97U2147C
TNZRFO(11)    =  -2.122E-01                    !V97U2148C
TNZRFO(12)    =  -2.826E-01                    !V97U2149C
TNZRFO(13)    =  -2.659E-01                    !V97U2150C
TNZRFO(14)    =  -2.225E-01                    !V97U2151C
TNZRFO(15)    =  -1.167E-01                    !V97U2152C
TNZRFO(16)    =  -9.993E-02                    !V97U2153C
TNZRFO(17)    =  -8.39E-02                     !V97U2154C
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286   TNZRFO(18)    =  -8.87E-02                    !V97U2155C
287   TNZRFO(19)    =  -1.06E-01                    !V97U2156C
288   TNZRFO(20)    =  -1.27E-01                    !V97U2157C
289   TREFAD        =  +1.92E+01                    !V99U7566C
290   TRIMDT        =  +1.2000000E+01               !V98U9809C
291   TSRPTO(1)     =  -2.68E-01                    !V97U1714C
292   TSRPTO(2)     =  -1.98E-01                    !V97U1715C
293   TSRPTO(3)     =  -2.84E-01                    !V97U1716C
294   TSRPTO(4)     =  -5.75E-01                    !V97U1717C
295   TSRPTO(5)     =  -4.54E-01                    !V97U1718C
296   TSRPTO(6)     =  -1.517E+00                   !V97U1719C
297   TSRPTO(7)     =  -1.13E+00                    !V97U1720C
298   TSRPTO(8)     =  -1.232E+00                   !V97U1721C
299   TSRPTO(9)     =  -1.37E+00                    !V97U1722C
300   TSRPTO(10)    =  -1.133E+00                   !V97U1723C
301   TSRPTO(11)    =  -1.015E+00                   !V97U1724C
302   TSRPTO(12)    =  -1.177E+00                   !V97U1725C
303   TSRPTO(13)    =  -9.49E-01                    !V97U1726C
304   TSRPTO(14)    =  -4.79E-01                    !V97U1727C
305   TSRPTO(15)    =  +3.45E-02                    !V97U1728C
306   TSRPTO(16)    =  +1.17E-01                    !V97U1729C
307   TSRPTO(17)    =  +1.61E-01                    !V97U1730C
308   TSRPTO(18)    =  +3.22E-01                    !V97U1731C
309   TSRPTO(19)    =  +5.99E-01                    !V97U1732C
310   TSRPTO(20)    =  +8.25E-01                    !V97U1733C
311   UYD(1)        =  +9.820068E-02                !V97U4413C
312   UYD(2)        =  -4.6616053E-01               !V97U4414C
313   UYD(3)        =  -8.7923318E-01               !V97U4415C
314   UYDNOM(1)     =  +9.820068E-02                !V96U9385C
315   UYDNOM(2)     =  -4.6616053E-01               !V96U9386C
316   UYDNOM(3)     =  -8.7923318E-01               !V96U9387C
317   VDMAG         =  +2.5873E+04                  !V97U4828C
318   VDNOM         =  +2.5873E+04                  !V97U4827C
319   VREFAD        =  +4.295E+02                   !V99U7567C
320   VREL20(1)     =  +0.0E+00                     !V97U2297C
321   VREL20(2)     =  +1.27E+02                    !V97U2298C
322   VREL20(3)     =  +3.41E+02                    !V97U2299C
323   VREL20(4)     =  +5.52E+02                    !V97U2300C
324   VREL20(5)     =  +5.98E+02                    !V97U2301C
325   VREL20(6)     =  +9.68E+02                    !V97U2302C
326   VREL20(7)     =  +1.115E+03                   !V97U2303C
327   VREL20(8)     =  +1.159E+03                   !V97U2304C
328   VREL20(9)     =  +1.202E+03                   !V97U2305C
329   VREL20(10)    =  +1.249E+03                   !V97U2306C
330   VREL20(11)    =  +1.367E+03                   !V97U2307C
331   VREL20(12)    =  +1.479E+03                   !V97U2308C
332   VREL20(13)    =  +1.545E+03                   !V97U2309C
333   VREL20(14)    =  +1.724E+03                   !V97U2310C
334   VREL20(15)    =  +2.066E+03                   !V97U2311C
335   VREL20(16)    =  +2.163E+03                   !V97U2312C
336   VREL20(17)    =  +2.262E+03                   !V97U2313C
337   VREL20(18)    =  +2.413E+03                   !V97U2314C
338   VREL20(19)    =  +2.955E+03                   !V97U2315C
339   VREL20(20)    =  +3.737E+03                   !V97U2316C
340   VRELT8(1)     =  +0.0E+00                     !V97U2276C
341   VRELT8(2)     =  +1.242E+03                   !V97U2277C
34    VRELT8(3)     =  +1.393E+03                   !V97U2
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VRELT8(4)     =  +1.578E+03                  !V97U2279C
VRELT8(5)     =  +1.693E+03                  !V97U2280C
VRELT8(6)     =  +2.275E+03                  !V97U2281C
VRELT8(7)     =  +2.382E+03                  !V97U2282C
VRELT8(8)     =  +2.488E+03                  !V97U2283C
VRHOPH        =  +5.7000000E+03              !V97U4823C
WLS1G         =  +1.5E+01                    !V97U2321C
XKDOT         =  +1.0000000E+01              !V97U4422C
              =                              !V97U4831C
XKMISS        =  +1.0E-02                    !V97U4831C
XMASS         =  +5.977E+04                  !V97U4429C1
XMASSL        =  +1.120E+04                  !V97U4432C
XMASST        =  +1.556E+04                  !V97U4436C
              =                              !V97U4440C
XMDOMS        =  +5.9542050E-01              !V97U4440C
XMDRCS        =  +1.0655714E-01              !V97U4441C
              =                              !V97U4442C
XMDSME        =  +3.2221560E+01              !V97U4442C
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LTQS RUNID: F8MKCB START: 04/23/91 20:27 TIME: 20:27
TRAJ PROC RUN 15 - SVDS ASCT 17 ADI OUTPUT

DOL ASCENT ADI-NOMINAL

TIME	THETA	HDOT	H
0:30	69	651	9K
0:50	62	1005	26K
1:10	54	1406	50K
1:30	40	1876	83K
1:50	31	2187	124K

STAGING

VI	THETA	HDOT	H
6	22	1782	34NM
7	18	1334	45
8	15	992	51
9	13	719	55
10	10	495	58
12	7	164	60
14	4	-45	60
16	1	-151	60
18	0	-169	59
20	-1	-110	59
22	-2	11	58
24	-3	165	59
25875	-2	344	60

Launch Tracking Cameras Azimuth and Elevation Data

TRACKING TELESCOPE TIMING - AZ/EL PRINTOUT

PREPARED BY :
TGS TECHNOLOGY INC.
CCAFS

DATE : 02 August 1991

TEST : C8181 STS-43

THIS IS
TEST ITEM : ET 221

FROM
TRACKING
ITEM : ET-204A

SITE : PAFB IGOR

DIST : JSC/JL3

TEST : C8181 - STS-43
TRKNG ITEM : ET-204A
SITE : PAFB IGOR
DISTRIB. : JSC/JL3

**** PIPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
000	00:00:00.0	000	000000	+000.000	-000.148	00	
214	15:01:58.0	010	002043	+359.407	-000.148	04	
214	15:01:59.0	010	002043	+359.398	-000.148	04	
214	15:02:00.0	010	002043	+359.398	-000.148	04	
214	15:02:01.0	010	002043	+359.404	-000.146	04	
214	15:02:02.0	010	002043	+359.401	-000.146	04	
214	15:02:03.0	010	002043	+359.401	-000.143	04	
214	15:02:04.0	010	002043	+359.401	-000.135	04	
214	15:02:05.0	010	002043	+359.401	-000.107	04	
214	15:02:06.0	010	002043	+359.401	-000.071	04	
214	15:02:07.0	010	002043	+359.401	-000.030	04	
214	15:02:08.0	010	002043	+359.401	+000.047	04	
214	15:02:09.0	010	002043	+359.401	+000.126	04	
214	15:02:10.0	010	002043	+359.401	+000.222	04	T
214	15:02:11.0	010	002043	+359.407	+000.302	04	T
214	15:02:12.0	010	002043	+359.409	+000.390	04	T
214	15:02:13.0	010	002043	+359.415	+000.489	04	T
214	15:02:14.0	010	002043	+359.423	+000.599	04	T
214	15:02:15.0	010	002043	+359.440	+000.736	04	T
214	15:02:16.0	010	002043	+359.473	+000.868	04	T
214	15:02:17.0	010	002043	+359.497	+001.005	04	T
214	15:02:18.0	010	002043	+359.536	+001.148	04	T
214	15:02:19.0	010	002043	+359.594	+001.285	04	T
214	15:02:20.0	010	002043	+359.651	+001.453	04	T
214	15:02:21.0	010	002043	+359.712	+001.642	04	T
214	15:02:22.0	010	002043	+359.786	+001.835	04	T
214	15:02:23.0	010	002043	+359.863	+002.010	04	T
214	15:02:24.0	010	002043	+359.942	+002.214	04	T
214	15:02:25.0	010	002043	+000.038	+002.436	04	T
214	15:02:26.0	010	002043	+000.140	+002.678	04	T
214	15:02:27.0	010	002043	+000.244	+002.898	04	T
214	15:02:28.0	010	002043	+000.354	+003.148	04	T
214	15:02:29.0	010	002043	+000.475	+003.406	04	T
214	15:02:30.0	010	002043	+000.604	+003.650	04	T
214	15:02:31.0	010	002043	+000.731	+003.922	04	T
214	15:02:32.0	010	002043	+000.871	+004.205	04	T
214	15:02:33.0	010	002043	+001.013	+004.471	04	T
214	15:02:34.0	010	002043	+001.162	+004.765	04	T
214	15:02:35.0	010	002043	+001.324	+005.054	04	T
214	15:02:36.0	010	002043	+001.486	+005.353	04	T
214	15:02:37.0	010	002043	+001.659	+005.669	04	T
214	15:02:38.0	010	002043	+001.837	+005.968	04	T
214	15:02:39.0	010	002043	+002.019	+006.288	04	T
214	15:02:40.0	010	002043	+002.206	+006.595	04	T
214	15:02:41.0	010	002043	+002.406	+006.941	04	T
214	15:02:42.0	010	002043	+002.620	+007.287	04	T
214	15:02:43.0	010	002043	+002.829	+007.611	04	T
214	15:02:44.0	010	002043	+003.043	+007.968	04	T
214	15:02:45.0	010	002043	+003.263	+008.322	04	T
214	15:02:46.0	010	002043	+003.505	+008.690	04	T

**** FTIC - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	INT	TRAL
214	15:02:47.0	010	002043	+003.749	+009.039	04	[illegible]
214	15:02:48.0	010	002043	+003.994	+009.402	04	T
214	15:02:49.0	010	002043	+004.249	+009.775	04	T
214	15:02:50.0	010	002043	+004.510	+010.171	04	T
214	15:02:51.0	010	002043	+004.782	+010.555	04	T
214	15:02:52.0	010	002043	+005.048	+010.929	04	T
214	15:02:53.0	010	002043	+005.328	+011.319	04	T
214	15:02:54.0	010	002043	+005.611	+011.728	04	T
214	15:02:55.0	010	002043	+005.924	+012.107	04	T
214	15:02:56.0	010	002043	+006.227	+012.516	04	T
214	15:02:57.0	010	002043	+006.531	+012.920	04	T
214	15:02:58.0	010	002043	+006.850	+013.326	04	T
214	15:02:59.0	010	002043	+007.174	+013.714	04	T
214	15:03:00.0	010	002043	+007.506	+014.126	04	T
214	15:03:01.0	010	002043	+007.852	+014.527	04	T
214	15:03:02.0	010	002043	+008.212	+014.958	04	T
214	15:03:03.0	010	002043	+008.578	+015.351	04	T
214	15:03:04.0	010	002043	+008.946	+015.776	04	T
214	15:03:05.0	010	002043	+009.330	+016.208	04	T
214	15:03:06.0	010	002043	+009.723	+016.631	04	T
214	15:03:07.0	010	002043	+010.124	+017.065	04	T
214	15:03:08.0	010	002043	+010.547	+017.515	04	T
214	15:03:09.0	010	002043	+010.975	+017.968	04	T
214	15:03:10.0	010	002043	+011.418	+018.402	04	T
214	15:03:11.0	010	002043	+011.868	+018.858	04	T
214	15:03:12.0	010	002043	+012.327	+019.303	04	T
214	15:03:13.0	010	002043	+012.807	+019.767	04	T
214	15:03:14.0	010	002043	+013.299	+020.223	04	T
214	15:03:15.0	010	002043	+013.802	+020.671	04	T
214	15:03:16.0	010	002043	+014.315	+021.140	04	T
214	15:03:17.0	010	002043	+014.851	+021.588	04	T
214	15:03:18.0	010	002043	+015.406	+022.058	04	T
214	15:03:19.0	010	002043	+015.969	+022.527	04	T
214	15:03:20.0	010	002043	+016.548	+022.964	04	T
214	15:03:21.0	010	002043	+017.141	+023.423	04	T
214	15:03:22.0	010	002043	+017.748	+023.871	04	T
214	15:03:23.0	010	002043	+018.375	+024.315	04	T
214	15:03:24.0	010	002043	+019.009	+024.752	04	T
214	15:03:25.0	010	002043	+019.663	+025.172	04	T
214	15:03:26.0	010	002043	+020.330	+025.615	04	T
214	15:03:27.0	010	002043	+021.011	+026.005	04	T
214	15:03:28.0	010	002043	+021.706	+026.433	04	T
214	15:03:29.0	010	002043	+022.412	+026.842	04	T
214	15:03:30.0	010	002043	+023.126	+027.238	04	T
214	15:03:31.0	010	002043	+023.851	+027.606	04	T
214	15:03:32.0	010	002043	+024.585	+027.996	04	T
214	15:03:33.0	010	002043	+025.329	+028.361	04	T
214	15:03:34.0	010	002043	+026.084	+028.724	04	T
214	15:03:35.0	010	002043	+026.848	+029.042	04	T
214	15:03:36.0	010	002043	+027.625	+029.383	04	[illegible]

**** PIPO - HIGH DENSITY DATA DUMP UTILITY IR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRAC
214	15:03:37.0	010	002043	+028.405	+029.699	04	T
214	15:03:38.0	010	002043	+029.185	+030.023	04	T
214	15:03:39.0	010	002043	+029.973	+030.520	04	T
214	15:03:40.0	010	002043	+030.764	+030.608	04	T
214	15:03:41.0	010	002043	+031.558	+030.891	04	T
214	15:03:42.0	010	002043	+032.360	+031.143	04	T
214	15:03:43.0	010	002043	+033.165	+031.391	04	T
214	15:03:44.0	010	002043	+033.967	+031.635	04	T
214	15:03:45.0	010	002043	+034.772	+031.838	04	T
214	15:03:46.0	010	002043	+035.571	+032.042	04	T
214	15:03:47.0	010	002043	+036.367	+032.250	04	T
214	15:03:48.0	010	002043	+037.169	+032.434	04	T
214	15:03:49.0	010	002043	+037.961	+032.594	04	T
214	15:03:50.0	010	002043	+038.754	+032.756	04	T
214	15:03:51.0	010	002043	+039.540	+032.907	04	T
214	15:03:52.0	010	002043	+040.320	+033.047	04	T
214	15:03:53.0	010	002043	+041.092	+033.173	04	T
214	15:03:54.0	010	002043	+041.855	+033.272	04	T
214	15:03:55.0	010	002043	+042.605	+033.360	04	T
214	15:03:56.0	010	002043	+043.347	+033.453	04	T
214	15:03:57.0	010	002043	+044.080	+033.536	04	T
214	15:03:58.0	010	002043	+044.791	+033.602	04	T
214	15:03:59.0	010	002043	+045.494	+033.659	04	T
214	15:04:00.0	010	002043	+046.187	+033.703	04	T
214	15:04:01.0	010	002043	+046.868	+033.739	04	T
214	15:04:02.0	010	002043	+047.524	+033.766	04	T
214	15:04:03.0	010	002043	+048.172	+033.783	04	T
214	15:04:04.0	010	002043	+048.812	+033.794	04	T
214	15:04:05.0	010	002043	+049.430	+033.799	04	T
214	15:04:06.0	010	002043	+050.040	+033.799	04	T
214	15:04:07.0	010	002043	+050.636	+033.799	04	T
214	15:04:08.0	010	002043	+051.216	+033.799	04	T
214	15:04:09.0	010	002043	+051.798	+033.797	04	T
214	15:04:10.0	010	002043	+052.342	+033.791	04	
214	15:04:11.0	010	002043	+052.839	+033.775	04	
214	15:04:12.0	010	002043	+053.322	+033.723	04	
214	15:04:13.0	010	002043	+053.828	+033.635	04	
214	15:04:14.0	010	002043	+054.393	+033.522	04	
214	15:04:15.0	010	002043	+054.973	+033.423	04	
214	15:04:16.0	010	002043	+055.464	+033.393	04	
214	15:04:17.0	010	002043	+055.552	+033.426	04	
214	15:04:18.0	010	002043	+055.860	+033.338	04	
214	15:04:19.0	010	002043	+056.286	+033.247	04	
214	15:04:20.0	010	002043	+057.316	+033.187	04	
214	15:04:21.0	010	002043	+057.829	+033.094	04	
214	15:04:22.0	010	002043	+058.307	+033.030	04	
214	15:04:23.0	010	002043	+058.615	+032.951	04	
214	15:04:24.0	010	002043	+059.109	+032.841	04	
214	15:04:25.0	010	002043	+059.527	+032.753	04	
214	15:04:26.0	010	002043	+059.958	+032.654	04	T

**** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SIGES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRACK
214	15:04:27.0	010	002043	+060.359	+032.563	04	T
214	15:04:28.0	010	002043	+060.749	+032.465	04	T
214	15:04:29.0	010	002043	+061.133	+032.368	04	T
214	15:04:30.0	010	002043	+061.507	+032.283	04	T
214	15:04:31.0	010	002043	+061.878	+032.168	04	T
214	15:04:32.0	010	002043	+062.229	+032.050	04	T
214	15:04:33.0	010	002043	+062.592	+031.945	04	T
214	15:04:34.0	010	002043	+062.941	+031.833	04	T
214	15:04:35.0	010	002043	+063.276	+031.726	04	T
214	15:04:36.0	010	002043	+063.625	+031.621	04	T
214	15:04:37.0	010	002043	+063.954	+031.503	04	T
214	15:04:38.0	010	002043	+064.270	+031.371	04	T
214	15:04:39.0	010	002043	+064.589	+031.262	04	T
214	15:04:40.0	010	002043	+064.910	+031.143	04	T
214	15:04:41.0	010	002043	+065.215	+031.020	04	T
214	15:04:42.0	010	002043	+065.514	+030.899	04	T
214	15:04:43.0	010	002043	+065.814	+030.778	04	T
214	15:04:44.0	010	002043	+066.107	+030.660	04	T
214	15:04:45.0	010	002043	+066.385	+030.531	04	T
214	15:04:46.0	010	002043	+066.657	+030.399	04	T
214	15:04:47.0	010	002043	+066.937	+030.276	04	T
214	15:04:48.0	010	002043	+067.214	+030.155	04	T
214	15:04:49.0	010	002043	+067.473	+030.026	04	T
214	15:04:50.0	010	002043	+067.744	+029.891	04	T
214	15:04:51.0	010	002043	+067.000	+029.759	04	T
214	15:04:52.0	010	002043	+068.258	+029.627	04	T
214	15:04:53.0	010	002043	+068.503	+029.496	04	T
214	15:04:54.0	010	002043	+068.741	+029.364	04	T
214	15:04:55.0	010	002043	+068.980	+029.237	04	T
214	15:04:56.0	010	002043	+069.222	+029.128	04	T
214	15:04:57.0	010	002043	+069.447	+028.971	04	T
214	15:04:58.0	010	002043	+069.675	+028.828	04	T
214	15:04:59.0	010	002043	+069.906	+028.696	04	T
214	15:05:00.0	010	002043	+070.120	+028.570	04	T
214	15:05:01.0	010	002043	+070.348	+028.433	04	T
214	15:05:02.0	010	002043	+070.565	+028.295	04	T
214	15:05:03.0	010	002043	+070.779	+028.158	04	T
214	15:05:04.0	010	002043	+070.985	+028.021	04	T
214	15:05:05.0	010	002043	+071.180	+027.886	04	T
214	15:05:06.0	010	002043	+071.386	+027.754	04	T
214	15:05:07.0	010	002043	+071.576	+027.639	04	T
214	15:05:08.0	010	002043	+071.768	+027.488	04	T
214	15:05:09.0	010	002043	+071.969	+027.309	04	T
214	15:05:10.0	010	002043	+072.161	+027.183	04	T
214	15:05:11.0	010	002043	+072.345	+027.062	04	T
214	15:05:12.0	010	002043	+072.526	+026.941	04	T
214	15:05:13.0	010	002043	+072.702	+026.798	04	T
214	15:05:14.0	010	002043	+072.872	+026.656	04	T
214	15:05:15.0	010	002043	+073.051	+026.516	04	T
214	15:05:16.0	010	002043	+073.213	+026.370	04	T

**** PIPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:05:17.0	010	002043	+073.386	+026.235	04	T
214	15:05:18.0	010	002043	+073.573	+026.128	04	T
214	15:05:19.0	010	002043	+073.718	+025.968	04	T
214	15:05:20.0	010	002043	+073.878	+025.834	04	T
214	15:05:21.0	010	002043	+074.042	+025.689	04	T
214	15:05:22.0	010	002043	+074.196	+025.554	04	T
214	15:05:23.0	010	002043	+074.355	+025.428	04	T
214	15:05:24.0	010	002043	+074.520	+025.310	04	T
214	15:05:25.0	010	002043	+074.663	+025.159	04	T
214	15:05:26.0	010	002043	+074.814	+025.016	04	T
214	15:05:27.0	010	002043	+074.957	+024.873	04	T
214	15:05:28.0	010	002043	+075.097	+024.736	04	T
214	15:05:29.0	010	002043	+075.234	+024.604	04	T
214	15:05:30.0	010	002043	+075.380	+024.480	04	T
214	15:05:31.0	010	002043	+075.517	+024.337	04	T
214	15:05:32.0	010	002043	+075.646	+024.195	04	T
214	15:05:33.0	010	002043	+075.792	+024.060	04	T
214	15:05:34.0	010	002043	+075.932	+023.942	04	T
214	15:05:35.0	010	002043	+076.047	+023.799	04	T
214	15:05:36.0	010	002043	+076.185	+023.659	04	T
214	15:05:37.0	010	002043	+076.319	+023.519	04	T
214	15:05:38.0	010	002043	+076.429	+023.384	04	T
214	15:05:39.0	010	002043	+076.555	+023.247	04	T
214	15:05:40.0	010	002043	+076.679	+023.126	04	T
214	15:05:41.0	010	002043	+076.805	+023.003	04	T
214	15:05:42.0	010	002043	+076.924	+022.838	04	T
214	15:05:43.0	010	002043	+077.039	+022.709	04	T
214	15:05:44.0	010	002043	+077.154	+022.574	04	T
214	15:05:45.0	010	002043	+077.272	+022.456	04	T
214	15:05:46.0	010	002043	+077.379	+022.335	04	T
214	15:05:47.0	010	002043	+077.489	+022.201	04	T
214	15:05:48.0	010	002043	+077.605	+022.069	04	T
214	15:05:49.0	010	002043	+077.715	+021.937	04	T
214	15:05:50.0	010	002043	+077.816	+021.802	04	T
214	15:05:51.0	010	002043	+077.918	+021.671	04	T
214	15:05:52.0	010	002043	+078.039	+021.555	04	T
214	15:05:53.0	010	002043	+078.138	+021.423	04	T
214	15:05:54.0	010	002043	+078.231	+021.286	04	T
214	15:05:55.0	010	002043	+078.335	+021.154	04	T
214	15:05:56.0	010	002043	+078.434	+021.028	04	T
214	15:05:57.0	010	002043	+078.539	+020.904	04	T
214	15:05:58.0	010	002043	+078.637	+020.778	04	T
214	15:05:59.0	010	002043	+078.725	+020.649	04	T
214	15:06:00.0	010	002043	+078.819	+020.517	04	T
214	15:06:01.0	010	002043	+078.923	+020.385	04	T
214	15:06:02.0	010	002043	+079.019	+020.259	04	T
214	15:06:03.0	010	002043	+079.107	+020.138	04	T
214	15:06:04.0	010	002043	+079.200	+020.023	04	T
214	15:06:05.0	010	002043	+079.280	+019.896	04	T
214	15:06:06.0	010	002043	+079.371	+019.762	04	T

**** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	SMT	TRACK
214	15:06:07.0	010	002043	+079.459	+019.635	04	T
214	15:06:08.0	010	002043	+079.547	+019.512	04	T
214	15:06:09.0	010	002043	+079.632	+019.388	04	T
214	15:06:10.0	010	002043	+079.714	+019.270	04	T
214	15:06:11.0	010	002043	+079.799	+019.144	04	T
214	15:06:12.0	010	002043	+079.884	+019.017	04	T
214	15:06:13.0	010	002043	+079.961	+018.896	04	T
214	15:06:14.0	010	002043	+080.046	+018.773	04	T
214	15:06:15.0	010	002043	+080.126	+018.655	04	T
214	15:06:16.0	010	002043	+080.203	+018.542	04	T
214	15:06:17.0	010	002043	+080.288	+018.419	04	T
214	15:06:18.0	010	002043	+080.362	+018.295	04	T
214	15:06:19.0	010	002043	+080.434	+018.171	04	T
214	15:06:20.0	010	002043	+080.516	+018.053	04	T
214	15:06:21.0	010	002043	+080.587	+017.935	04	T
214	15:06:22.0	010	002043	+080.659	+017.820	04	T
214	15:06:23.0	010	002043	+080.733	+017.704	04	T
214	15:06:24.0	010	002043	+080.802	+017.584	04	T
214	15:06:25.0	010	002043	+080.873	+017.463	04	T
214	15:06:26.0	010	002043	+080.950	+017.345	04	T
214	15:06:27.0	010	002043	+081.016	+017.227	04	T
214	15:06:28.0	010	002043	+081.082	+017.106	04	T
214	15:06:29.0	010	002043	+081.151	+016.999	04	T
214	15:06:30.0	010	002043	+081.222	+016.891	04	T
214	15:06:31.0	010	002043	+081.293	+016.762	04	T
214	15:06:32.0	010	002043	+081.354	+016.647	04	T
214	15:06:33.0	010	002043	+081.414	+016.534	04	T
214	15:06:34.0	010	002043	+081.483	+016.419	04	T
214	15:06:35.0	010	002043	+081.552	+016.309	04	T
214	15:06:36.0	010	002043	+081.615	+016.205	04	T
214	15:06:37.0	010	002043	+081.675	+016.087	04	T
214	15:06:38.0	010	002043	+081.736	+015.974	04	T
214	15:06:39.0	010	002043	+081.793	+015.856	04	T
214	15:06:40.0	010	002043	+081.854	+015.743	04	T
214	15:06:41.0	010	002043	+081.914	+015.628	04	T
214	15:06:42.0	010	002043	+081.980	+015.515	04	T
214	15:06:43.0	010	002043	+082.040	+015.419	04	T
214	15:06:44.0	010	002043	+082.104	+015.312	04	T
214	15:06:45.0	010	002043	+082.159	+015.191	04	T
214	15:06:46.0	010	002043	+082.216	+015.076	04	T
214	15:06:47.0	010	002043	+082.274	+014.969	04	T
214	15:06:48.0	010	002043	+082.321	+014.862	04	T
214	15:06:49.0	010	002043	+082.375	+014.757	04	T
214	15:06:50.0	010	002043	+082.444	+014.653	04	T
214	15:06:51.0	010	002043	+082.496	+014.543	04	T
214	15:06:52.0	010	002043	+082.546	+014.433	04	T
214	15:06:53.0	010	002043	+082.598	+014.326	04	T
214	15:06:54.0	010	002043	+082.653	+014.211	04	T
214	15:06:55.0	010	002043	+082.705	+014.101	04	T
214	15:06:56.0	010	002043	+082.757	+014.002	04	T

**** PIPS - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRACK
214	15:06:57.0	010	002043	+082.809	-013.914	04	T
214	15:06:58.0	010	002043	+082.864	+013.813	04	T
214	15:06:59.0	010	002043	+082.911	+013.705	04	T
214	15:07:00.0	010	002043	+082.955	+013.593	04	T
214	15:07:01.0	010	002043	+083.004	+013.491	04	T
214	15:07:02.0	010	002043	+083.059	+013.387	04	T
214	15:07:03.0	010	002043	+083.109	+013.293	04	T
214	15:07:04.0	010	002043	+083.161	+013.195	04	T
214	15:07:05.0	010	002043	+083.205	+013.090	04	T
214	15:07:06.0	010	002043	+083.246	+012.986	04	T
214	15:07:07.0	010	002043	+083.296	+012.881	04	T
214	15:07:08.0	010	002043	+083.348	+012.785	04	T
214	15:07:09.0	010	002043	+083.397	+012.692	04	T
214	15:07:10.0	010	002043	+083.447	+012.579	04	T
214	15:07:11.0	010	002043	+083.496	+012.478	04	T
214	15:07:12.0	010	002043	+083.543	+012.390	04	T
214	15:07:13.0	010	002043	+083.592	+012.291	04	T
214	15:07:14.0	010	002043	+083.625	+012.184	04	T
214	15:07:15.0	010	002043	+083.669	+012.079	04	T
214	15:07:16.0	010	002043	+083.708	+011.978	04	T
214	15:07:17.0	010	002043	+083.749	+011.882	04	T
214	15:07:18.0	010	002043	+083.793	+011.786	04	T
214	15:07:19.0	010	002043	+083.837	+011.703	04	T
214	15:07:20.0	010	002043	+083.872	+011.610	04	T
214	15:07:21.0	010	002043	+083.911	+011.511	04	T
214	15:07:22.0	010	002043	+083.958	+011.407	04	T
214	15:07:23.0	010	002043	+084.001	+011.310	04	T
214	15:07:24.0	010	002043	+084.037	+011.217	04	T
214	15:07:25.0	010	002043	+084.081	+011.118	04	T
214	15:07:26.0	010	002043	+084.120	+011.022	04	T
214	15:07:27.0	010	002043	+084.150	+010.923	04	T
214	15:07:28.0	010	002043	+084.185	+010.830	04	T
214	15:07:29.0	010	002043	+084.240	+010.756	04	T
214	15:07:30.0	010	002043	+084.271	+010.659	04	T
214	15:07:31.0	010	002043	+084.309	+010.572	04	T
214	15:07:32.0	010	002043	+084.348	+010.478	04	T
214	15:07:33.0	010	002043	+084.378	+010.385	04	T
214	15:07:34.0	010	002043	+084.427	+010.294	04	T
214	15:07:35.0	010	002043	+084.471	+010.198	04	T
214	15:07:36.0	010	002043	+084.499	+010.113	04	T
214	15:07:37.0	010	002043	+084.526	+010.017	04	T
214	15:07:38.0	010	002043	+084.567	+009.926	04	T
214	15:07:39.0	010	002043	+084.606	+009.836	04	T
214	15:07:40.0	010	002043	+084.628	+009.748	04	T
214	15:07:41.0	010	002043	+084.666	+009.657	04	T
214	15:07:42.0	010	002043	+084.710	+009.569	04	T
214	15:07:43.0	010	002043	+084.743	+009.481	04	T
214	15:07:44.0	010	002043	+084.781	+009.393	04	T
214	15:07:45.0	010	002043	+084.817	+009.316	04	T
214	15:07:46.0	010	002043	+084.842	+009.226	04	T

**** PIPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:07:47.0	010	002043	+084.875	+009.133	04	T
214	15:07:48.0	010	002043	+084.919	+009.044	04	T
214	15:07:49.0	010	002043	+084.946	+008.954	04	T
214	15:07:50.0	010	002043	+084.977	+008.866	04	T
214	15:07:51.0	010	002043	+085.012	+008.786	04	T
214	15:07:52.0	010	002043	+085.045	+008.709	04	T
214	15:07:53.0	010	002043	+085.078	+008.622	04	T
214	15:07:54.0	010	002043	+085.106	+008.528	04	T
214	15:07:55.0	010	002043	+085.128	+008.440	04	T
214	15:07:56.0	010	002043	+085.155	+008.355	04	T
214	15:07:57.0	010	002043	+085.196	+008.267	04	T
214	15:07:58.0	010	002043	+085.226	+008.188	04	T
214	15:07:59.0	010	002043	+085.254	+008.108	04	T
214	15:08:00.0	010	002043	+085.284	+008.023	04	T
214	15:08:01.0	010	002043	+085.314	+007.940	04	T
214	15:08:02.0	010	002043	+085.353	+007.858	04	T
214	15:08:03.0	010	002043	+085.378	+007.787	04	T
214	15:08:04.0	010	002043	+085.399	+007.701	04	T
214	15:08:05.0	010	002043	+085.432	+007.619	04	T
214	15:08:06.0	010	002043	+085.463	+007.534	04	T
214	15:08:07.0	010	002043	+085.487	+007.449	04	T
214	15:08:08.0	010	002043	+085.523	+007.372	04	T
214	15:08:09.0	010	002043	+085.556	+007.289	04	T
214	15:08:10.0	010	002043	+085.575	+007.218	04	T
214	15:08:11.0	010	002043	+085.597	+007.141	04	T
214	15:08:12.0	010	002043	+085.633	+007.061	04	T
214	15:08:13.0	010	002043	+085.660	+006.979	04	T
214	15:08:14.0	010	002043	+085.685	+006.897	04	T
214	15:08:15.0	010	002043	+085.713	+006.814	04	T
214	15:08:16.0	010	002043	+085.746	+006.740	04	T
214	15:08:17.0	010	002043	+085.770	+006.660	04	T
214	15:08:18.0	010	002043	+085.792	+006.581	04	T
214	15:08:19.0	010	002043	+085.820	+006.501	04	T
214	15:08:20.0	010	002043	+085.844	+006.422	04	T
214	15:08:21.0	010	002043	+085.869	+006.347	04	T
214	15:08:22.0	010	002043	+085.894	+006.276	04	T
214	15:08:23.0	010	002043	+085.921	+006.207	04	T
214	15:08:24.0	010	002043	+085.943	+006.125	04	T
214	15:08:25.0	010	002043	+085.963	+006.045	04	T
214	15:08:26.0	010	002043	+085.987	+005.968	04	T
214	15:08:27.0	010	002043	+086.015	+005.891	04	T
214	15:08:28.0	010	002043	+086.045	+005.817	04	T
214	15:08:29.0	010	002043	+086.070	+005.751	04	T
214	15:08:30.0	010	002043	+086.086	+005.680	04	T
214	15:08:31.0	010	002043	+086.105	+005.598	04	T
214	15:08:32.0	010	002043	+086.136	+005.526	04	T
214	15:08:33.0	010	002043	+086.169	+005.452	04	T
214	15:08:34.0	010	002043	+086.188	+005.375	04	T
214	15:08:35.0	010	002043	+086.201	+005.306	04	T
214	15:08:36.0	010	002043	+086.221	+005.227	04	T

**** STPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SIZES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	CRACK
214	15:08:37.0	010	002043	+086.174	+005.153	04	T
214	15:08:38.0	010	002043	+086.281	+005.081	04	T
214	15:08:39.0	010	002043	+086.303	+005.007	04	T
214	15:08:40.0	010	002043	+086.320	+004.936	04	T
214	15:08:41.0	010	002043	+086.339	+004.861	04	T
214	15:08:42.0	010	002043	+086.364	+004.796	04	T
214	15:08:43.0	010	002043	+086.388	+004.727	04	T
214	15:08:44.0	010	002043	+086.410	+004.669	04	T
214	15:08:45.0	010	002043	+086.429	+004.592	04	T
214	15:08:46.0	010	002043	+086.449	+004.518	04	T
214	15:08:47.0	010	002043	+086.476	+004.444	04	T
214	15:08:48.0	010	002043	+086.504	+004.373	04	T
214	15:08:49.0	010	002043	+086.523	+004.304	04	T
214	15:08:50.0	010	002043	+086.537	+004.230	04	T
214	15:08:51.0	010	002043	+086.553	+004.158	04	T
214	15:08:52.0	010	002043	+086.578	+004.095	04	T
214	15:08:53.0	010	002043	+086.600	+004.035	04	T
214	15:08:54.0	010	002043	+086.619	+003.966	04	T
214	15:08:55.0	010	002043	+086.644	+003.895	04	T
214	15:08:56.0	010	002043	+086.660	+003.826	04	T
214	15:08:57.0	010	002043	+086.674	+003.755	04	T
214	15:08:58.0	010	002043	+086.696	+003.680	04	T
214	15:08:59.0	010	002043	+086.726	+003.612	04	T
214	15:09:00.0	010	002043	+086.748	+003.543	04	T
214	15:09:01.0	010	002043	+086.759	+003.474	04	T
214	15:09:02.0	010	002043	+086.770	+003.411	04	T
214	15:09:03.0	010	002043	+086.784	+003.345	04	T
214	15:09:04.0	010	002043	+086.833	+003.282	04	T
214	15:09:05.0	010	002043	+086.847	+003.214	04	T
214	15:09:06.0	010	002043	+086.863	+003.150	04	T
214	15:09:07.0	010	002043	+086.883	+003.098	04	T
214	15:09:08.0	010	002043	+086.899	+003.029	04	T
214	15:09:09.0	010	002043	+086.913	+002.958	04	T
214	15:09:10.0	010	002043	+086.924	+002.889	04	T
214	15:09:11.0	010	002043	+086.938	+002.818	04	T
214	15:09:12.0	010	002043	+086.962	+002.747	04	T
214	15:09:13.0	010	002043	+086.987	+002.686	04	T
214	15:09:14.0	010	002043	+087.003	+002.623	04	T
214	15:09:15.0	010	002043	+087.020	+002.557	04	T
214	15:09:16.0	010	002043	+087.036	+002.494	04	T
214	15:09:17.0	010	002043	+087.053	+002.436	04	T
214	15:09:18.0	010	002043	+087.086	+002.381	04	T
214	15:09:19.0	010	002043	+087.100	+002.313	04	T
214	15:09:20.0	010	002043	+087.111	+002.247	04	T
214	15:09:21.0	010	002043	+087.122	+002.178	04	T
214	15:09:22.0	010	002043	+087.138	+002.115	04	T
214	15:09:23.0	010	002043	+087.166	+002.052	04	T
214	15:09:24.0	010	002043	+087.179	+001.986	04	T
214	15:09:25.0	010	002043	+087.182	+001.895	04	
214	15:09:26.0	010	002043	+087.187	+001.832	04	

TRACKING TELESCOPE TIMING - AZ/EL PRINTOUT

PREPARED BY :
TGS TECHNOLOGY INC.
CCAFS

DATE : 02 August 1991

TEST : C8181 STS-43

THIS IS
TEST ITEM : ET 221

FROM
TRACKING
ITEM : ET-206A

SITE : MB ROTI

DIST : JSC/JL3

TEST : C8181 - STS-43
TRKNG ITEM : ET-206A
SITE : MB ROTI
DISTRIB. : JSC/JL3

**** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:02:00.0	012	002043	+354.982	-000.261	04	*
214	15:02:01.0	012	002043	+354.982	-000.261	04	
214	15:02:02.0	012	002043	+354.982	-000.261	04	
214	15:02:03.0	012	002043	+354.982	-000.261	04	
214	15:02:04.0	012	002043	+354.982	-000.250	04	
214	15:02:05.0	012	002043	+354.982	-000.228	04	
214	15:02:06.0	012	002043	+354.982	-000.195	04	
214	15:02:07.0	012	002043	+354.982	-000.162	04	
214	15:02:08.0	012	002043	+354.971	-000.118	04	
214	15:02:09.0	012	002043	+354.971	-000.074	04	
214	15:02:10.0	012	002043	+354.971	+000.014	04	
214	15:02:11.0	012	002043	+354.971	+000.102	04	T
214	15:02:12.0	012	002043	+354.971	+000.124	04	T
214	15:02:13.0	012	002043	+354.982	+000.190	04	T
214	15:02:14.0	012	002043	+354.982	+000.266	04	T
214	15:02:15.0	012	002043	+355.004	+000.343	04	T
214	15:02:16.0	012	002043	+355.026	+000.431	04	T
214	15:02:17.0	012	002043	+355.048	+000.530	04	T
214	15:02:18.0	012	002043	+355.070	+000.618	04	T
214	15:02:19.0	012	002043	+355.103	+000.717	04	T
214	15:02:20.0	012	002043	+355.150	+000.838	04	T
214	15:02:21.0	012	002043	+355.182	+000.961	04	T
214	15:02:22.0	012	002043	+355.237	+001.082	04	T
214	15:02:23.0	012	002043	+355.281	+001.214	04	T
214	15:02:24.0	012	002043	+355.336	+001.357	04	T
214	15:02:25.0	012	002043	+355.402	+001.500	04	T
214	15:02:26.0	012	002043	+355.468	+001.653	04	T
214	15:02:27.0	012	002043	+355.545	+001.807	04	T
214	15:02:28.0	012	002043	+355.622	+001.972	04	T
214	15:02:29.0	012	002043	+355.710	+002.148	04	T
214	15:02:30.0	012	002043	+355.787	+002.326	04	T
214	15:02:31.0	012	002043	+355.877	+002.502	04	T
214	15:02:32.0	012	002043	+355.965	+002.689	04	T
214	15:02:33.0	012	002043	+356.075	+002.887	04	T
214	15:02:34.0	012	002043	+356.174	+003.095	04	T
214	15:02:35.0	012	002043	+356.284	+003.293	04	T
214	15:02:36.0	012	002043	+356.405	+003.491	04	T
214	15:02:37.0	012	002043	+356.515	+003.711	04	T
214	15:02:38.0	012	002043	+356.635	+003.908	04	T
214	15:02:39.0	012	002043	+356.770	+004.139	04	T
214	15:02:40.0	012	002043	+356.891	+004.359	04	T
214	15:02:41.0	012	002043	+357.034	+004.592	04	T
214	15:02:42.0	012	002043	+357.177	+004.834	04	T
214	15:02:43.0	012	002043	+357.319	+005.076	04	T
214	15:02:44.0	012	002043	+357.473	+005.306	04	T
214	15:02:45.0	012	002043	+357.616	+005.559	04	T
214	15:02:46.0	012	002043	+357.784	+005.801	04	T
214	15:02:47.0	012	002043	+357.948	+006.064	04	T
214	15:02:48.0	012	002043	+358.113	+006.306	04	T
214	15:02:49.0	012	002043	+358.289	+006.581	04	

**** PIPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRACK
214	15:02:50.0	012	002043	+358.498	+006.888	04	
214	15:02:51.0	012	002043	+358.673	+007.152	04	
214	15:02:52.0	012	002043	+358.863	+007.427	04	
214	15:02:53.0	012	002043	+359.061	+007.701	04	
214	15:02:54.0	012	002043	+359.258	+007.976	04	T
214	15:02:55.0	012	002043	+359.456	+008.240	04	T
214	15:02:56.0	012	002043	+359.654	+008.528	04	T
214	15:02:57.0	012	002043	+359.874	+008.814	04	T
214	15:02:58.0	012	002043	+000.093	+009.099	04	T
214	15:02:59.0	012	002043	+000.327	+009.396	04	T
214	15:03:00.0	012	002043	+000.558	+009.693	04	T
214	15:03:01.0	012	002043	+000.788	+010.000	04	T
214	15:03:02.0	012	002043	+001.052	+010.308	04	T
214	15:03:03.0	012	002043	+001.305	+010.616	04	T
214	15:03:04.0	012	002043	+001.557	+010.923	04	T
214	15:03:05.0	012	002043	+001.835	+011.242	04	T
214	15:03:06.0	012	002043	+002.109	+011.560	04	
214	15:03:07.0	012	002043	+002.428	+011.912	04	
214	15:03:08.0	012	002043	+002.714	+012.253	04	
214	15:03:09.0	012	002043	+003.021	+012.593	04	
214	15:03:10.0	012	002043	+003.340	+012.934	04	
214	15:03:11.0	012	002043	+003.661	+013.285	04	
214	15:03:12.0	012	002043	+003.991	+013.637	04	
214	15:03:13.0	012	002043	+004.309	+013.977	04	T
214	15:03:14.0	012	002043	+004.650	+014.340	04	T
214	15:03:15.0	012	002043	+005.023	+014.705	04	T
214	15:03:16.0	012	002043	+005.408	+015.090	04	T
214	15:03:17.0	012	002043	+005.793	+015.452	04	T
214	15:03:18.0	012	002043	+006.202	+015.837	04	T
214	15:03:19.0	012	002043	+006.608	+016.210	04	T
214	15:03:20.0	012	002043	+007.026	+016.606	04	T
214	15:03:21.0	012	002043	+007.465	+016.979	04	T
214	15:03:22.0	012	002043	+007.916	+017.375	04	T
214	15:03:23.0	012	002043	+008.388	+017.748	04	T
214	15:03:24.0	012	002043	+008.860	+018.144	04	T
214	15:03:25.0	012	002043	+009.358	+018.528	04	T
214	15:03:26.0	012	002043	+009.863	+018.924	04	T
214	15:03:27.0	012	002043	+010.379	+019.308	04	T
214	15:03:28.0	012	002043	+010.907	+019.693	04	T
214	15:03:29.0	012	002043	+011.456	+020.067	04	T
214	15:03:30.0	012	002043	+012.005	+020.462	04	T
214	15:03:31.0	012	002043	+012.577	+020.822	04	T
214	15:03:32.0	012	002043	+013.159	+021.195	04	T
214	15:03:33.0	012	002043	+013.741	+021.580	04	T
214	15:03:34.0	012	002043	+014.345	+021.942	04	T
214	15:03:35.0	012	002043	+014.961	+022.316	04	T
214	15:03:36.0	012	002043	+015.598	+022.679	04	T
214	15:03:37.0	012	002043	+016.227	+023.030	04	T
214	15:03:38.0	012	002043	+016.875	+023.382	04	T
214	15:03:39.0	012	002043	+017.534	+023.733	04	T

**** PIPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	SMI	TRACK
214	15:03:40.0	012	002043	+018.204	+024.674	04	T
214	15:03:41.0	012	002043	+018.875	+024.403	04	T
214	15:03:42.0	012	002043	+019.556	+024.733	04	T
214	15:03:43.0	012	002043	+020.248	+025.063	04	T
214	15:03:44.0	012	002043	+020.951	+025.370	04	T
214	15:03:45.0	012	002043	+021.651	+025.678	04	T
214	15:03:46.0	012	002043	+022.376	+025.974	04	T
214	15:03:47.0	012	002043	+023.091	+026.260	04	T
214	15:03:48.0	012	002043	+023.816	+026.535	04	T
214	15:03:49.0	012	002043	+024.541	+026.809	04	T
214	15:03:50.0	012	002043	+025.277	+027.070	04	T
214	15:03:51.0	012	002043	+026.013	+027.334	04	T
214	15:03:52.0	012	002043	+026.749	+027.565	04	T
214	15:03:53.0	012	002043	+027.485	+027.795	04	T
214	15:03:54.0	012	002043	+028.221	+028.026	04	T
214	15:03:55.0	012	002043	+028.968	+028.235	04	T
214	15:03:56.0	012	002043	+029.702	+028.444	04	T
214	15:03:57.0	012	002043	+030.427	+028.630	04	T
214	15:03:58.0	012	002043	+031.141	+028.817	04	T
214	15:03:59.0	012	002043	+031.855	+028.982	04	T
214	15:04:00.0	012	002043	+032.569	+029.136	04	T
214	15:04:01.0	012	002043	+033.261	+029.290	04	T
214	15:04:02.0	012	002043	+033.953	+029.432	04	T
214	15:04:03.0	012	002043	+034.632	+029.564	04	T
214	15:04:04.0	012	002043	+035.313	+029.685	04	T
214	15:04:05.0	012	002043	+035.994	+029.806	04	T
214	15:04:06.0	012	002043	+036.653	+029.905	04	T
214	15:04:07.0	012	002043	+037.290	+030.004	04	T
214	15:04:08.0	012	002043	+037.928	+030.089	04	T
214	15:04:09.0	012	002043	+038.551	+030.166	04	T
214	15:04:10.0	012	002043	+039.166	+030.243	04	T
214	15:04:11.0	012	002043	+039.760	+030.298	04	T
214	15:04:12.0	012	002043	+040.353	+030.352	04	T
214	15:04:13.0	012	002043	+040.924	+030.407	04	T
214	15:04:14.0	012	002043	+041.506	+030.440	04	T
214	15:04:15.0	012	002043	+042.053	+030.462	04	T
214	15:04:16.0	012	002043	+042.613	+030.484	04	T
214	15:04:17.0	012	002043	+043.141	+030.506	04	T
214	15:04:18.0	012	002043	+043.668	+030.517	04	T
214	15:04:19.0	012	002043	+044.195	+030.517	04	T
214	15:04:20.0	012	002043	+044.701	+030.528	04	T
214	15:04:21.0	012	002043	+045.195	+030.517	04	T
214	15:04:22.0	012	002043	+045.687	+030.506	04	T
214	15:04:23.0	012	002043	+046.159	+030.473	04	T
214	15:04:24.0	012	002043	+046.631	+030.451	04	T
214	15:04:25.0	012	002043	+047.104	+030.418	04	T
214	15:04:26.0	012	002043	+047.554	+030.374	04	T
214	15:04:27.0	012	002043	+047.994	+030.341	04	T
214	15:04:28.0	012	002043	+048.433	+030.287	04	T
214	15:04:29.0	012	002043	+048.870	+030.232	04	T

TRACK SOUTH BOOSTER

**** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:04:30.0	012	002043	+049.298	+030.177	04	I
214	15:04:31.0	012	002043	+049.705	+030.111	04	
214	15:04:32.0	012	002043	+050.111	+030.045	04	
214	15:04:33.0	012	002043	+050.507	+029.979	04	
214	15:04:34.0	012	002043	+050.913	+029.902	04	
214	15:04:35.0	012	002043	+051.287	+029.825	04	
214	15:04:36.0	012	002043	+051.671	+029.748	04	
214	15:04:37.0	012	002043	+052.042	+029.660	04	
214	15:04:38.0	012	002043	+052.405	+029.572	04	
214	15:04:39.0	012	002043	+052.767	+029.482	04	
214	15:04:40.0	012	002043	+053.130	+029.383	04	
214	15:04:41.0	012	002043	+053.470	+029.284	04	
214	15:04:42.0	012	002043	+053.822	+029.185	04	
214	15:04:43.0	012	002043	+054.152	+029.075	04	
214	15:04:44.0	012	002043	+054.481	+028.976	04	
214	15:04:45.0	012	002043	+054.800	+028.878	04	
214	15:04:46.0	012	002043	+055.129	+028.757	04	
214	15:04:47.0	012	002043	+055.448	+028.647	04	
214	15:04:48.0	012	002043	+055.753	+028.526	04	
214	15:04:49.0	012	002043	+056.060	+028.394	04	
214	15:04:50.0	012	002043	+056.368	+028.273	04	
214	15:04:51.0	012	002043	+056.654	+028.141	04	
214	15:04:52.0	012	002043	+056.950	+028.021	04	
214	15:04:53.0	012	002043	+057.225	+027.878	04	
214	15:04:54.0	012	002043	+057.511	+027.757	04	
214	15:04:55.0	012	002043	+057.796	+027.614	04	
214	15:04:56.0	012	002043	+058.060	+027.482	04	
214	15:04:57.0	012	002043	+058.346	+027.350	04	
214	15:04:58.0	012	002043	+058.598	+027.197	04	
214	15:04:59.0	012	002043	+058.862	+027.054	04	
214	15:05:00.0	012	002043	+059.126	+026.900	04	
214	15:05:01.0	012	002043	+059.367	+026.768	04	
214	15:05:02.0	012	002043	+059.620	+026.614	04	
214	15:05:03.0	012	002043	+059.862	+026.458	04	
214	15:05:04.0	012	002043	+060.101	+026.315	04	
214	15:05:05.0	012	002043	+060.331	+026.161	04	
214	15:05:06.0	012	002043	+060.573	+025.996	04	
214	15:05:07.0	012	002043	+060.793	+025.843	04	
214	15:05:08.0	012	002043	+061.024	+025.678	04	
214	15:05:09.0	012	002043	+061.254	+025.513	04	
214	15:05:10.0	012	002043	+061.474	+025.348	04	
214	15:05:11.0	012	002043	+061.694	+025.194	04	
214	15:05:12.0	012	002043	+061.902	+025.019	04	
214	15:05:13.0	012	002043	+062.122	+024.865	04	
214	15:05:14.0	012	002043	+062.320	+024.689	04	
214	15:05:15.0	012	002043	+062.529	+024.513	04	
214	15:05:16.0	012	002043	+062.737	+024.348	04	
214	15:05:17.0	012	002043	+062.935	+024.173	04	
214	15:05:18.0	012	002043	+063.122	+023.983	04	
214	15:05:19.0	012	002043	+063.320	+023.818	04	

**** PIPD - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMI	TRACK
214	15:05:20.0	012	002043	+063.506	+023.643	04	
214	15:05:21.0	012	002043	+063.704	+023.456	04	
214	15:05:22.0	012	002043	+063.891	+023.280	04	
214	15:05:23.0	012	002043	+064.067	+023.104	04	
214	15:05:24.0	012	002043	+064.243	+022.896	04	
214	15:05:25.0	012	002043	+064.418	+022.731	04	
214	15:05:26.0	012	002043	+064.594	+022.533	04	
214	15:05:27.0	012	002043	+064.770	+022.357	04	
214	15:05:28.0	012	002043	+064.935	+022.181	04	
214	15:05:29.0	012	002043	+065.110	+021.984	04	
214	15:05:30.0	012	002043	+065.286	+021.794	04	
214	15:05:31.0	012	002043	+065.451	+021.607	04	
214	15:05:32.0	012	002043	+065.616	+021.410	04	
214	15:05:33.0	012	002043	+065.781	+021.234	04	
214	15:05:34.0	012	002043	+065.934	+021.036	04	
214	15:05:35.0	012	002043	+066.088	+020.827	04	
214	15:05:36.0	012	002043	+066.250	+020.641	04	
214	15:05:37.0	012	002043	+066.404	+020.429	04	
214	15:05:38.0	012	002043	+066.558	+020.231	04	
214	15:05:39.0	012	002043	+066.701	+020.045	04	
214	15:05:40.0	012	002043	+066.844	+019.836	04	
214	15:05:41.0	012	002043	+066.986	+019.638	04	
214	15:05:42.0	012	002043	+067.129	+019.440	04	
214	15:05:43.0	012	002043	+067.272	+019.243	04	
214	15:05:44.0	012	002043	+067.415	+019.045	04	
214	15:05:45.0	012	002043	+067.558	+018.822	04	
214	15:05:46.0	012	002043	+067.690	+018.614	04	
214	15:05:47.0	012	002043	+067.832	+018.416	04	
214	15:05:48.0	012	002043	+067.964	+018.196	04	
214	15:05:49.0	012	002043	+068.085	+017.998	04	
214	15:05:50.0	012	002043	+068.217	+017.779	04	
214	15:05:51.0	012	002043	+068.360	+017.567	04	
214	15:05:52.0	012	002043	+068.481	+017.347	04	
214	15:05:53.0	012	002043	+068.612	+017.139	04	
214	15:05:54.0	012	002043	+068.733	+016.930	04	
214	15:05:55.0	012	002043	+068.854	+016.710	04	
214	15:05:56.0	012	002043	+068.975	+016.512	04	
214	15:05:57.0	012	002043	+069.096	+016.290	04	
214	15:05:58.0	012	002043	+069.206	+016.070	04	
214	15:05:59.0	012	002043	+069.326	+015.862	04	
214	15:06:00.0	012	002043	+069.447	+015.642	04	
214	15:06:01.0	012	002043	+069.557	+015.419	04	
214	15:06:02.0	012	002043	+069.678	+015.189	04	
214	15:06:03.0	012	002043	+069.777	+014.980	04	
214	15:06:04.0	012	002043	+069.898	+014.771	04	
214	15:06:05.0	012	002043	+070.019	+014.538	04	
214	15:06:06.0	012	002043	+070.117	+014.329	04	
214	15:06:07.0	012	002043	+070.227	+014.109	04	
214	15:06:08.0	012	002043	+070.337	+013.878	04	
214	15:06:09.0	012	002043	+070.425	+013.656	04	

**** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:06:10.0	012	002043	+070.524	+013.414	04	
214	15:06:11.0	012	002043	+070.634	+013.206	04	
214	15:06:12.0	012	002043	+070.733	+012.983	04	
214	15:06:13.0	012	002043	+070.843	+012.752	04	
214	15:06:14.0	012	002043	+070.941	+012.533	04	
214	15:06:15.0	012	002043	+071.040	+012.310	04	
214	15:06:16.0	012	002043	+071.139	+012.079	04	
214	15:06:17.0	012	002043	+071.238	+011.871	04	
214	15:06:18.0	012	002043	+071.326	+011.626	04	
214	15:06:19.0	012	002043	+071.425	+011.396	04	
214	15:06:20.0	012	002043	+071.524	+011.162	04	
214	15:06:21.0	012	002043	+071.612	+010.942	04	
214	15:06:22.0	012	002043	+071.711	+010.731	04	
214	15:06:23.0	012	002043	+071.798	+010.500	04	
214	15:06:24.0	012	002043	+071.886	+010.269	04	
214	15:06:25.0	012	002043	+071.963	+010.025	04	
214	15:06:26.0	012	002043	+072.051	+009.803	04	
214	15:06:27.0	012	002043	+072.139	+009.583	04	
214	15:06:28.0	012	002043	+072.216	+009.327	04	
214	15:06:29.0	012	002043	+072.293	+009.086	04	
214	15:06:30.0	012	002043	+072.359	+008.885	04	
214	15:06:31.0	012	002043	+072.425	+008.687	04	
214	15:06:32.0	012	002043	+072.578	+008.476	04	
214	15:06:33.0	012	002043	+072.633	+008.242	04	
214	15:06:34.0	012	002043	+072.688	+008.001	04	
214	15:06:35.0	012	002043	+072.765	+007.767	04	
214	15:06:36.0	012	002043	+072.831	+007.556	04	
214	15:06:37.0	012	002043	+072.897	+007.355	04	
214	15:06:38.0	012	002043	+072.974	+007.133	04	
214	15:06:39.0	012	002043	+073.040	+006.913	04	
214	15:06:40.0	012	002043	+073.106	+006.691	04	
214	15:06:41.0	012	002043	+073.161	+006.457	04	
214	15:06:42.0	012	002043	+073.227	+006.257	04	
214	15:06:43.0	012	002043	+073.293	+006.045	04	
214	15:06:44.0	012	002043	+073.358	+005.834	04	
214	15:06:45.0	012	002043	+073.413	+005.630	04	
214	15:06:46.0	012	002043	+073.468	+005.441	04	
214	15:06:47.0	012	002043	+073.534	+005.240	04	
214	15:06:48.0	012	002043	+073.600	+005.029	04	
214	15:06:49.0	012	002043	+073.644	+004.850	04	

TRACKING TELESCOPE TIMING - AZ/EL PRINTOUT

PREPARED BY :
TGS TECHNOLOGY INC.
CCAFS

DATE : 02 August 1991

TEST : C8181 STS-43

THIS IS
TEST ITEM : ET 221

FROM
TRACKING
ITEM : ET-207A

SITE : UCS-10

DIST : JSC/JL3

TEST : C8181 - STS-43
TRKNG ITEM : ET-207A
SITE : UCS-10
DISTRIB. : JSC/JL3

**** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRACK
214	15:01:54.0	272	002043	+149.247	+000.126	04	T
214	15:01:55.0	272	002043	+149.247	+000.126	04	T
214	15:01:56.0	272	002043	+149.247	+000.126	04	T
214	15:01:57.0	272	002043	+149.279	+000.126	04	T
214	15:01:58.0	272	002043	+149.279	+000.126	04	T
214	15:01:59.0	272	002043	+149.279	+000.126	04	T
214	15:02:00.0	272	002043	+149.279	+000.126	04	T
214	15:02:01.0	272	002043	+149.279	+000.126	04	T
214	15:02:02.0	272	002043	+149.279	+000.126	04	T
214	15:02:03.0	272	002043	+149.290	+000.148	04	T
214	15:02:04.0	272	002043	+149.290	+000.236	04	T
214	15:02:05.0	272	002043	+149.290	+000.379	04	T
214	15:02:06.0	272	002043	+149.268	+000.544	04	T
214	15:02:07.0	272	002043	+149.236	+000.709	04	T
214	15:02:08.0	272	002043	+149.225	+000.917	04	T
214	15:02:09.0	272	002043	+149.225	+001.137	04	T
214	15:02:10.0	272	002043	+149.203	+001.390	04	T
214	15:02:11.0	272	002043	+149.192	+001.675	04	T
214	15:02:12.0	272	002043	+149.170	+002.016	04	T
214	15:02:13.0	272	002043	+149.159	+002.368	04	T
214	15:02:14.0	272	002043	+149.115	+002.752	04	T
214	15:02:15.0	272	002043	+149.071	+003.181	04	T
214	15:02:16.0	272	002043	+148.994	+003.623	04	T
214	15:02:17.0	272	002043	+148.887	+004.106	04	T
214	15:02:18.0	272	002043	+148.755	+004.612	04	T
214	15:02:19.0	272	002043	+148.601	+005.150	04	T
214	15:02:20.0	272	002043	+148.403	+005.688	04	T
214	15:02:21.0	272	002043	+148.206	+006.292	04	T
214	15:02:22.0	272	002043	+147.986	+006.919	04	T
214	15:02:23.0	272	002043	+147.744	+007.567	04	T
214	15:02:24.0	272	002043	+147.480	+008.259	04	T
214	15:02:25.0	272	002043	+147.195	+008.962	04	T
214	15:02:26.0	272	002043	+146.909	+009.676	04	T
214	15:02:27.0	272	002043	+146.591	+010.434	04	T
214	15:02:28.0	272	002043	+146.250	+011.192	04	T
214	15:02:29.0	272	002043	+145.909	+011.972	04	T
214	15:02:30.0	272	002043	+145.547	+012.752	04	T
214	15:02:31.0	272	002043	+145.151	+013.554	04	T
214	15:02:32.0	272	002043	+144.734	+014.378	04	
214	15:02:33.0	272	002043	+144.283	+015.202	04	
214	15:02:34.0	272	002043	+143.932	+016.092	04	
214	15:02:35.0	272	002043	+143.317	+017.026	04	
214	15:02:36.0	272	002043	+142.888	+017.872	04	
214	15:02:37.0	272	002043	+142.471	+018.696	04	
214	15:02:38.0	272	002043	+142.042	+019.399	04	
214	15:02:39.0	272	002043	+141.595	+020.149	04	
214	15:02:40.0	272	002043	+141.100	+020.984	04	
214	15:02:41.0	272	002043	+140.551	+021.819	04	
214	15:02:42.0	272	002043	+140.045	+022.643	04	
214	15:02:43.0	272	002043	+139.518	+023.445	04	

★★★★ PIPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ★★★★

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMI	TRACK
214	15:02:44.0	272	002043	+138.958	+024.203	04	
214	15:02:45.0	272	002043	+138.398	+024.917	04	
214	15:02:46.0	272	002043	+137.837	+025.675	04	T
214	15:02:47.0	272	002043	+137.288	+026.400	04	T
214	15:02:48.0	272	002043	+136.717	+027.136	04	T
214	15:02:49.0	272	002043	+136.112	+027.850	04	T
214	15:02:50.0	272	002043	+135.541	+028.542	04	T
214	15:02:51.0	272	002043	+134.959	+029.235	04	T
214	15:02:52.0	272	002043	+134.366	+029.897	04	T
214	15:02:53.0	272	002043	+133.775	+030.545	04	T
214	15:02:54.0	272	002043	+133.171	+031.171	04	T
214	15:02:55.0	272	002043	+132.567	+031.764	04	T
214	15:02:56.0	272	002043	+131.973	+032.357	04	T
214	15:02:57.0	272	002043	+131.358	+032.929	04	T
214	15:02:58.0	272	002043	+130.743	+033.467	04	T
214	15:02:59.0	272	002043	+130.128	+033.983	04	T
214	15:03:00.0	272	002043	+129.512	+034.489	04	T
214	15:03:01.0	272	002043	+128.908	+034.972	04	T
214	15:03:02.0	272	002043	+128.282	+035.445	04	T
214	15:03:03.0	272	002043	+127.667	+035.906	04	T
214	15:03:04.0	272	002043	+127.051	+036.346	04	T
214	15:03:05.0	272	002043	+126.425	+036.763	04	T
214	15:03:06.0	272	002043	+125.813	+037.180	04	T
214	15:03:07.0	272	002043	+125.186	+037.568	04	T
214	15:03:08.0	272	002043	+124.560	+037.941	04	T
214	15:03:09.0	272	002043	+123.934	+038.304	04	T
214	15:03:10.0	272	002043	+123.319	+038.655	04	T
214	15:03:11.0	272	002043	+122.693	+038.985	04	T
214	15:03:12.0	272	002043	+122.066	+039.304	04	T
214	15:03:13.0	272	002043	+121.440	+039.589	04	T
214	15:03:14.0	272	002043	+120.825	+039.875	04	T
214	15:03:15.0	272	002043	+120.232	+040.139	04	T
214	15:03:16.0	272	002043	+119.605	+040.369	04	T
214	15:03:17.0	272	002043	+118.990	+040.600	04	T
214	15:03:18.0	272	002043	+118.375	+040.798	04	T
214	15:03:19.0	272	002043	+117.782	+040.995	04	T
214	15:03:20.0	272	002043	+117.166	+041.171	04	T
214	15:03:21.0	272	002043	+116.573	+041.325	04	T
214	15:03:22.0	272	002043	+115.980	+041.468	04	T
214	15:03:23.0	272	002043	+115.409	+041.578	04	T
214	15:03:24.0	272	002043	+114.815	+041.677	04	T
214	15:03:25.0	272	002043	+114.233	+041.765	04	T
214	15:03:26.0	272	002043	+113.662	+041.819	04	T
214	15:03:27.0	272	002043	+113.112	+041.874	04	T
214	15:03:28.0	272	002043	+112.563	+041.907	04	T
214	15:03:29.0	272	002043	+112.025	+041.940	04	T
214	15:03:30.0	272	002043	+111.487	+041.951	04	T
214	15:03:31.0	272	002043	+110.959	+041.951	04	T
214	15:03:32.0	272	002043	+110.443	+041.951	04	T
214	15:03:33.0	272	002043	+109.946	+041.940	04	T

*** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS BIISS ***

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRACK
214	15:03:34.0	272	002043	+109.432	+041.896	04	T
214	15:03:35.0	272	002043	+108.949	+041.819	04	T
214	15:03:36.0	272	002043	+108.465	+041.765	04	T
214	15:03:37.0	272	002043	+108.015	+041.688	04	T
214	15:03:38.0	272	002043	+107.553	+041.608	04	T
214	15:03:39.0	272	002043	+107.103	+041.542	04	T
214	15:03:40.0	272	002043	+106.664	+041.443	04	T
214	15:03:41.0	272	002043	+106.246	+041.333	04	T
214	15:03:42.0	272	002043	+105.829	+041.234	04	T
214	15:03:43.0	272	002043	+105.433	+041.114	04	T
214	15:03:44.0	272	002043	+105.027	+040.993	04	T
214	15:03:45.0	272	002043	+104.642	+040.872	04	T
214	15:03:46.0	272	002043	+104.268	+040.751	04	T
214	15:03:47.0	272	002043	+103.895	+040.608	04	T
214	15:03:48.0	272	002043	+103.543	+040.465	04	T
214	15:03:49.0	272	002043	+103.203	+040.312	04	T
214	15:03:50.0	272	002043	+102.873	+040.158	04	T
214	15:03:51.0	272	002043	+102.544	+040.001	04	T
214	15:03:52.0	272	002043	+102.225	+039.847	04	T
214	15:03:53.0	272	002043	+101.917	+039.694	04	T
214	15:03:54.0	272	002043	+101.621	+039.529	04	T
214	15:03:55.0	272	002043	+101.335	+039.353	04	T
214	15:03:56.0	272	002043	+101.049	+039.188	04	T
214	15:03:57.0	272	002043	+100.786	+039.034	04	T
214	15:03:58.0	272	002043	+100.522	+038.859	04	T
214	15:03:59.0	272	002043	+100.269	+038.683	04	T
214	15:04:00.0	272	002043	+100.028	+038.518	04	T
214	15:04:01.0	272	002043	+099.797	+038.342	04	T
214	15:04:02.0	272	002043	+099.577	+038.177	04	T
214	15:04:03.0	272	002043	+099.358	+038.024	04	T
214	15:04:04.0	272	002043	+099.149	+037.848	04	T
214	15:04:05.0	272	002043	+098.940	+037.669	04	T
214	15:04:06.0	272	002043	+098.753	+037.505	04	T
214	15:04:07.0	272	002043	+098.567	+037.329	04	T
214	15:04:08.0	272	002043	+098.369	+037.175	04	T
214	15:04:09.0	272	002043	+098.190	+037.010	04	T
214	15:04:10.0	272	002043	+098.015	+036.834	04	
214	15:04:11.0	272	002043	+097.850	+036.670	04	
214	15:04:12.0	272	002043	+097.696	+036.527	04	
214	15:04:13.0	272	002043	+097.531	+036.351	04	
214	15:04:14.0	272	002043	+097.388	+036.175	04	
214	15:04:15.0	272	002043	+097.234	+036.021	04	
214	15:04:16.0	272	002043	+097.103	+035.857	04	
214	15:04:17.0	272	002043	+096.971	+035.692	04	
214	15:04:18.0	272	002043	+096.850	+035.538	04	
214	15:04:19.0	272	002043	+096.718	+035.384	04	
214	15:04:20.0	272	002043	+096.597	+035.206	04	
214	15:04:21.0	272	002043	+096.476	+035.030	04	
214	15:04:22.0	272	002043	+096.356	+034.865	04	
214	15:04:23.0	272	002043	+096.257	+034.689	04	

*** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ***

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:04:24.0	272	002043	+096.147	+034.525	04	
214	15:04:25.0	272	002043	+096.026	+034.360	04	
214	15:04:26.0	272	002043	+095.938	+034.184	04	
214	15:04:27.0	272	002043	+095.828	+033.997	04	
214	15:04:28.0	272	002043	+095.729	+033.843	04	
214	15:04:29.0	272	002043	+095.652	+033.668	04	
214	15:04:30.0	272	002043	+095.554	+033.503	04	
214	15:04:31.0	272	002043	+095.455	+033.327	04	
214	15:04:32.0	272	002043	+095.378	+033.162	04	
214	15:04:33.0	272	002043	+095.301	+032.984	04	
214	15:04:34.0	272	002043	+095.202	+032.808	04	
214	15:04:35.0	272	002043	+095.136	+032.643	04	
214	15:04:36.0	272	002043	+095.059	+032.456	04	
214	15:04:37.0	272	002043	+094.971	+032.270	04	
214	15:04:38.0	272	002043	+094.883	+032.105	04	
214	15:04:39.0	272	002043	+094.828	+031.918	04	
214	15:04:40.0	272	002043	+094.763	+031.742	04	
214	15:04:41.0	272	002043	+094.697	+031.566	04	
214	15:04:42.0	272	002043	+094.620	+031.391	04	
214	15:04:43.0	272	002043	+094.543	+031.204	04	
214	15:04:44.0	272	002043	+094.488	+031.039	04	
214	15:04:45.0	272	002043	+094.433	+030.850	04	
214	15:04:46.0	272	002043	+094.356	+030.674	04	
214	15:04:47.0	272	002043	+094.312	+030.498	04	
214	15:04:48.0	272	002043	+094.235	+030.322	04	
214	15:04:49.0	272	002043	+094.191	+030.135	04	
214	15:04:50.0	272	002043	+094.134	+029.949	04	
214	15:04:51.0	272	002043	+094.057	+029.773	04	
214	15:04:52.0	272	002043	+094.013	+029.586	04	
214	15:04:53.0	272	002043	+093.958	+029.399	04	
214	15:04:54.0	272	002043	+093.914	+029.224	04	
214	15:04:55.0	272	002043	+093.870	+029.026	04	
214	15:04:56.0	272	002043	+093.815	+028.839	04	
214	15:04:57.0	272	002043	+093.749	+028.650	04	
214	15:04:58.0	272	002043	+093.705	+028.463	04	
214	15:04:59.0	272	002043	+093.661	+028.276	04	
214	15:05:00.0	272	002043	+093.617	+028.100	04	
214	15:05:01.0	272	002043	+093.573	+027.914	04	
214	15:05:02.0	272	002043	+093.529	+027.683	04	
214	15:05:03.0	272	002043	+093.485	+027.507	04	
214	15:05:04.0	272	002043	+093.441	+027.331	04	
214	15:05:05.0	272	002043	+093.398	+027.133	04	
214	15:05:06.0	272	002043	+093.354	+026.936	04	
214	15:05:07.0	272	002043	+093.321	+026.746	04	
214	15:05:08.0	272	002043	+093.288	+026.548	04	
214	15:05:09.0	272	002043	+093.244	+026.362	04	
214	15:05:10.0	272	002043	+093.211	+026.164	04	
214	15:05:11.0	272	002043	+093.167	+025.966	04	
214	15:05:12.0	272	002043	+093.123	+025.757	04	
214	15:05:13.0	272	002043	+093.090	+025.571	04	

**** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMI	TRACK
214	15:05:14.0	272	002043	+093.057	+025.373	04	
214	15:05:15.0	272	002043	+093.024	+025.186	04	
214	15:05:16.0	272	002043	+092.991	+025.008	04	
214	15:05:17.0	272	002043	+092.958	+024.788	04	
214	15:05:18.0	272	002043	+092.925	+024.590	04	
214	15:05:19.0	272	002043	+092.903	+024.381	04	
214	15:05:20.0	272	002043	+092.848	+024.184	04	
214	15:05:21.0	272	002043	+092.716	+023.953	04	
214	15:05:22.0	272	002043	+092.694	+023.733	04	
214	15:05:23.0	272	002043	+092.694	+023.535	04	
214	15:05:24.0	272	002043	+092.694	+023.346	04	
214	15:05:25.0	272	002043	+092.694	+023.148	04	
214	15:05:26.0	272	002043	+092.694	+022.885	04	
214	15:05:27.0	272	002043	+092.672	+022.709	04	
214	15:05:28.0	272	002043	+092.639	+022.522	04	
214	15:05:29.0	272	002043	+092.596	+022.335	04	
214	15:05:30.0	272	002043	+092.563	+022.137	04	
214	15:05:31.0	272	002043	+092.530	+021.915	04	
214	15:05:32.0	272	002043	+092.508	+021.706	04	
214	15:05:33.0	272	002043	+092.486	+021.497	04	
214	15:05:34.0	272	002043	+092.464	+021.300	04	
214	15:05:35.0	272	002043	+092.431	+021.080	04	
214	15:05:36.0	272	002043	+092.387	+020.860	04	
214	15:05:37.0	272	002043	+092.376	+020.641	04	
214	15:05:38.0	272	002043	+092.376	+020.440	04	
214	15:05:39.0	272	002043	+092.343	+020.242	04	
214	15:05:40.0	272	002043	+092.318	+020.023	04	
214	15:05:41.0	272	002043	+092.285	+019.814	04	
214	15:05:42.0	272	002043	+092.274	+019.583	04	
214	15:05:43.0	272	002043	+092.252	+019.372	04	
214	15:05:44.0	272	002043	+092.219	+019.163	04	
214	15:05:45.0	272	002043	+092.186	+018.954	04	
214	15:05:46.0	272	002043	+092.164	+018.734	04	
214	15:05:47.0	272	002043	+092.164	+018.526	04	
214	15:05:48.0	272	002043	+092.142	+018.306	04	
214	15:05:49.0	272	002043	+092.120	+018.083	04	
214	15:05:50.0	272	002043	+092.109	+017.864	04	
214	15:05:51.0	272	002043	+092.065	+017.644	04	
214	15:05:52.0	272	002043	+092.065	+017.424	04	
214	15:05:53.0	272	002043	+092.043	+017.202	04	
214	15:05:54.0	272	002043	+092.021	+016.971	04	
214	15:05:55.0	272	002043	+091.989	+016.751	04	
214	15:06:22.0	272	002043	+091.241	+017.644	04	*
214	15:06:23.0	272	002043	+091.230	+017.531	04	
214	15:06:24.0	272	002043	+091.187	+017.422	04	
214	15:06:25.0	272	002043	+091.154	+017.290	04	
214	15:06:26.0	272	002043	+091.154	+017.169	04	
214	15:06:27.0	272	002043	+091.143	+017.070	04	
214	15:06:28.0	272	002043	+091.121	+016.949	04	T
214	15:06:29.0	272	002043	+091.110	+016.839	04	T

*** PTPD - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ***

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRAK
214	15:06:30.0	272	002043	+091.090	+016.729	04	T
214	15:06:31.0	272	002043	+091.099	+016.617	04	T
214	15:06:32.0	272	002043	+091.077	+016.496	04	T
214	15:06:33.0	272	002043	+091.066	+016.386	04	T
214	15:06:34.0	272	002043	+091.055	+016.276	04	T
214	15:06:35.0	272	002043	+091.055	+016.155	04	T
214	15:06:36.0	272	002043	+091.033	+016.046	04	T
214	15:06:37.0	272	002043	+091.022	+015.936	04	T
214	15:06:38.0	272	002043	+091.011	+015.826	04	T
214	15:06:39.0	272	002043	+090.000	+015.702	04	T
214	15:06:40.0	272	002043	+090.000	+015.592	04	T
214	15:06:41.0	272	002043	+090.989	+015.493	04	T
214	15:06:42.0	272	002043	+090.967	+015.373	04	T
214	15:06:43.0	272	002043	+090.967	+015.263	04	T
214	15:06:44.0	272	002043	+090.956	+015.153	04	T
214	15:06:45.0	272	002043	+090.945	+015.054	04	T
214	15:06:46.0	272	002043	+090.934	+014.941	04	T
214	15:06:47.0	272	002043	+090.923	+014.821	04	T
214	15:06:48.0	272	002043	+090.923	+014.733	04	T
214	15:06:49.0	272	002043	+090.901	+014.612	04	T
214	15:06:50.0	272	002043	+090.890	+014.513	04	T
214	15:06:51.0	272	002043	+090.890	+014.403	04	T
214	15:06:52.0	272	002043	+090.879	+014.290	04	T
214	15:06:53.0	272	002043	+090.879	+014.192	04	T
214	15:06:54.0	272	002043	+090.857	+014.082	04	T
214	15:06:55.0	272	002043	+090.857	+013.983	04	T
214	15:06:56.0	272	002043	+090.846	+013.895	04	T
214	15:06:57.0	272	002043	+090.846	+013.774	04	T
214	15:06:58.0	272	002043	+090.835	+013.675	04	T
214	15:06:59.0	272	002043	+090.824	+013.563	04	T
214	15:07:00.0	272	002043	+090.813	+013.464	04	T
214	15:07:01.0	272	002043	+090.802	+013.365	04	T
214	15:07:02.0	272	002043	+090.791	+013.266	04	T
214	15:07:03.0	272	002043	+090.791	+013.167	04	T
214	15:07:04.0	272	002043	+090.791	+013.068	04	T
214	15:07:05.0	272	002043	+090.791	+012.967	04	T
214	15:07:06.0	272	002043	+090.780	+012.846	04	T
214	15:07:07.0	272	002043	+090.769	+012.747	04	T
214	15:07:08.0	272	002043	+090.747	+012.659	04	T
214	15:07:09.0	272	002043	+090.747	+012.571	04	T
214	15:07:10.0	272	002043	+090.747	+012.458	04	T
214	15:07:11.0	272	002043	+090.736	+012.360	04	T
214	15:07:12.0	272	002043	+090.725	+012.261	04	T
214	15:07:13.0	272	002043	+090.714	+012.173	04	T
214	15:07:14.0	272	002043	+090.714	+012.074	04	T
214	15:07:15.0	272	002043	+090.703	+011.961	04	T
214	15:07:16.0	272	002043	+090.703	+011.862	04	T
214	15:07:17.0	272	002043	+090.681	+011.775	04	T
214	15:07:18.0	272	002043	+090.681	+011.687	04	T
214	15:07:19.0	272	002043	+090.681	+011.588	04	T

**** FIPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBS/TEST	AZIMUTH	ELEVATION	EMT	BLOCK
214	15:07:20.0	272	002043	+090.681	+011.489	04	I
214	15:07:21.0	272	002043	+090.670	+011.387	04	I
214	15:07:22.0	272	002043	+090.659	+011.288	04	I
214	15:07:23.0	272	002043	+090.659	+011.201	04	I
214	15:07:24.0	272	002043	+090.648	+011.113	04	I
214	15:07:25.0	272	002043	+090.648	+011.022	04	I
214	15:07:26.0	272	002043	+090.637	+010.934	04	I
214	15:07:27.0	272	002043	+090.637	+010.835	04	I
214	15:07:28.0	272	002043	+090.615	+010.736	04	I
214	15:07:29.0	272	002043	+090.615	+010.648	04	I
214	15:07:30.0	272	002043	+090.615	+010.558	04	I
214	15:07:31.0	272	002043	+090.615	+010.459	04	I
214	15:07:32.0	272	002043	+090.615	+010.371	04	I
214	15:07:33.0	272	002043	+090.604	+010.272	04	I
214	15:07:34.0	272	002043	+090.582	+010.182	04	I
214	15:07:35.0	272	002043	+090.582	+010.094	04	I
214	15:07:36.0	272	002043	+090.582	+010.006	04	I
214	15:07:37.0	272	002043	+090.582	+009.918	04	I
214	15:07:38.0	272	002043	+090.571	+009.827	04	I
214	15:07:39.0	272	002043	+090.571	+009.739	04	I
214	15:07:40.0	272	002043	+090.571	+009.651	04	I
214	15:07:41.0	272	002043	+090.560	+009.564	04	I
214	15:07:42.0	272	002043	+090.549	+009.473	04	I
214	15:07:43.0	272	002043	+090.549	+009.385	04	I
214	15:07:44.0	272	002043	+090.549	+009.297	04	I
214	15:07:45.0	272	002043	+090.538	+009.220	04	I
214	15:07:46.0	272	002043	+090.538	+009.130	04	I
214	15:07:47.0	272	002043	+090.527	+009.042	04	I
214	15:07:48.0	272	002043	+090.527	+008.954	04	I
214	15:07:49.0	272	002043	+090.527	+008.863	04	I
214	15:07:50.0	272	002043	+090.527	+008.786	04	I
214	15:07:51.0	272	002043	+090.516	+008.709	04	I
214	15:07:52.0	272	002043	+090.516	+008.622	04	I
214	15:07:53.0	272	002043	+090.505	+008.542	04	I
214	15:07:54.0	272	002043	+090.494	+008.454	04	I
214	15:07:55.0	272	002043	+090.483	+008.366	04	I
214	15:07:56.0	272	002043	+090.483	+008.286	04	I
214	15:07:57.0	272	002043	+090.483	+008.199	04	I
214	15:07:58.0	272	002043	+090.483	+008.122	04	I
214	15:07:59.0	272	002043	+090.483	+008.031	04	I
214	15:08:00.0	272	002043	+090.483	+007.954	04	I
214	15:08:01.0	272	002043	+090.483	+007.866	04	I
214	15:08:02.0	272	002043	+090.472	+007.789	04	I
214	15:08:03.0	272	002043	+090.472	+007.710	04	I
214	15:08:04.0	272	002043	+090.461	+007.622	04	I
214	15:08:05.0	272	002043	+090.461	+007.545	04	I
214	15:08:06.0	272	002043	+090.450	+007.465	04	I
214	15:08:07.0	272	002043	+090.450	+007.388	04	I
214	15:08:08.0	272	002043	+090.450	+007.298	04	I
214	15:08:09.0	272	002043	+090.450	+007.221	04	I

**** RTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRACK
214	15:08:10.0	272	002043	+090.439	+007.144	04	T
214	15:08:11.0	272	002043	+090.439	+007.075	04	T
214	15:08:12.0	272	002043	+090.439	+006.987	04	T
214	15:08:13.0	272	002043	+090.439	+006.910	04	T
214	15:08:14.0	272	002043	+090.428	+006.831	04	T
214	15:08:15.0	272	002043	+090.428	+006.765	04	T
214	15:08:16.0	272	002043	+090.428	+006.674	04	T
214	15:08:17.0	272	002043	+090.417	+006.586	04	T
214	15:08:18.0	272	002043	+090.417	+006.507	04	T
214	15:08:19.0	272	002043	+090.406	+006.430	04	T
214	15:08:20.0	272	002043	+090.406	+006.364	04	T
214	15:08:21.0	272	002043	+090.406	+006.284	04	T
214	15:08:22.0	272	002043	+090.406	+006.218	04	T
214	15:08:23.0	272	002043	+090.396	+006.139	04	T
214	15:08:24.0	272	002043	+090.396	+006.062	04	T
214	15:08:25.0	272	002043	+090.396	+005.982	04	T
214	15:08:26.0	272	002043	+090.396	+005.916	04	T
214	15:08:27.0	272	002043	+090.396	+005.836	04	T
214	15:08:28.0	272	002043	+090.396	+005.760	04	T
214	15:08:29.0	272	002043	+090.396	+005.691	04	T
214	15:08:30.0	272	002043	+090.396	+005.614	04	T
214	15:08:31.0	272	002043	+090.385	+005.534	04	T
214	15:08:32.0	272	002043	+090.385	+005.468	04	T
214	15:08:33.0	272	002043	+090.363	+005.389	04	T
214	15:08:34.0	272	002043	+090.363	+005.334	04	T
214	15:08:35.0	272	002043	+090.363	+005.243	04	T
214	15:08:36.0	272	002043	+090.363	+005.177	04	T
214	15:08:37.0	272	002043	+090.363	+005.109	04	T
214	15:08:38.0	272	002043	+090.363	+005.032	04	T
214	15:08:39.0	272	002043	+090.363	+004.963	04	T
214	15:08:40.0	272	002043	+090.352	+004.883	04	T
214	15:08:41.0	272	002043	+090.352	+004.818	04	T
214	15:08:42.0	272	002043	+090.352	+004.749	04	T
214	15:08:43.0	272	002043	+090.352	+004.669	04	T
214	15:08:44.0	272	002043	+090.352	+004.614	04	T
214	15:08:45.0	272	002043	+090.352	+004.524	04	T
214	15:08:46.0	272	002043	+090.352	+004.469	04	T
214	15:08:47.0	272	002043	+090.352	+004.389	04	T
214	15:08:48.0	272	002043	+090.352	+004.320	04	T
214	15:08:49.0	272	002043	+090.341	+004.252	04	T
214	15:08:50.0	272	002043	+090.341	+004.164	04	T
214	15:08:51.0	272	002043	+090.330	+004.117	04	T
214	15:08:52.0	272	002043	+090.319	+004.037	04	T
214	15:08:53.0	272	002043	+090.319	+003.969	04	T
214	15:08:54.0	272	002043	+090.308	+003.892	04	T
214	15:08:55.0	272	002043	+090.308	+003.845	04	T
214	15:08:56.0	272	002043	+090.308	+003.777	04	T
214	15:08:57.0	272	002043	+090.308	+003.708	04	T
214	15:08:58.0	272	002043	+090.308	+003.642	04	T
214	15:08:59.0	272	002043	+090.305	+003.573	04	T

**** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR [illegible] SITES ****

DAY	TIME	SITE	OBJ/SEQ	AZIMUTH	ELEVATION	SMI	TRACK
214	15:09:00.0	272	002043	+090.305	+003.483	04	I
214	15:09:01.0	272	002043	+090.305	+003.436	04	I
214	15:09:02.0	272	002043	+090.305	+003.356	04	I
214	15:09:03.0	272	002043	+090.305	+003.277	04	I
214	15:09:04.0	272	002043	+090.305	+003.208	04	I

TRACKING TELESCOPE TIMING - AZ/EL PRINTOUT

PREPARED BY :
TGS TECHNOLOGY INC.
CCAFS

DATE : 02 August 1991

TEST : C8181 STS-43

THIS IS
TEST ITEM : ET 221

FROM
TRACKING
ITEM : ET-208A

SITE : CB DOAMS

DIST : JSC/JL3

TEST : CB181 - STS-43
TRKNG ITEM : ET-208A
SITE : CB DOAMS
DISTRIB. : JSC/JL3

**** PIPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRACK
214	15:02:00.0	011	002043	+000.382	-000.060	04	
214	15:02:01.0	011	002043	+000.387	-000.052	04	
214	15:02:02.0	011	002043	+000.385	-000.052	04	
214	15:02:03.0	011	002043	+000.385	-000.052	04	
214	15:02:04.0	011	002043	+000.387	-000.011	04	
214	15:02:05.0	011	002043	+000.379	+000.044	04	
214	15:02:06.0	011	002043	+000.376	+000.104	04	
214	15:02:07.0	011	002043	+000.365	+000.181	04	
214	15:02:08.0	011	002043	+000.379	+000.277	04	
214	15:02:09.0	011	002043	+000.385	+000.382	04	
214	15:02:10.0	011	002043	+000.376	+000.497	04	
214	15:02:11.0	011	002043	+000.387	+000.591	04	
214	15:02:12.0	011	002043	+000.396	+000.747	04	
214	15:02:13.0	011	002043	+000.409	+000.923	04	
214	15:02:14.0	011	002043	+000.398	+001.088	04	
214	15:02:15.0	011	002043	+000.406	+001.258	04	
214	15:02:16.0	011	002043	+000.445	+001.450	04	
214	15:02:17.0	011	002043	+000.505	+001.667	04	
214	15:02:18.0	011	002043	+000.571	+001.890	04	
214	15:02:19.0	011	002043	+000.645	+002.115	04	
214	15:02:20.0	011	002043	+000.731	+002.359	04	
214	15:02:21.0	011	002043	+000.829	+002.631	04	
214	15:02:22.0	011	002043	+000.942	+002.909	04	
214	15:02:23.0	011	002043	+001.055	+003.203	04	
214	15:02:24.0	011	002043	+001.178	+003.502	04	
214	15:02:25.0	011	002043	+001.313	+003.823	04	
214	15:02:26.0	011	002043	+001.469	+004.183	04	
214	15:02:27.0	011	002043	+001.631	+004.529	04	
214	15:02:28.0	011	002043	+001.794	+004.889	04	
214	15:02:29.0	011	002043	+001.972	+005.257	04	
214	15:02:30.0	011	002043	+002.162	+005.630	04	
214	15:02:31.0	011	002043	+002.346	+005.919	04	
214	15:02:32.0	011	002043	+002.532	+006.306	04	
214	15:02:33.0	011	002043	+002.722	+006.748	04	
214	15:02:34.0	011	002043	+002.997	+007.204	04	
214	15:02:35.0	011	002043	+003.233	+007.611	04	
214	15:02:36.0	011	002043	+003.463	+008.028	04	
214	15:02:37.0	011	002043	+003.702	+008.481	04	
214	15:02:38.0	011	002043	+003.972	+008.918	04	
214	15:02:39.0	011	002043	+004.246	+009.371	04	
214	15:02:40.0	011	002043	+004.524	+009.844	04	
214	15:02:41.0	011	002043	+004.815	+010.324	04	
214	15:02:42.0	011	002043	+005.117	+010.811	04	
214	15:02:43.0	011	002043	+005.424	+011.299	04	
214	15:02:44.0	011	002043	+005.751	+011.794	04	
214	15:02:45.0	011	002043	+006.084	+012.302	04	
214	15:02:46.0	011	002043	+006.427	+012.813	04	
214	15:02:47.0	011	002043	+006.781	+013.329	04	
214	15:02:48.0	011	002043	+007.141	+013.848	04	
214	15:02:49.0	011	002043	+007.509	+014.373	04	

**** PIPO - HIGH DENSITY DATA DUMP UTILITY FOR GRIDS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRACK
214	15:02:50.0	011	002043	+007.921	+014.000	04	T
214	15:02:51.0	011	002043	+008.308	+015.430	04	T
214	15:02:52.0	011	002043	+008.693	+015.963	04	T
214	15:02:53.0	011	002043	+009.097	+016.496	04	T
214	15:02:54.0	011	002043	+009.506	+017.032	04	T
214	15:02:55.0	011	002043	+009.934	+017.567	04	T
214	15:02:56.0	011	002043	+010.374	+018.103	04	T
214	15:02:57.0	011	002043	+010.822	+018.644	04	T
214	15:02:58.0	011	002043	+011.286	+019.179	04	T
214	15:02:59.0	011	002043	+011.753	+019.715	04	T
214	15:03:00.0	011	002043	+012.239	+020.253	04	T
214	15:03:01.0	011	002043	+012.730	+020.792	04	T
214	15:03:02.0	011	002043	+013.230	+021.324	04	T
214	15:03:03.0	011	002043	+013.749	+021.863	04	T
214	15:03:04.0	011	002043	+014.285	+022.401	04	T
214	15:03:05.0	011	002043	+014.832	+022.945	04	T
214	15:03:06.0	011	002043	+015.381	+023.489	04	T
214	15:03:07.0	011	002043	+015.952	+024.033	04	T
214	15:03:08.0	011	002043	+016.540	+024.571	04	T
214	15:03:09.0	011	002043	+017.130	+025.109	04	T
214	15:03:10.0	011	002043	+017.743	+025.645	04	T
214	15:03:11.0	011	002043	+018.375	+026.180	04	T
214	15:03:12.0	011	002043	+019.015	+026.716	04	T
214	15:03:13.0	011	002043	+019.677	+027.243	04	T
214	15:03:14.0	011	002043	+020.341	+027.771	04	T
214	15:03:15.0	011	002043	+021.042	+028.290	04	T
214	15:03:16.0	011	002043	+021.745	+028.803	04	T
214	15:03:17.0	011	002043	+022.464	+029.306	04	T
214	15:03:18.0	011	002043	+023.200	+029.800	04	T
214	15:03:19.0	011	002043	+023.947	+030.284	04	T
214	15:03:20.0	011	002043	+024.714	+030.759	04	T
214	15:03:21.0	011	002043	+025.497	+031.220	04	T
214	15:03:22.0	011	002043	+026.296	+031.671	04	T
214	15:03:23.0	011	002043	+027.098	+032.108	04	T
214	15:03:24.0	011	002043	+027.924	+032.531	04	T
214	15:03:25.0	011	002043	+028.762	+032.943	04	T
214	15:03:26.0	011	002043	+029.611	+033.330	04	T
214	15:03:27.0	011	002043	+030.468	+033.709	04	T
214	15:03:28.0	011	002043	+031.330	+034.066	04	T
214	15:03:29.0	011	002043	+032.198	+034.409	04	T
214	15:03:30.0	011	002043	+033.066	+034.736	04	T
214	15:03:31.0	011	002043	+033.951	+035.046	04	T
214	15:03:32.0	011	002043	+034.835	+035.340	04	T
214	15:03:33.0	011	002043	+035.725	+035.615	04	T
214	15:03:34.0	011	002043	+036.615	+035.876	04	T
214	15:03:35.0	011	002043	+037.505	+036.120	04	T
214	15:03:36.0	011	002043	+038.389	+036.343	04	T
214	15:03:37.0	011	002043	+039.265	+036.552	04	T
214	15:03:38.0	011	002043	+040.147	+036.738	04	T
214	15:03:39.0	011	002043	+041.034	+036.920	04	T

*** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ***

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	SMI	TRACK
214	15:03:40.0	011	002043	+041.916	+037.082	04	T
214	15:03:41.0	011	002043	+042.784	+037.224	04	T
214	15:03:42.0	011	002043	+043.640	+037.354	04	T
214	15:03:43.0	011	002043	+044.489	+037.463	04	T
214	15:03:44.0	011	002043	+045.335	+037.562	04	T
214	15:03:45.0	011	002043	+046.167	+037.642	04	T
214	15:03:46.0	011	002043	+046.997	+037.713	04	T
214	15:03:47.0	011	002043	+047.815	+037.768	04	T
214	15:03:48.0	011	002043	+048.623	+037.809	04	T
214	15:03:49.0	011	002043	+049.411	+037.842	04	T
214	15:03:50.0	011	002043	+050.186	+037.859	04	T
214	15:03:51.0	011	002043	+050.949	+037.864	04	T
214	15:03:52.0	011	002043	+051.704	+037.862	04	T
214	15:03:53.0	011	002043	+052.440	+037.845	04	T
214	15:03:54.0	011	002043	+053.160	+037.820	04	T
214	15:03:55.0	011	002043	+053.866	+037.782	04	T
214	15:03:56.0	011	002043	+054.547	+037.738	04	T
214	15:03:57.0	011	002043	+055.217	+037.686	04	T
214	15:03:58.0	011	002043	+055.865	+037.628	04	T
214	15:03:59.0	011	002043	+056.494	+037.560	04	T
214	15:04:00.0	011	002043	+057.115	+037.485	04	T
214	15:04:01.0	011	002043	+057.714	+037.406	04	T
214	15:04:02.0	011	002043	+058.293	+037.321	04	T
214	15:04:03.0	011	002043	+058.859	+037.233	04	T
214	15:04:04.0	011	002043	+059.406	+037.139	04	T
214	15:04:05.0	011	002043	+059.941	+037.043	04	T
214	15:04:06.0	011	002043	+060.463	+036.942	04	T
214	15:04:07.0	011	002043	+060.969	+036.837	04	T
214	15:04:08.0	011	002043	+061.458	+036.730	04	T
214	15:04:09.0	011	002043	+061.933	+036.617	04	T
214	15:04:10.0	011	002043	+062.397	+036.499	04	T
214	15:04:11.0	011	002043	+062.850	+036.381	04	T
214	15:04:12.0	011	002043	+063.295	+036.263	04	T
214	15:04:13.0	011	002043	+063.732	+036.140	04	T
214	15:04:14.0	011	002043	+064.155	+036.016	04	T
214	15:04:15.0	011	002043	+064.556	+035.887	04	T
214	15:04:16.0	011	002043	+064.954	+035.758	04	T
214	15:04:17.0	011	002043	+065.344	+035.629	04	T
214	15:04:18.0	011	002043	+065.726	+035.497	04	T
214	15:04:19.0	011	002043	+066.096	+035.362	04	T
214	15:04:20.0	011	002043	+066.456	+035.225	04	T
214	15:04:21.0	011	002043	+066.811	+035.088	04	T
214	15:04:22.0	011	002043	+067.157	+034.950	04	T
214	15:04:23.0	011	002043	+067.495	+034.807	04	T
214	15:04:24.0	011	002043	+067.821	+034.667	04	T
214	15:04:25.0	011	002043	+068.145	+034.525	04	T
214	15:04:26.0	011	002043	+068.456	+034.382	04	T
214	15:04:27.0	011	002043	+068.766	+034.236	04	T
214	15:04:28.0	011	002043	+069.066	+034.091	04	T
214	15:04:29.0	011	002043	+069.359	+033.942	04	T

**** PTPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:04:30.0	011	002043	+069.648	+033.797	04	T
214	15:04:31.0	011	002043	+069.928	+033.648	04	T
214	15:04:32.0	011	002043	+070.203	+033.500	04	T
214	15:04:33.0	011	002043	+070.469	+033.349	04	T
214	15:04:34.0	011	002043	+070.733	+033.201	04	T
214	15:04:35.0	011	002043	+070.991	+033.052	04	T
214	15:04:36.0	011	002043	+071.241	+032.901	04	T
214	15:04:37.0	011	002043	+071.485	+032.747	04	T
214	15:04:38.0	011	002043	+071.730	+032.596	04	T
214	15:04:39.0	011	002043	+071.969	+032.445	04	T
214	15:04:40.0	011	002043	+072.197	+032.292	04	T
214	15:04:41.0	011	002043	+072.422	+032.141	04	T
214	15:04:42.0	011	002043	+072.647	+031.987	04	T
214	15:04:43.0	011	002043	+072.867	+031.833	04	T
214	15:04:44.0	011	002043	+073.078	+031.682	04	T
214	15:04:45.0	011	002043	+073.290	+031.528	04	T
214	15:04:46.0	011	002043	+073.496	+031.377	04	T
214	15:04:47.0	011	002043	+073.694	+031.220	04	T
214	15:04:48.0	011	002043	+073.891	+031.067	04	T
214	15:04:49.0	011	002043	+074.089	+030.913	04	T
214	15:04:50.0	011	002043	+074.279	+030.762	04	T
214	15:04:51.0	011	002043	+074.463	+030.608	04	T
214	15:04:52.0	011	002043	+074.644	+030.454	04	T
214	15:04:53.0	011	002043	+074.825	+030.298	04	T
214	15:04:54.0	011	002043	+075.004	+030.146	04	T
214	15:04:55.0	011	002043	+075.177	+029.993	04	T
214	15:04:56.0	011	002043	+075.347	+029.839	04	T
214	15:04:57.0	011	002043	+075.515	+029.685	04	T
214	15:04:58.0	011	002043	+075.679	+029.531	04	T
214	15:04:59.0	011	002043	+075.841	+029.380	04	T
214	15:05:00.0	011	002043	+075.998	+029.226	04	T
214	15:05:01.0	011	002043	+076.154	+029.075	04	T
214	15:05:02.0	011	002043	+076.308	+028.924	04	T
214	15:05:03.0	011	002043	+076.459	+028.770	04	T
214	15:05:04.0	011	002043	+076.608	+028.617	04	T
214	15:05:05.0	011	002043	+076.750	+028.466	04	T
214	15:05:06.0	011	002043	+076.893	+028.315	04	T
214	15:05:07.0	011	002043	+077.033	+028.163	04	T
214	15:05:08.0	011	002043	+077.176	+028.010	04	T
214	15:05:09.0	011	002043	+077.308	+027.861	04	T
214	15:05:10.0	011	002043	+077.440	+027.710	04	T
214	15:05:11.0	011	002043	+077.574	+027.559	04	T
214	15:05:12.0	011	002043	+077.704	+027.411	04	T
214	15:05:13.0	011	002043	+077.830	+027.260	04	T
214	15:05:14.0	011	002043	+077.959	+027.112	04	T
214	15:05:15.0	011	002043	+078.080	+026.963	04	T
214	15:05:16.0	011	002043	+078.201	+026.815	04	T
214	15:05:17.0	011	002043	+078.319	+026.667	04	T
214	15:05:18.0	011	002043	+078.440	+026.516	04	T
214	15:05:19.0	011	002043	+078.558	+026.373	04	T

**** PTPC - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	STAT
214	15:05:20.0	011	002043	+078.670	+026.224	04	T
214	15:05:21.0	011	002043	+078.783	+026.076	04	T
214	15:05:22.0	011	002043	+078.893	+025.930	04	T
214	15:05:23.0	011	002043	+078.000	+025.782	04	T
214	15:05:24.0	011	002043	+079.107	+025.637	04	T
214	15:05:25.0	011	002043	+079.214	+025.491	04	T
214	15:05:26.0	011	002043	+079.321	+025.345	04	T
214	15:05:27.0	011	002043	+079.426	+025.203	04	T
214	15:05:28.0	011	002043	+079.527	+025.057	04	T
214	15:05:29.0	011	002043	+079.626	+024.911	04	T
214	15:05:30.0	011	002043	+079.722	+024.769	04	T
214	15:05:31.0	011	002043	+079.818	+024.626	04	T
214	15:05:32.0	011	002043	+079.915	+024.483	04	T
214	15:05:33.0	011	002043	+080.011	+024.340	04	T
214	15:05:34.0	011	002043	+080.104	+024.197	04	T
214	15:05:35.0	011	002043	+080.195	+024.057	04	T
214	15:05:36.0	011	002043	+080.288	+023.917	04	T
214	15:05:37.0	011	002043	+080.376	+023.774	04	T
214	15:05:38.0	011	002043	+080.461	+023.634	04	T
214	15:05:39.0	011	002043	+080.546	+023.494	04	T
214	15:05:40.0	011	002043	+080.634	+023.354	04	T
214	15:05:41.0	011	002043	+080.719	+023.217	04	T
214	15:05:42.0	011	002043	+080.804	+023.077	04	T
214	15:05:43.0	011	002043	+080.887	+022.939	04	T
214	15:05:44.0	011	002043	+080.966	+022.802	04	T
214	15:05:45.0	011	002043	+081.049	+022.662	04	T
214	15:05:46.0	011	002043	+081.126	+022.525	04	T
214	15:05:47.0	011	002043	+081.203	+022.390	04	T
214	15:05:48.0	011	002043	+081.280	+022.256	04	T
214	15:05:49.0	011	002043	+081.357	+022.118	04	T
214	15:05:50.0	011	002043	+081.433	+021.984	04	T
214	15:05:51.0	011	002043	+081.508	+021.849	04	T
214	15:05:52.0	011	002043	+081.579	+021.714	04	T
214	15:05:53.0	011	002043	+081.653	+021.580	04	T
214	15:05:54.0	011	002043	+081.725	+021.445	04	T
214	15:05:55.0	011	002043	+081.796	+021.316	04	T
214	15:05:56.0	011	002043	+081.865	+021.182	04	T
214	15:05:57.0	011	002043	+081.931	+021.050	04	T
214	15:05:58.0	011	002043	+081.999	+020.918	04	T
214	15:05:59.0	011	002043	+082.068	+020.786	04	T
214	15:06:00.0	011	002043	+082.134	+020.654	04	T
214	15:06:01.0	011	002043	+082.200	+020.525	04	T
214	15:06:02.0	011	002043	+082.266	+020.396	04	T
214	15:06:03.0	011	002043	+082.329	+020.267	04	T
214	15:06:04.0	011	002043	+082.392	+020.141	04	T
214	15:06:05.0	011	002043	+082.455	+020.009	04	T
214	15:06:06.0	011	002043	+082.516	+019.883	04	T
214	15:06:07.0	011	002043	+082.576	+019.753	04	T
214	15:06:08.0	011	002043	+082.636	+019.627	04	T
214	15:06:09.0	011	002043	+082.697	+019.501	04	T

★★★★ PEPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ★★★★

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:06:10.0	011	002043	+082.755	+019.374	04	T
214	15:06:11.0	011	002043	+082.815	+019.251	04	T
214	15:06:12.0	011	002043	+082.873	+019.124	04	T
214	15:06:13.0	011	002043	+082.928	+018.998	04	T
214	15:06:14.0	011	002043	+082.982	+018.875	04	T
214	15:06:15.0	011	002043	+083.040	+018.751	04	T
214	15:06:16.0	011	002043	+083.095	+018.627	04	T
214	15:06:17.0	011	002043	+083.150	+018.506	04	T
214	15:06:18.0	011	002043	+083.202	+018.383	04	T
214	15:06:19.0	011	002043	+083.257	+018.262	04	T
214	15:06:20.0	011	002043	+083.309	+018.138	04	T
214	15:06:21.0	011	002043	+083.362	+018.018	04	T
214	15:06:22.0	011	002043	+083.414	+017.894	04	T
214	15:06:23.0	011	002043	+083.463	+017.776	04	T
214	15:06:24.0	011	002043	+083.513	+017.655	04	T
214	15:06:25.0	011	002043	+083.562	+017.537	04	T
214	15:06:26.0	011	002043	+083.611	+017.419	04	T
214	15:06:27.0	011	002043	+083.661	+017.298	04	T
214	15:06:28.0	011	002043	+083.710	+017.180	04	T
214	15:06:29.0	011	002043	+083.757	+017.062	04	T
214	15:06:30.0	011	002043	+083.806	+016.946	04	T
214	15:06:31.0	011	002043	+083.853	+016.831	04	T
214	15:06:32.0	011	002043	+083.897	+016.713	04	T
214	15:06:33.0	011	002043	+083.944	+016.598	04	T
214	15:06:34.0	011	002043	+083.990	+016.482	04	T
214	15:06:35.0	011	002043	+084.034	+016.367	04	T
214	15:06:36.0	011	002043	+084.078	+016.252	04	T
214	15:06:37.0	011	002043	+084.122	+016.136	04	T
214	15:06:38.0	011	002043	+084.166	+016.024	04	T
214	15:06:39.0	011	002043	+084.207	+015.908	04	T
214	15:06:40.0	011	002043	+084.251	+015.796	04	T
214	15:06:41.0	011	002043	+084.293	+015.683	04	T
214	15:06:42.0	011	002043	+084.337	+015.573	04	T
214	15:06:43.0	011	002043	+084.378	+015.461	04	T
214	15:06:44.0	011	002043	+084.416	+015.351	04	T
214	15:06:45.0	011	002043	+084.457	+015.241	04	T
214	15:06:46.0	011	002043	+084.499	+015.131	04	T
214	15:06:47.0	011	002043	+084.537	+015.018	04	T
214	15:06:48.0	011	002043	+084.578	+014.908	04	T
214	15:06:49.0	011	002043	+084.617	+014.799	04	T
214	15:06:50.0	011	002043	+084.655	+014.689	04	T
214	15:06:51.0	011	002043	+084.694	+014.582	04	T
214	15:06:52.0	011	002043	+084.732	+014.472	04	T
214	15:06:53.0	011	002043	+084.771	+014.367	04	T
214	15:06:54.0	011	002043	+084.803	+014.260	04	T
214	15:06:55.0	011	002043	+084.842	+014.153	04	T
214	15:06:56.0	011	002043	+084.878	+014.046	04	T
214	15:06:57.0	011	002043	+084.913	+013.942	04	T
214	15:06:58.0	011	002043	+084.949	+013.835	04	T
214	15:06:59.0	011	002043	+084.985	+013.730	04	T

**** PIPS - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRACK
214	15:07:00.0	011	002043	+085.020	+013.626	04	T
214	15:07:01.0	011	002043	+085.053	+013.521	04	T
214	15:07:02.0	011	002043	+085.089	+013.417	04	T
214	15:07:03.0	011	002043	+085.122	+013.313	04	T
214	15:07:04.0	011	002043	+085.158	+013.211	04	T
214	15:07:05.0	011	002043	+085.191	+013.107	04	T
214	15:07:06.0	011	002043	+085.224	+013.002	04	T
214	15:07:07.0	011	002043	+085.257	+012.903	04	T
214	15:07:08.0	011	002043	+085.290	+012.802	04	T
214	15:07:09.0	011	002043	+085.320	+012.700	04	T
214	15:07:10.0	011	002043	+085.353	+012.601	04	T
214	15:07:11.0	011	002043	+085.386	+012.502	04	T
214	15:07:12.0	011	002043	+085.419	+012.401	04	T
214	15:07:13.0	011	002043	+085.449	+012.302	04	T
214	15:07:14.0	011	002043	+085.479	+012.203	04	T
214	15:07:15.0	011	002043	+085.509	+012.104	04	T
214	15:07:16.0	011	002043	+085.542	+012.005	04	T
214	15:07:17.0	011	002043	+085.573	+011.906	04	T
214	15:07:18.0	011	002043	+085.600	+011.808	04	T
214	15:07:19.0	011	002043	+085.630	+011.709	04	T
214	15:07:20.0	011	002043	+085.658	+011.615	04	T
214	15:07:21.0	011	002043	+085.688	+011.516	04	T
214	15:07:22.0	011	002043	+085.715	+011.420	04	T
214	15:07:23.0	011	002043	+085.746	+011.324	04	T
214	15:07:24.0	011	002043	+085.773	+011.228	04	T
214	15:07:25.0	011	002043	+085.800	+011.135	04	T
214	15:07:26.0	011	002043	+085.828	+011.041	04	T
214	15:07:27.0	011	002043	+085.858	+010.948	04	T
214	15:07:28.0	011	002043	+085.886	+010.854	04	T
214	15:07:29.0	011	002043	+085.910	+010.761	04	T
214	15:07:30.0	011	002043	+085.941	+010.668	04	T
214	15:07:31.0	011	002043	+085.965	+010.572	04	T
214	15:07:32.0	011	002043	+085.990	+010.478	04	T
214	15:07:33.0	011	002043	+086.017	+010.388	04	T
214	15:07:34.0	011	002043	+086.045	+010.294	04	T
214	15:07:35.0	011	002043	+086.070	+010.204	04	T
214	15:07:36.0	011	002043	+086.086	+010.113	04	T
214	15:07:37.0	011	002043	+086.116	+010.022	04	T
214	15:07:38.0	011	002043	+086.147	+009.932	04	T
214	15:07:39.0	011	002043	+086.174	+009.844	04	T
214	15:07:40.0	011	002043	+086.199	+009.753	04	T
214	15:07:41.0	011	002043	+086.221	+009.662	04	T
214	15:07:42.0	011	002043	+086.245	+009.575	04	T
214	15:07:43.0	011	002043	+086.273	+009.484	04	T
214	15:07:44.0	011	002043	+086.300	+009.396	04	T
214	15:07:45.0	011	002043	+086.322	+009.305	04	T
214	15:07:46.0	011	002043	+086.342	+009.218	04	T
214	15:07:47.0	011	002043	+086.364	+009.132	04	T
214	15:07:48.0	011	002043	+086.385	+009.047	04	T
214	15:07:49.0	011	002043	+086.410	+008.959	04	T

**** PCPO - HIGH DENSITY DATA DUMP UTILITY FOR SPACE SIZE ****

DAY	TIME	SIZE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:07:50.0	011	002043	+086.432	+008.374	04	T
214	15:07:51.0	011	002043	+086.457	+008.786	04	T
214	15:07:52.0	011	002043	+086.479	+008.698	04	T
214	15:07:53.0	011	002043	+086.501	+008.613	04	T
214	15:07:54.0	011	002043	+086.523	+008.528	04	T
214	15:07:55.0	011	002043	+086.545	+008.443	04	T
214	15:07:56.0	011	002043	+086.567	+008.361	04	T
214	15:07:57.0	011	002043	+086.589	+008.275	04	T
214	15:07:58.0	011	002043	+086.611	+008.193	04	T
214	15:07:59.0	011	002043	+086.633	+008.108	04	T
214	15:08:00.0	011	002043	+086.652	+008.026	04	T
214	15:08:01.0	011	002043	+086.674	+007.943	04	T
214	15:08:02.0	011	002043	+086.696	+007.863	04	T
214	15:08:03.0	011	002043	+086.715	+007.781	04	T
214	15:08:04.0	011	002043	+086.737	+007.699	04	T
214	15:08:05.0	011	002043	+086.759	+007.614	04	T
214	15:08:06.0	011	002043	+086.778	+007.531	04	T
214	15:08:07.0	011	002043	+086.797	+007.451	04	T
214	15:08:08.0	011	002043	+086.819	+007.366	04	T
214	15:08:09.0	011	002043	+086.836	+007.287	04	T
214	15:08:10.0	011	002043	+086.855	+007.207	04	T
214	15:08:11.0	011	002043	+086.877	+007.127	04	T
214	15:08:12.0	011	002043	+086.896	+007.048	04	T
214	15:08:13.0	011	002043	+086.916	+006.968	04	T
214	15:08:14.0	011	002043	+086.935	+006.891	04	T
214	15:08:15.0	011	002043	+086.954	+006.812	04	T
214	15:08:16.0	011	002043	+086.973	+006.732	04	T
214	15:08:17.0	011	002043	+086.990	+006.658	04	T
214	15:08:18.0	011	002043	+087.009	+006.581	04	T
214	15:08:19.0	011	002043	+087.028	+006.501	04	T
214	15:08:20.0	011	002043	+087.045	+006.424	04	T
214	15:08:21.0	011	002043	+087.064	+006.347	04	T
214	15:08:22.0	011	002043	+087.083	+006.270	04	T
214	15:08:23.0	011	002043	+087.100	+006.191	04	T
214	15:08:24.0	011	002043	+087.119	+006.114	04	T
214	15:08:25.0	011	002043	+087.135	+006.042	04	T
214	15:08:26.0	011	002043	+087.152	+005.966	04	T
214	15:08:27.0	011	002043	+087.171	+005.889	04	T
214	15:08:28.0	011	002043	+087.187	+005.812	04	T
214	15:08:29.0	011	002043	+087.204	+005.735	04	T
214	15:08:30.0	011	002043	+087.220	+005.661	04	T
214	15:08:31.0	011	002043	+087.237	+005.587	04	T
214	15:08:32.0	011	002043	+087.253	+005.512	04	T
214	15:08:33.0	011	002043	+087.270	+005.438	04	T
214	15:08:34.0	011	002043	+087.286	+005.367	04	T
214	15:08:35.0	011	002043	+087.306	+005.293	04	T
214	15:08:36.0	011	002043	+087.322	+005.219	04	T
214	15:08:37.0	011	002043	+087.339	+005.147	04	T
214	15:08:38.0	011	002043	+087.355	+005.076	04	T
214	15:08:39.0	011	002043	+087.372	+005.004	04	T

**** PIPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMC	TRACK
214	15:08:40.0	011	002043	+087.388	+004.930	04	I
214	15:08:41.0	011	002043	+087.402	+004.859	04	I
214	15:08:42.0	011	002043	+087.418	+004.787	04	I
214	15:08:43.0	011	002043	+087.432	+004.716	04	I
214	15:08:44.0	011	002043	+087.446	+004.644	04	I
214	15:08:45.0	011	002043	+087.462	+004.573	04	I
214	15:08:46.0	011	002043	+087.479	+004.504	04	I
214	15:08:47.0	011	002043	+087.495	+004.433	04	I
214	15:08:48.0	011	002043	+087.512	+004.362	04	I
214	15:08:49.0	011	002043	+087.525	+004.293	04	I
214	15:08:50.0	011	002043	+087.539	+004.221	04	I
214	15:08:51.0	011	002043	+087.553	+004.150	04	I
214	15:08:52.0	011	002043	+087.569	+004.081	04	I
214	15:08:53.0	011	002043	+087.586	+004.013	04	I
214	15:08:54.0	011	002043	+087.599	+003.944	04	I
214	15:08:55.0	011	002043	+087.613	+003.875	04	I
214	15:08:56.0	011	002043	+087.627	+003.807	04	I
214	15:08:57.0	011	002043	+087.643	+003.738	04	I
214	15:08:58.0	011	002043	+087.657	+003.672	04	I
214	15:08:59.0	011	002043	+087.671	+003.604	04	I
214	15:09:00.0	011	002043	+087.685	+003.538	04	I
214	15:09:01.0	011	002043	+087.698	+003.469	04	I
214	15:09:02.0	011	002043	+087.712	+003.400	04	I
214	15:09:03.0	011	002043	+087.726	+003.332	04	I
214	15:09:04.0	011	002043	+087.740	+003.266	04	I
214	15:09:05.0	011	002043	+087.753	+003.200	04	I
214	15:09:06.0	011	002043	+087.767	+003.134	04	I
214	15:09:07.0	011	002043	+087.778	+003.071	04	I
214	15:09:08.0	011	002043	+087.789	+003.005	04	I
214	15:09:09.0	011	002043	+087.803	+002.936	04	I
214	15:09:10.0	011	002043	+087.819	+002.870	04	I
214	15:09:11.0	011	002043	+087.833	+002.804	04	I
214	15:09:12.0	011	002043	+087.847	+002.741	04	I
214	15:09:13.0	011	002043	+087.858	+002.672	04	I
214	15:09:14.0	011	002043	+087.871	+002.607	04	I
214	15:09:15.0	011	002043	+087.885	+002.543	04	I
214	15:09:16.0	011	002043	+087.896	+002.480	04	I
214	15:09:17.0	011	002043	+087.907	+002.414	04	I
214	15:09:18.0	011	002043	+087.918	+002.351	04	
214	15:09:19.0	011	002043	+087.929	+002.285	04	

TRACKING TELESCOPE TIMING - AZ/EL PRINTOUT

PREPARED BY :
TGS TECHNOLOGY INC.
CCAFS

DATE : 02 August 1991

TEST : C8181 STS-43

THIS IS
TEST ITEM : ET 221

FROM
TRACKING
ITEM : ET-212A

SITE : UCS-23

DIST : JSC/JL3

TEST : C8181 - STS-43
TRKNG ITEM : ET-212A
SITE : UCS-23
DISTRIB. : JSC/JL3

**** PEPS - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SIZE	OBJ/TEST	AZIMUTH	ELEVATION	GMT	TRACK
214	15:02:00.0	291	002043	+339.225	+001.436	04	*
214	15:02:01.0	291	002043	+339.225	+001.436	04	
214	15:02:02.0	291	002043	+339.225	+001.436	04	
214	15:02:03.0	291	002043	+339.225	+001.436	04	
214	15:02:04.0	291	002043	+339.225	+001.436	04	
214	15:02:05.0	291	002043	+339.225	+001.436	04	
214	15:02:06.0	291	002043	+339.225	+001.436	04	
214	15:02:07.0	291	002043	+339.225	+001.436	04	
214	15:02:08.0	291	002043	+339.236	+001.436	04	
214	15:02:09.0	291	002043	+339.236	+001.436	04	
214	15:02:10.0	291	002043	+339.247	+001.436	04	T
214	15:02:11.0	291	002043	+339.269	+001.667	04	T
214	15:02:12.0	291	002043	+339.280	+001.964	04	T
214	15:02:13.0	291	002043	+339.302	+002.337	04	T
214	15:02:14.0	291	002043	+339.335	+002.722	04	T
214	15:02:15.0	291	002043	+339.401	+003.139	04	T
214	15:02:16.0	291	002043	+339.489	+003.568	04	T
214	15:02:17.0	291	002043	+339.598	+004.029	04	T
214	15:02:18.0	291	002043	+339.730	+004.535	04	T
214	15:02:19.0	291	002043	+339.895	+005.073	04	T
214	15:02:20.0	291	002043	+340.082	+005.611	04	T
214	15:02:21.0	291	002043	+340.269	+006.172	04	T
214	15:02:22.0	291	002043	+340.488	+006.798	04	T
214	15:02:23.0	291	002043	+340.741	+007.479	04	T
214	15:02:24.0	291	002043	+341.038	+008.182	04	T
214	15:02:25.0	291	002043	+341.345	+008.918	04	T
214	15:02:26.0	291	002043	+341.686	+009.687	04	T
214	15:02:27.0	291	002043	+342.037	+010.478	04	T
214	15:02:28.0	291	002043	+342.400	+011.302	04	T
214	15:02:29.0	291	002043	+342.795	+012.148	04	T
214	15:02:30.0	291	002043	+343.224	+013.016	04	T
214	15:02:31.0	291	002043	+343.674	+013.906	04	T
214	15:02:32.0	291	002043	+344.147	+014.818	04	T
214	15:02:33.0	291	002043	+344.641	+015.763	04	T
214	15:02:34.0	291	002043	+345.168	+016.707	04	T
214	15:02:35.0	291	002043	+345.707	+017.674	04	T
214	15:02:36.0	291	002043	+346.267	+018.663	04	T
214	15:02:37.0	291	002043	+346.860	+019.674	04	T
214	15:02:38.0	291	002043	+347.476	+020.685	04	T
214	15:02:39.0	291	002043	+348.146	+021.739	04	T
214	15:02:40.0	291	002043	+348.838	+022.816	04	T
214	15:02:41.0	291	002043	+349.541	+023.882	04	T
214	15:02:42.0	291	002043	+350.266	+024.914	04	T
214	15:02:43.0	291	002043	+351.013	+025.958	04	T
214	15:02:44.0	291	002043	+351.793	+027.013	04	T
214	15:02:45.0	291	002043	+352.606	+028.056	04	T
214	15:02:46.0	291	002043	+353.430	+029.111	04	T
214	15:02:47.0	291	002043	+354.298	+030.133	04	T
214	15:02:48.0	291	002043	+355.188	+031.176	04	T
214	15:02:49.0	291	002043	+356.100	+032.198	04	T

**** PTPC - HIGH DENSITY DATA DUMP UTILITY FOR TPTIIS DATES ****

DAY	TIME	SITE	OBJECT	AZIMUTH	ELEVATION	EMT	TRACK
214	15:02:50.0	291	002043	+357.022	+033.198	04	T
214	15:02:51.0	291	002043	+358.000	+034.108	04	T
214	15:02:52.0	291	002043	+358.989	+035.175	04	T
214	15:02:53.0	291	002043	+000.000	+036.131	04	T
214	15:02:54.0	291	002043	+001.055	+037.065	04	T
214	15:02:55.0	291	002043	+002.120	+037.988	04	T
214	15:02:56.0	291	002043	+003.208	+038.878	04	T
214	15:02:57.0	291	002043	+004.318	+039.746	04	T
214	15:02:58.0	291	002043	+005.460	+040.581	04	T
214	15:02:59.0	291	002043	+006.636	+041.394	04	T
214	15:03:00.0	291	002043	+007.833	+042.174	04	T
214	15:03:01.0	291	002043	+009.042	+042.943	04	T
214	15:03:02.0	291	002043	+010.283	+043.679	04	T
214	15:03:03.0	291	002043	+011.569	+044.393	04	T
214	15:03:04.0	291	002043	+012.876	+045.063	04	T
214	15:03:05.0	291	002043	+014.194	+045.722	04	T
214	15:03:06.0	291	002043	+015.524	+046.349	04	T
214	15:03:07.0	291	002043	+016.875	+046.942	04	T
214	15:03:08.0	291	002043	+018.248	+047.513	04	T
214	15:03:09.0	291	002043	+019.655	+048.051	04	T
214	15:03:10.0	291	002043	+021.072	+048.546	04	T
214	15:03:11.0	291	002043	+022.511	+049.029	04	T
214	15:03:12.0	291	002043	+023.961	+049.469	04	T
214	15:03:13.0	291	002043	+025.411	+049.886	04	T
214	15:03:14.0	291	002043	+026.873	+050.260	04	T
214	15:03:15.0	291	002043	+028.334	+050.611	04	T
214	15:03:16.0	291	002043	+029.806	+050.941	04	T
214	15:03:17.0	291	002043	+031.289	+051.205	04	T
214	15:03:18.0	291	002043	+032.772	+051.446	04	T
214	15:03:19.0	291	002043	+034.255	+051.666	04	T
214	15:03:20.0	291	002043	+035.739	+051.853	04	T
214	15:03:21.0	291	002043	+037.189	+051.996	04	T
214	15:03:22.0	291	002043	+038.639	+052.105	04	T
214	15:03:23.0	291	002043	+040.056	+052.193	04	T
214	15:03:24.0	291	002043	+041.484	+052.237	04	T
214	15:03:25.0	291	002043	+042.880	+052.259	04	T
214	15:03:26.0	291	002043	+044.264	+052.259	04	T
214	15:03:27.0	291	002043	+045.604	+052.215	04	T
214	15:03:28.0	291	002043	+046.912	+052.160	04	T
214	15:03:29.0	291	002043	+048.208	+052.083	04	T
214	15:03:30.0	291	002043	+049.460	+051.974	04	T
214	15:03:31.0	291	002043	+050.680	+051.853	04	T
214	15:03:32.0	291	002043	+051.855	+051.699	04	T
214	15:03:33.0	291	002043	+053.009	+051.545	04	T
214	15:03:34.0	291	002043	+054.130	+051.369	04	T
214	15:03:35.0	291	002043	+055.206	+051.172	04	T
214	15:03:36.0	291	002043	+056.261	+050.963	04	T
214	15:03:37.0	291	002043	+057.283	+050.743	04	T
214	15:03:38.0	291	002043	+058.260	+050.512	04	T
214	15:03:39.0	291	002043	+059.216	+050.271	04	T

*** STPO - HIGH DENSITY DATA DUMP UTILITY FOR SERIES SIESE ***

DAY	TIME	SITE	SSG/TEST	AZIMUTH	ELEVATION	SMT	TRACK
214	15:03:40.0	291	002043	+060.128	+050.018	04	T
214	15:03:41.0	291	002043	+061.007	+049.754	04	T
214	15:03:42.0	291	002043	+061.353	+049.491	04	T
214	15:03:43.0	291	002043	+062.677	+049.216	04	T
214	15:03:44.0	291	002043	+063.468	+048.930	04	T
214	15:03:45.0	291	002043	+064.226	+048.645	04	T
214	15:03:46.0	291	002043	+064.962	+048.359	04	T
214	15:03:47.0	291	002043	+065.654	+048.062	04	T
214	15:03:48.0	291	002043	+066.335	+047.755	04	T
214	15:03:49.0	291	002043	+066.995	+047.458	04	T
214	15:03:50.0	291	002043	+067.632	+047.162	04	T
214	15:03:51.0	291	002043	+068.225	+046.854	04	T
214	15:03:52.0	291	002043	+068.807	+046.546	04	T
214	15:03:53.0	291	002043	+069.368	+046.250	04	T
214	15:03:54.0	291	002043	+069.906	+045.942	04	T
214	15:03:55.0	291	002043	+070.411	+045.634	04	T
214	15:03:56.0	291	002043	+070.906	+045.338	04	T
214	15:03:57.0	291	002043	+071.378	+045.030	04	T
214	15:03:58.0	291	002043	+071.818	+044.745	04	T
214	15:03:59.0	291	002043	+072.257	+044.448	04	T
214	15:04:00.0	291	002043	+072.664	+044.151	04	T
214	15:04:01.0	291	002043	+073.059	+043.877	04	T
214	15:04:02.0	291	002043	+073.444	+043.591	04	T
214	15:04:03.0	291	002043	+073.795	+043.305	04	T
214	15:04:04.0	291	002043	+074.147	+043.042	04	T
214	15:04:05.0	291	002043	+074.487	+042.767	04	T
214	15:04:06.0	291	002043	+074.806	+042.492	04	T
214	15:04:07.0	291	002043	+075.125	+042.229	04	T
214	15:04:08.0	291	002043	+075.410	+041.965	04	T
214	15:04:09.0	291	002043	+075.696	+041.712	04	T
214	15:04:10.0	291	002043	+075.981	+041.449	04	T
214	15:04:11.0	291	002043	+076.245	+041.196	04	T
214	15:04:12.0	291	002043	+076.509	+040.943	04	T
214	15:04:13.0	291	002043	+076.750	+040.691	04	T
214	15:04:14.0	291	002043	+077.003	+040.438	04	T
214	15:04:15.0	291	002043	+077.234	+040.196	04	T
214	15:04:16.0	291	002043	+077.454	+039.955	04	T
214	15:04:17.0	291	002043	+077.673	+039.713	04	T
214	15:04:18.0	291	002043	+077.893	+039.471	04	T
214	15:04:19.0	291	002043	+078.091	+039.229	04	T
214	15:04:20.0	291	002043	+078.289	+038.999	04	T
214	15:04:21.0	291	002043	+078.486	+038.768	04	T
214	15:04:22.0	291	002043	+078.673	+038.537	04	T
214	15:04:23.0	291	002043	+078.860	+038.307	04	T
214	15:04:24.0	291	002043	+079.036	+038.076	04	T
214	15:04:25.0	291	002043	+079.211	+037.856	04	T
214	15:04:26.0	291	002043	+079.376	+037.636	04	T
214	15:04:27.0	291	002043	+079.541	+037.406	04	T
214	15:04:28.0	291	002043	+079.695	+037.186	04	T
214	15:04:29.0	291	002043	+079.849	+036.966	04	T

*** PIPO - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ***

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EXT	TRACK
214	15:04:30.0	291	002043	+080.002	+036.756	04	T
214	15:04:31.0	291	002043	+080.156	+036.538	04	T
214	15:04:32.0	291	002043	+080.299	+036.329	04	T
214	15:04:33.0	291	002043	+080.442	+036.109	04	T
214	15:04:34.0	291	002043	+080.574	+035.901	04	T
214	15:04:35.0	291	002043	+080.706	+035.692	04	T
214	15:04:36.0	291	002043	+080.826	+035.483	04	T
214	15:04:37.0	291	002043	+080.958	+035.274	04	T
214	15:04:38.0	291	002043	+081.079	+035.066	04	T
214	15:04:39.0	291	002043	+081.200	+034.868	04	T
214	15:04:40.0	291	002043	+081.321	+034.659	04	T
214	15:04:41.0	291	002043	+081.442	+034.450	04	T
214	15:04:42.0	291	002043	+081.541	+034.253	04	T
214	15:04:43.0	291	002043	+081.650	+034.044	04	T
214	15:04:44.0	291	002043	+081.760	+033.846	04	T
214	15:04:45.0	291	002043	+081.859	+033.648	04	T
214	15:04:46.0	291	002043	+081.969	+033.451	04	T
214	15:04:47.0	291	002043	+082.068	+033.253	04	T
214	15:04:48.0	291	002043	+082.167	+033.066	04	T
214	15:04:49.0	291	002043	+082.266	+032.879	04	T
214	15:04:50.0	291	002043	+082.354	+032.682	04	T
214	15:04:51.0	291	002043	+082.452	+032.495	04	T
214	15:04:52.0	291	002043	+082.540	+032.297	04	T
214	15:04:53.0	291	002043	+082.628	+032.099	04	T
214	15:04:54.0	291	002043	+082.716	+031.924	04	T
214	15:04:55.0	291	002043	+082.804	+031.737	04	T
214	15:04:56.0	291	002043	+082.881	+031.550	04	T
214	15:04:57.0	291	002043	+082.958	+031.363	04	T
214	15:04:58.0	291	002043	+083.046	+031.176	04	T
214	15:04:59.0	291	002043	+083.123	+030.990	04	T
214	15:05:00.0	291	002043	+083.199	+030.803	04	T
214	15:05:01.0	291	002043	+083.276	+030.627	04	T
214	15:05:02.0	291	002043	+083.353	+030.440	04	T
214	15:05:03.0	291	002043	+083.419	+030.265	04	T
214	15:05:04.0	291	002043	+083.496	+030.089	04	T
214	15:05:05.0	291	002043	+083.562	+029.913	04	T
214	15:05:06.0	291	002043	+083.639	+029.726	04	T
214	15:05:07.0	291	002043	+083.694	+029.550	04	T
214	15:05:08.0	291	002043	+083.771	+029.375	04	T
214	15:05:09.0	291	002043	+083.826	+029.199	04	T
214	15:05:10.0	291	002043	+083.903	+029.034	04	T
214	15:05:11.0	291	002043	+083.958	+028.858	04	T
214	15:05:12.0	291	002043	+084.023	+028.683	04	T
214	15:05:13.0	291	002043	+084.078	+028.507	04	T
214	15:05:14.0	291	002043	+084.133	+028.342	04	T
214	15:05:15.0	291	002043	+084.199	+028.166	04	T
214	15:05:16.0	291	002043	+084.265	+028.001	04	T
214	15:05:17.0	291	002043	+084.320	+027.837	04	T
214	15:05:18.0	291	002043	+084.375	+027.661	04	T
214	15:05:19.0	291	002043	+084.430	+027.496	04	T

**** PIPC - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRAIL
214	15:05:20.0	291	002043	+084.485	+027.331	04	T
214	15:05:21.0	291	002043	+084.540	+027.166	04	T
214	15:05:22.0	291	002043	+084.595	+027.002	04	T
214	15:05:23.0	291	002043	+084.639	+026.837	04	T
214	15:05:24.0	291	002043	+084.694	+026.672	04	T
214	15:05:25.0	291	002043	+084.738	+026.518	04	T
214	15:05:26.0	291	002043	+084.792	+026.353	04	T
214	15:05:27.0	291	002043	+084.836	+026.200	04	T
214	15:05:28.0	291	002043	+084.891	+026.035	04	T
214	15:05:29.0	291	002043	+084.935	+025.870	04	T
214	15:05:30.0	291	002043	+084.979	+025.716	04	T
214	15:05:31.0	291	002043	+085.034	+025.562	04	T
214	15:05:32.0	291	002043	+085.078	+025.398	04	T
214	15:05:33.0	291	002043	+085.122	+025.244	04	T
214	15:05:34.0	291	002043	+085.166	+025.079	04	T
214	15:05:35.0	291	002043	+085.210	+024.925	04	T
214	15:05:36.0	291	002043	+085.254	+024.771	04	T
214	15:05:37.0	291	002043	+085.298	+024.629	04	T
214	15:05:38.0	291	002043	+085.331	+024.475	04	T
214	15:05:39.0	291	002043	+085.375	+024.321	04	T
214	15:05:40.0	291	002043	+085.419	+024.167	04	T
214	15:05:41.0	291	002043	+085.452	+024.013	04	T
214	15:05:42.0	291	002043	+085.496	+023.871	04	T
214	15:05:43.0	291	002043	+085.540	+023.717	04	T
214	15:05:44.0	291	002043	+085.573	+023.563	04	T
214	15:05:45.0	291	002043	+085.616	+023.409	04	T
214	15:05:46.0	291	002043	+085.649	+023.266	04	T
214	15:05:47.0	291	002043	+085.693	+023.123	04	T
214	15:05:48.0	291	002043	+085.715	+022.970	04	T
214	15:05:49.0	291	002043	+085.759	+022.827	04	T
214	15:05:50.0	291	002043	+085.792	+022.684	04	T
214	15:05:51.0	291	002043	+085.825	+022.541	04	T
214	15:05:52.0	291	002043	+085.869	+022.398	04	T
214	15:05:53.0	291	002043	+085.891	+022.256	04	T
214	15:05:54.0	291	002043	+085.935	+022.113	04	T
214	15:05:55.0	291	002043	+085.968	+021.970	04	T
214	15:05:56.0	291	002043	+086.001	+021.827	04	T
214	15:05:57.0	291	002043	+086.023	+021.684	04	T
214	15:05:58.0	291	002043	+086.067	+021.552	04	T
214	15:05:59.0	291	002043	+086.100	+021.410	04	T
214	15:06:00.0	291	002043	+086.133	+021.267	04	T
214	15:06:01.0	291	002043	+086.155	+021.124	04	T
214	15:06:02.0	291	002043	+086.188	+020.992	04	T
214	15:06:03.0	291	002043	+086.221	+020.860	04	T
214	15:06:04.0	291	002043	+086.243	+020.717	04	T
214	15:06:05.0	291	002043	+086.287	+020.586	04	T
214	15:06:06.0	291	002043	+086.309	+020.454	04	T
214	15:06:07.0	291	002043	+086.331	+020.311	04	T
214	15:06:08.0	291	002043	+086.364	+020.179	04	T
214	15:06:09.0	291	002043	+086.396	+020.047	04	T

*** PIPS - HIGH DENSITY DATA DUMP UTILITY FOR OPTICS SITES ***

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	EMI	ERAS
214	15:06:10.0	291	002043	+086.418	+019.915	04	I
214	15:06:11.0	291	002043	+086.451	+019.784	04	I
214	15:06:12.0	291	002043	+086.473	+019.652	04	I
214	15:06:13.0	291	002043	+086.506	+019.520	04	I
214	15:06:14.0	291	002043	+086.528	+019.388	04	I
214	15:06:15.0	291	002043	+086.550	+019.256	04	I
214	15:06:16.0	291	002043	+086.583	+019.124	04	I
214	15:06:17.0	291	002043	+086.616	+019.004	04	I
214	15:06:18.0	291	002043	+086.638	+018.872	04	I
214	15:06:19.0	291	002043	+086.660	+018.751	04	I
214	15:06:20.0	291	002043	+086.682	+018.619	04	I
214	15:06:21.0	291	002043	+086.704	+018.487	04	I
214	15:06:22.0	291	002043	+086.726	+018.366	04	I
214	15:06:23.0	291	002043	+086.759	+018.235	04	I
214	15:06:24.0	291	002043	+086.770	+018.114	04	I
214	15:06:25.0	291	002043	+086.803	+017.993	04	I
214	15:06:26.0	291	002043	+086.825	+017.861	04	I
214	15:06:27.0	291	002043	+086.847	+017.740	04	I
214	15:06:28.0	291	002043	+086.869	+017.619	04	I
214	15:06:29.0	291	002043	+086.891	+017.498	04	I
214	15:06:30.0	291	002043	+086.924	+017.378	04	I
214	15:06:31.0	291	002043	+086.946	+017.257	04	I
214	15:06:32.0	291	002043	+086.968	+017.136	04	I
214	15:06:33.0	291	002043	+086.979	+017.015	04	I
214	15:06:34.0	291	002043	+087.012	+016.894	04	I
214	15:06:35.0	291	002043	+087.034	+016.762	04	I
214	15:06:36.0	291	002043	+087.056	+016.642	04	I
214	15:06:37.0	291	002043	+087.078	+016.532	04	I
214	15:06:38.0	291	002043	+087.100	+016.411	04	I
214	15:06:39.0	291	002043	+087.111	+016.290	04	I
214	15:06:40.0	291	002043	+087.133	+016.180	04	I
214	15:06:41.0	291	002043	+087.155	+016.059	04	I
214	15:06:42.0	291	002043	+087.177	+015.938	04	I
214	15:06:43.0	291	002043	+087.198	+015.840	04	I
214	15:06:44.0	291	002043	+087.209	+015.719	04	I
214	15:06:45.0	291	002043	+087.231	+015.609	04	I
214	15:06:46.0	291	002043	+087.253	+015.488	04	I
214	15:06:47.0	291	002043	+087.275	+015.367	04	I
214	15:06:48.0	291	002043	+087.286	+015.257	04	I
214	15:06:49.0	291	002043	+087.308	+015.147	04	I
214	15:06:50.0	291	002043	+087.330	+015.038	04	I
214	15:06:51.0	291	002043	+087.341	+014.917	04	I
214	15:06:52.0	291	002043	+087.363	+014.807	04	I
214	15:06:53.0	291	002043	+087.385	+014.697	04	I
214	15:06:54.0	291	002043	+087.396	+014.587	04	I
214	15:06:55.0	291	002043	+087.418	+014.477	04	I
214	15:06:56.0	291	002043	+087.429	+014.378	04	I
214	15:06:57.0	291	002043	+087.451	+014.268	04	I
214	15:06:58.0	291	002043	+087.462	+014.159	04	I
214	15:06:59.0	291	002043	+087.484	+014.049	04	I

**** PIPO - HIGH DENSITY DATA DUMP UTILITY FOR [illegible] ****

DAY	TIME	SIZE	OBJ/TEST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:07:00.0	291	002043	+087.506	+013.939	04	T
214	15:07:01.0	291	002043	+087.517	+013.829	04	T
214	15:07:02.0	291	002043	+087.539	+013.730	04	T
214	15:07:03.0	291	002043	+087.561	+013.620	04	T
214	15:07:04.0	291	002043	+087.572	+013.521	04	T
214	15:07:05.0	291	002043	+087.594	+013.412	04	T
214	15:07:06.0	291	002043	+087.605	+013.302	04	T
214	15:07:07.0	291	002043	+087.616	+013.203	04	T
214	15:07:08.0	291	002043	+087.638	+013.104	04	T
214	15:07:09.0	291	002043	+087.649	+012.994	04	T
214	15:07:10.0	291	002043	+087.671	+012.895	04	T
214	15:07:11.0	291	002043	+087.682	+012.785	04	T
214	15:07:12.0	291	002043	+087.693	+012.686	04	T
214	15:07:13.0	291	002043	+087.715	+012.588	04	T
214	15:07:14.0	291	002043	+087.726	+012.489	04	T
214	15:07:15.0	291	002043	+087.737	+012.379	04	T
214	15:07:16.0	291	002043	+087.759	+012.280	04	T
214	15:07:17.0	291	002043	+087.770	+012.181	04	T
214	15:07:18.0	291	002043	+087.781	+012.082	04	T
214	15:07:19.0	291	002043	+087.803	+011.983	04	T
214	15:07:20.0	291	002043	+087.814	+011.884	04	T
214	15:07:21.0	291	002043	+087.825	+011.786	04	T
214	15:07:22.0	291	002043	+087.847	+011.687	04	T
214	15:07:23.0	291	002043	+087.858	+011.588	04	T
214	15:07:24.0	291	002043	+087.869	+011.500	04	T
214	15:07:25.0	291	002043	+087.891	+011.401	04	T
214	15:07:26.0	291	002043	+087.902	+011.302	04	T
214	15:07:27.0	291	002043	+087.913	+011.203	04	T
214	15:07:28.0	291	002043	+087.924	+011.115	04	T
214	15:07:29.0	291	002043	+087.935	+011.017	04	T
214	15:07:30.0	291	002043	+087.946	+010.918	04	T
214	15:07:31.0	291	002043	+087.957	+010.830	04	T
214	15:07:32.0	291	002043	+087.979	+010.731	04	T
214	15:07:33.0	291	002043	+087.990	+010.643	04	T
214	15:07:34.0	291	002043	+088.000	+010.544	04	T
214	15:07:35.0	291	002043	+088.022	+010.456	04	T
214	15:07:36.0	291	002043	+088.033	+010.357	04	T
214	15:07:37.0	291	002043	+088.044	+010.269	04	T
214	15:07:38.0	291	002043	+088.055	+010.182	04	T
214	15:07:39.0	291	002043	+088.066	+010.094	04	T
214	15:07:40.0	291	002043	+088.077	+009.995	04	T
214	15:07:41.0	291	002043	+088.088	+009.907	04	T
214	15:07:42.0	291	002043	+088.110	+009.819	04	T
214	15:07:43.0	291	002043	+088.110	+009.731	04	T
214	15:07:44.0	291	002043	+088.121	+009.643	04	T
214	15:07:45.0	291	002043	+088.132	+009.555	04	T
214	15:07:46.0	291	002043	+088.154	+009.467	04	T
214	15:07:47.0	291	002043	+088.165	+009.380	04	T
214	15:07:48.0	291	002043	+088.176	+009.292	04	T
214	15:07:49.0	291	002043	+088.187	+009.193	04	T

DAY	TIME	SITE	OBJ/CBST	AZIMUTH	ELEVATION	EMT	TRACK
214	15:07:50.0	291	002043	+088.158	+009.105	04	T
214	15:07:51.0	291	002043	+088.209	+009.017	04	T
214	15:07:52.0	291	002043	+088.220	+008.929	04	T
214	15:07:53.0	291	002043	+088.231	+008.841	04	T
214	15:07:54.0	291	002043	+088.242	+008.764	04	T
214	15:07:55.0	291	002043	+088.253	+008.676	04	T
214	15:07:56.0	291	002043	+088.264	+008.600	04	T
214	15:07:57.0	291	002043	+088.275	+008.512	04	T
214	15:07:58.0	291	002043	+088.286	+008.424	04	T
214	15:07:59.0	291	002043	+088.297	+008.336	04	T
214	15:08:00.0	291	002043	+088.308	+008.248	04	T
214	15:08:01.0	291	002043	+088.319	+008.171	04	T
214	15:08:02.0	291	002043	+088.330	+008.083	04	T
214	15:08:03.0	291	002043	+088.341	+008.006	04	T
214	15:08:04.0	291	002043	+088.341	+007.918	04	T
214	15:08:05.0	291	002043	+088.352	+007.841	04	T
214	15:08:06.0	291	002043	+088.374	+007.754	04	T
214	15:08:07.0	291	002043	+088.385	+007.677	04	T
214	15:08:08.0	291	002043	+088.396	+007.589	04	T
214	15:08:09.0	291	002043	+088.396	+007.512	04	T
214	15:08:10.0	291	002043	+088.407	+007.435	04	T
214	15:08:11.0	291	002043	+088.418	+007.358	04	T
214	15:08:12.0	291	002043	+088.429	+007.281	04	T
214	15:08:13.0	291	002043	+088.440	+007.204	04	T
214	15:08:14.0	291	002043	+088.440	+007.127	04	T
214	15:08:15.0	291	002043	+088.462	+007.039	04	T
214	15:08:16.0	291	002043	+088.462	+006.963	04	T
214	15:08:17.0	291	002043	+088.473	+006.886	04	T
214	15:08:18.0	291	002043	+088.484	+006.809	04	T
214	15:08:19.0	291	002043	+088.495	+006.732	04	T
214	15:08:20.0	291	002043	+088.506	+006.655	04	T
214	15:08:21.0	291	002043	+088.517	+006.578	04	T
214	15:08:22.0	291	002043	+088.517	+006.501	04	T
214	15:08:23.0	291	002043	+088.528	+006.424	04	T
214	15:08:24.0	291	002043	+088.539	+006.347	04	T
214	15:08:25.0	291	002043	+088.550	+006.270	04	T
214	15:08:26.0	291	002043	+088.561	+006.194	04	T
214	15:08:27.0	291	002043	+088.561	+006.128	04	T
214	15:08:28.0	291	002043	+088.572	+006.051	04	T
214	15:08:29.0	291	002043	+088.583	+005.963	04	T
214	15:08:30.0	291	002043	+088.594	+005.897	04	T
214	15:08:31.0	291	002043	+088.605	+005.820	04	T
214	15:08:32.0	291	002043	+088.605	+005.754	04	T
214	15:08:33.0	291	002043	+088.616	+005.688	04	T
214	15:08:34.0	291	002043	+088.616	+005.611	04	T
214	15:08:35.0	291	002043	+088.638	+005.534	04	T
214	15:08:36.0	291	002043	+088.649	+005.457	04	T
214	15:08:37.0	291	002043	+088.649	+005.392	04	T
214	15:08:38.0	291	002043	+088.660	+005.315	04	T
214	15:08:39.0	291	002043	+088.671	+005.249	04	T

**** PTPC - HIGH DENSITY DATA DUMP UTILITY FOR SERVICE SITES ****

DAY	TIME	SITE	OBJ/TEST	AZIMUTH	ELEVATION	FMT	TRACK
214	15:08:40.0	291	002043	+088.671	+005.172	04	T
214	15:08:41.0	291	002043	+088.682	+005.106	04	T
214	15:08:42.0	291	002043	+088.682	+005.029	04	T
214	15:08:43.0	291	002043	+088.693	+004.963	04	T
214	15:08:44.0	291	002043	+088.704	+004.897	04	T
214	15:08:45.0	291	002043	+088.715	+004.820	04	T
214	15:08:46.0	291	002043	+088.715	+004.754	04	T
214	15:08:47.0	291	002043	+088.726	+004.688	04	T
214	15:08:48.0	291	002043	+088.737	+004.612	04	T
214	15:08:49.0	291	002043	+088.737	+004.546	04	T
214	15:08:50.0	291	002043	+088.748	+004.480	04	T
214	15:08:51.0	291	002043	+088.748	+004.414	04	T
214	15:08:52.0	291	002043	+088.759	+004.337	04	T
214	15:08:53.0	291	002043	+088.770	+004.271	04	T
214	15:08:54.0	291	002043	+088.781	+004.205	04	T
214	15:08:55.0	291	002043	+088.781	+004.150	04	T
214	15:08:56.0	291	002043	+088.792	+004.073	04	T
214	15:08:57.0	291	002043	+088.813	+004.018	04	T
214	15:08:58.0	291	002043	+088.813	+003.941	04	T
214	15:08:59.0	291	002043	+088.813	+003.875	04	T
214	15:09:00.0	291	002043	+088.835	+003.799	04	T
214	15:09:01.0	291	002043	+088.835	+003.733	04	T
214	15:09:02.0	291	002043	+088.846	+003.656	04	T
214	15:09:03.0	291	002043	+088.857	+003.590	04	T
214	15:09:04.0	291	002043	+088.857	+003.535	04	T

Acronym List

Acronym List

AFB	AIR FORCE BASE
BSM	BOOSTER SEPARATION MOTOR
CAD	COMPUTER AIDED DESIGN
CCD	CHARGED COUPLED DEVICE
DCS	DEBRIS CONTAINMENT SYSTEM
DOAMS	DISTANT OBJECT ATTITUDE MEASUREMENT SYSTEM
DTV	DRYDEN TELEVISION
E	ENGINEERING
ECD	EASTMAN COLOR NEGATIVE/DAYLIGHT
EP	ENGINEERING PRINT
ET	EXTERNAL TANK
ET	ENGINEERING TELEVISION
FPS	FRAMES PER SECOND
FSS	FIXED SERVICE STRUCTURE
GH	GASEOUS HYDROGEN
GOX	GASEOUS OXYGEN
GMT	GREENWICH MEAN TIME
GUCP	GROUND UMBILICAL CARRIER PLATE
HSI	HUE, SATURATION, INTENSITY
IRIG	INTER RANGE INTRUMENTATION GROUP
JSC	JOHNSON SPACE CENTER
KSC	KENNEDY SPACE CENTER
KTV	KENNEDY TELEVISION
LED	LIGHT EMITTING DIODES
LESC	LOCKHEED ENGINEERING AND SCIENCES COMPANY
LHSRB	LEFT HAND SOLID ROCKET BOOSTER
LH	LIQUID HYDROGEN
LO	LIQUID OXYGEN
LOX	LIQUID OXYGEN
LSRB	LEFT SOLID ROCKET BOOSTER
m	METERS
MER	MISSION EVALUATION ROOM
MET	MISSION ELAPSED TIME
MLP	MOBIL LAUNCH PLATFORM
MMT	MISSION MANAGEMENT TEAM
MSFC	MARSHALL SPACE FLIGHT CENTER
NASA	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
NORAD	NORTH AMERICAN AIR DEFENCE COMMAND
NSTS	NATIONAL SPACE TRANSPORTATION SYSTEM
OAMS	ORBITAL ATTITUDE AND MANUEVERING SYSTEM
OMRSD	OPERATION MAINTENANCE REQUIREMENTS AND SPECIFICATIONS DOCUMENT
OMS	ORBITAL MANEUVERING SUBSYSTEM
ORB	ORBITER
OTV	OPERATIONAL TELEVISION
OV	ORBITER VEHICLE
RCC	REINFORCED CARBON CARBON
PADD	PHOTOGRAPHIC ACQUISITION DISPOSITION DOCUMENT
PAL	PROTUBERANCE AIR LOAD
RCS	REACTION CONTROL SYSTEM
RHSRB	RIGHT HAND SOLID ROCKET BOOSTER

ROFI	RADIALLY OUTWARD FIRE IGNITORS
ROTI	RECORDING OPTICAL TRACKING INSTRUMENT
RSRB	RIGHT SOLID ROCKET BOOSTER
RSS	ROTATING SERVICE STRUCTURE
SLV	SHUTTLE LANDING VEHICLE
SOFI	SPRAY ON FOAM INSULATION
SRB	SOLID ROCKET BOOSTER
SSME	SPACE SHUTTLE MAIN ENGINE
STS	SPACE TRANSPORTATION SYSTEM
T-0	LIFTOFF TIME
TPS	THERMAL PROTECTION SYSTEM
TSM	TAIL SERVICE MAST
TV	TELEVISION
UTC	COORDINATED UNIVERSAL TIME
VDAS	VIDEO DIGITAL ANALYSIS SYSTEM
VND	VIDEO NEWS DAYLIGHT FILM

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