

STS 51-J National Space Transportation System Mission Report


December 1985



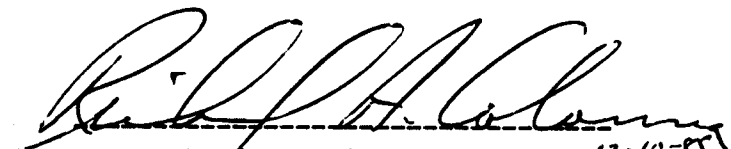
**National Aeronautics and
Space Administration**

**Lyndon B. Johnson Space Center
Houston, Texas**

STS 51-J
NATIONAL SPACE TRANSPORTATION SYSTEM
MISSION REPORT



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INTRODUCTION AND MISSION OBJECTIVES

The STS 51-J National Space Transportation System Mission Report contains a summary of the Orbiter, ET (external tank), SRB (solid rocket booster), and SSME (Space Shuttle main engine)/MPS (main propulsion system) systems operation for the twenty-first Space Shuttle mission. This was the first flight of the Orbiter vehicle Atlantis (OV-104). Because of the security classification assigned to this mission, this report contains no discussion of any of the classified mission activities or accomplishments.

Table I contains the sequence of events of major mission activities that are unclassified. This report also contains a discussion of the most significant unclassified Orbiter problem. Table II contains a listing of all unclassified Orbiter problems/anomalies.

MISSION SUMMARY

The STS 51-J mission was launched on October 3, 1985, at 273:15:15:30 G.m.t., from KSC with five crew members. The crew members for this mission were Karol J. Bobko, Col., U. S. Air Force, Commander; Ronald J. Grabe, Lt. Col., U. S. Air Force, Pilot; David C. Hilmers, Maj., U. S. Marine Corp., and Robert C. Stewart, Col., U. S. Army, Mission Specialists; and William A. Pailles, Maj., U. S. Air Force, Payload Specialist.

The countdown phase was completed satisfactorily. All system operations were nominal during the ascent phase. SRB motor performance was near the predicted levels and well within the allowable envelopes. External tank and MPS performance was excellent with MECO (main engine cutoff) near the predicted time.

The entry phase system operations were satisfactory with the Orbiter landing on runway 23 at Edwards Air Force Base at 280:17:00:08 G.m.t. on October 7, 1985. The rollout distance was 8056 ft. An inspection of the Orbiter after landing showed TPS (thermal protection system) damage to the left inboard elevon and the nose cap.

VEHICLE ASSESSMENT

SOLID ROCKET BOOSTER

All SRB systems performed as expected. The SRB prelaunch countdown was nominal with no problems noted. Performance of both SRM's (solid rocket motors) was close to predicted values and well within the allowable envelopes.

The SRB recovery system performed nominally, both SRB's drogues, frustums, and main parachutes were recovered and are reusable.

I. - STS 51-J SEQUENCE OF EVENTS

Parameter	G.m.t., hr:min:sec
APU Activation (1)	276:15:10:39
(2)	276:15:10:41
(3)	276:15:10:43
SRB HPU activation command (LH-A2)	276:15:14:59.4
MPS start command sequence (engine 3)	276:15:15:23.4
SRB ignition command from GPC (lift-off)	276:15:15:30
MPS throttle-down to 68-percent (engine 3)	276:15:15:55.4
MPS throttle-down to 65-percent (engine 3)	276:15:16:00.9
Maximum dynamic pressure	276:15:16:19
MPS throttle-up to 104-percent (engine 3)	276:15:16:24.57
SRB separation command from GPC	276:15:17:34
MPS throttle-down from 3g acceleration (engine 3)	276:15:23:05
Main engine cutoff (MECO)	276:15:24:02
External tank separation	276:15:24:20
APU deactivation (1)	276:15:30:21
(2)	276:15:30:22
(3)	276:15:30:23
Flight control system checkout APU 3 start	279:17:32:01
APU 3 shutdown	279:17:37:38
APU 1 activation	280:15:45:31
APU activation (2)	280:16:17:30
(3)	280:16:17:37
Entry Interface	280:16:30:21
End blackout	280:16:48:12
Terminal area energy management (TAEM)	280:16:53:53
Main landing gear contact	280:17:00:08
Nose landing gear contact	280:17:00:15
Wheels stop	280:17:01:13
APU deactivation complete (3)	280:17:13:47

EXTERNAL TANK

All ET systems performed as expected. There was only one minor ET instrumentation anomaly. There was no ice/frost buildup observed, and the vehicle was clean at lift-off.

SPACE SHUTTLE MAIN ENGINE

The SSME performance data during prelaunch, mainstage, shutdown and propellant dump were within specifications. Engine 1 HPTP (high pressure fuel turbopump) line pressure oscillations were observed during mainstage. This pump will be replaced before the next flight.

MAIN PROPULSION SYSTEM

The overall performance of the MPS was excellent. All pretanking purges were performed satisfactorily. The LO2 (liquid oxygen) and LH2 (liquid hydrogen) propellant loading, prepressurization and pressurization systems performed as planned. Propellant loading was accomplished with no flow stopages.

Ascent performance of the MPS was normal and was within specification requirements throughout the flight. At approximately T + 235 seconds, the Orbiter ME (main engine)-2 LH2 inlet temperature measurement failed; however, this had no effect on the flight. Trajectory reconstruction indicated that the vehicle specific impulse was near the MPS assessment tag values. One DTO (detailed test objective), 40 percent MPS Vacuum Dump Test, was successfully performed.

ORBITER

All Orbiter systems operated very satisfactorily with only eleven anomalies occurring during the flight. A discussion of the most significant problem is contained in the following paragraph, and a complete listing of all problems and anomalies is contained in Table II.

Intermittent Power to SSME 3 LH2 Prevalve

During preflight ground checkout, the right LH2 prevalve close RPC (remote power controller)-A power output indication was intermittent. Troubleshooting procedures were implemented to verify that the prevalve open functions were good. During this activity, the right LH2 prevalve open power on indication was intermittent when open command C was removed. Analysis of the circuitry indicated that even if the above two failures became hard failures during ascent, it would have required an additional failure to cause inadvertent closure of the prevalve. Therefore, the vehicle was launched with potential intermittent conditions and there was no mission impact.

JSC STS 51-J PROBLEM TRACKING LIST FOR OV-10A ATLANTIS FLIGHT 1

OCT. 25, 1985

NO.	TITLE	TIME, G.M.T.	COMMENTS	RESP. MGR.
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1	SSME 3 LH2 PREVALVE:			
A	CLOSE REMOTE POWER CONTROLLER "A" FAULTY "ON" INDICATION (V76X4126E).	PRELAUNCH	PRIOR TO LOADING, CLOSE RPC "A" WAS BLINKING WHEN PREVALVE WAS OPEN. SUSPECT AVIONICS BAY 6 COMMON WIRING PROBLEM. T/S AT KSC.	S. MURRAY D. PREVEITT
B	OPEN POWER CIRCUIT DID NOT OPERATE PROPERLY (V41X1303E).	PRELAUNCH	DURING SPECIAL ELECTRICAL TESTS, WHEN OPEN COMMANDS "A" AND "B" ONLY WERE "ON" (V41K1319X AND I320X). CHIT J-1810.	S. MURRAY D. PREVEITT
2	PORT PPM SHOULDER "A" PYRO INITIATOR CIRCUIT FAILED SELF TEST.	PRELAUNCH	FAILED RESISTANCE TEST. B WAS GOOD. IF PIC "A" FIRES, GUILLOTINE WOULD CUT RMS WIRE BUNDLE. POSTFLIGHT A CRUSHED WIRE WAS FOUND 2 INCHES FROM THE PYRO CONNECTOR.	J. PECK
3	INSTRUMENTATION:			
A	FUEL CELL 1 HYDROGEN FLOW (V45R0170A) LOW.	276:02:02 PRELAUNCH	DURING FUEL CELL PURGE, FLOW WAS 0.215 LBS/HR FOR 10 MINUTES. AT 276:04:18 FC 1 WAS ACTIVATED AND FLOW WAS NORMAL DURING MISSION. FLY AS IS.	F. PLAUCHE
B	SSME 2 LH2 INLET TEMPERATURE FAILED (V41T1201C).	T+4 MIN	INDICATED OFF SCALE HIGH. R&R AT KSC.	D. PREVEITT DR 28F007
C	APU 1 GAS GENERATOR VALVE MODULE TEMPERATURE FAILED (V46T0171A).	POST MECO	INDICATED OFF SCALE LOW AND THEN WAS INTERMITTENT. PREFLIGHT WAIVER. SUSPECT LOOSE WIRING. USED T2 (V46T0172A) TO VERIFY TEMPERATURE. T/S AND REPAIR AT KSC.	W. SCOTT
D	FES FREON COOLANT LOOP 1 TEMPERATURE (V63T1207) RESPONSE UNUSUAL AND FCL 2 TEMPERATURE (V63T1407) LAGGED FCL 1.	ASCENT AND ON ORBIT	AT T+2 MIN 45 SEC FCL 1 TEMP DROPPED TO 32 DEG F SETTING OFF C&W AND THEN RECOVERED. LAG RESPONSE SIMILAR ON OV-099. INSULATION OK. R&F FCL 2 SENSOR.	H. ROTTER

UNCLASSIFIED

JSC STS 51-J PROBLEM TRACKING LIST FOR OV-104 ATLANTIS FLIGHT 1

OCT. 25, 1985

NO.	TITLE	TIME, G.M.T.	COMMENTS	RESP. MGR.
E	FUEL CELL 3 OXYGEN FLOW METER (V45R0360) FAILED.	FLT DAY 4	READ OFF SCALE LOW. FUEL CELL OPERATION NORMAL. T/S AT KSC VERIFIED FAILURE. IPR. REPAIR WHEN FC IS PULLED. FLY AS IS.	F. PLAUCHE DR 28F006
F	APU 1 EXHAUST GAS TEMPERATURE 2 (V46T0140A) FAILED.	ENTRY	READ OFF SCALE LOW. R&R AT KSC.	W. SCOTT CAR 28F002
4	WSB 2 REGULATOR PRESSURE (V58P0204) DECAYED.	FLT DAY 1	SUSPECT RELIEF VALVE DID NOT FULLY SEAT AFTER ASCENT. SEE PROBLEM STS-8-17. T/S POSTFLIGHT FOUND OUT-OF-SPEC LEAK.	J. WILTZ DR 28F009
5	OPERATIONS RECORDER 2 TRACKS 7, 8 AND 9 INTERMITTENT.	FLT DAYS 3 AND 4	OTHER TRACKS FUNCTIONED PROPERLY. SEE PROBLEM STS-51F-13. DUMPED RECORDER AT DRYDEN AND KSC. R&R AT KSC.	J. MELUGIN HEN 0055F
6	RIGHT OMS FUEL TOTAL QUANTITY READING OFFSET (V43Q5331C).	DEORBIT	READ GOOD UNTIL NEAR END OF DEORBIT BURN, THEN IT HAD ABOUT A 10 PERCENT HIGH OFFSET. RIGHT POD IS FROM OV-099. FOUND GLASS BROKEN IN PROBE BUT NO LEAK. DEFER REPAIR UNTIL POD IS PULLED. FLY AS IS.	J. HOOPER
7	THERMAL PROTECTION SYSTEM DAMAGE ON LEFT INBOARD ELEVON LEADING EDGE AND IN NOSE CAP AREA.	LAUNCH AND ENTRY	GAP FILLER LOSS, SEVERE TILE EROSION AND AFT CARRIER PLATE DAMAGE WITH PROBABLE STRUCTURAL DAMAGE TO ELEVON. SEVERE TILE SLUMP WITH POSSIBLE SUBSURFACE FLOW TO NOSE CAP STRUCTURE. INSTALLED DOUBLERS ON ELEVON SUB-STRUCTURE.	J. SMITH CAR 23F009
8	SSME 1 AND 2 PITCH AND YAW ACTUATOR SECONDARY DELTA PRESSURES HIGH.	FLT DAY 4	AFTER SSME HYDRAULIC REPRESS, READ 300 TO 500 PSI. CONDITION EXISTED UNTIL APU 1 WAS SHUT DOWN AFTER LANDING. SUSPECT ISO VALVE LEAK. T/S AT KSC.	J. WILTZ CAR 28F008
9	PAYLOAD BAY CAMERA "B" WAS DIFFICULT TO FOCUS AND CAMERA "C" AZIMUTH AND ELEVATION FAILED.	ON ORBIT	CAMERA "C" ONLY MOVED CLOCKWISE, THEN PITCH SLOWED DOWN AND FINALLY THE AZ/EL STUCK. T/S AT KSC DID NOT REPEAT EITHER PROBLEM. R&R AT KSC.	B. EMBREY JSC EE615F JSC EE616F

UNCLASSIFIED

JSC STS 51-J PROBLEM TRACKING LIST FOR OV-104 ATLANTIS FLIGHT 1

OCT. 25, 1985

RESP. MGR.

COMMENTS

TIME, G.M.T.

TITLE

NO.	TITLE	TIME, G.M.T.	COMMENTS	RESP. MGR.
10	HATCHES:			
A	AIRLOCK HATCH "A" TAPERED PIN DID NOT LATCH IN HATCH OPEN POSITION.	ON ORBIT	CREW REPORTED LATCH ONLY FIT AROUND TO HOLD PIN IN SLOT WHEN DOOR WAS IN HALF OPEN POSITION. KSC FOUND PIN MISALIGNED 3/8 INCH.	N. JEVAS DR 28F004
B	SIDE HATCH "T" HANDLE DIFFICULT FOR GROUND CREW TO OPERATE.	PRELAUNCH AND POSTLANDING	FLIGHT CREW REPORTED THAT GROUND CREW HAD DIFFICULTY LOCKING AND UNLOCKING THE HATCH. POSTFLIGHT KSC FOUND ONE OF 4 "T" HANDLE TOOLS DID NOT WORK.	N. JEVAS DR 28F005
11	LEFT DISPLAY DRIVER UNIT DATA GOOD BIT TOGGLED DURING ENTRY.	ENTRY	FLAG TOGGLED ABOUT 25 TIMES. SEE R DDU PROBLEM STS-51F-21 ON OV-099. T/S AT KSC. CHIT J-1831.	T. LEWIS

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