

# **STS 51A NATIONAL SPACE TRANSPORTATION SYSTEMS MISSION REPORT**

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December 1984



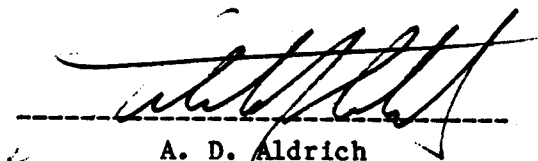
**National Aeronautics and  
Space Administration**

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

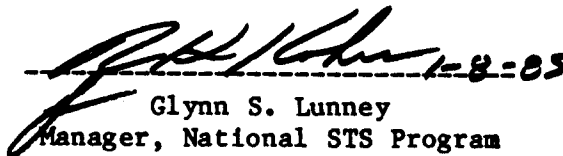
STS 51-A  
NATIONAL SPACE TRANSPORTATION SYSTEMS PROGRAM  
MISSION REPORT



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## INTRODUCTION AND MISSION OBJECTIVES

The STS 51-A National Space Transportation System Program Mission Report contains a summary of the major activities and accomplishments of the fourteenth Space Shuttle mission, which was also the second flight of the Orbiter vehicle, Discovery. Table I contains a sequence of events for the STS 51-A mission. This report also summarizes the most significant problems/anomalies that occurred during the mission. The Orbiter and booster problem tracking lists are presented in table II (at the back of the report) and provide a complete listing of all problems that occurred. None of the documented problems will cause any concern for the STS 51-C mission.

The primary objectives of the STS 51-A mission were to successfully deploy the SYNCOM IV-1 and Telesat-H (Anik D-2) spacecraft, retrieve two Hughes 376 satellites and perform the planned operations of the DMOS (Diffusive Mixing of Organic Solutions) payload and the RME (Radiation Monitoring Equipment).

This STS 51-A mission was performed as a nominal 8-day flight with a crew of five. Two periods of EVA (extravehicular activity) were also conducted during which the two spacecraft were retrieved. Eight DTO's (detailed test objectives) and four DSO's (detailed supplementary objectives) were completed during the STS 51-A mission.

## MISSION SUMMARY

The STS 51-A mission was scheduled for launch on November 7, 1984, but the launch was scrubbed during the planned hold at T-20 minutes because the data indicated that the predicted winds aloft would apply shear loads in excess of the design limits of the vehicle. Consequently, the launch was rescheduled for November 8, 1984, and all conditions were satisfactory for the rescheduled launch. The final countdown culminated in a successful launch at 313:12:15:00 G.m.t. (7:15:00 a.m. e.s.t.), from launch complex 39A at KSC (Kennedy Space Center) on November 8, 1984, and the mission was completed with a landing at the KSC Shuttle Landing Facility at 321:11:59:56 G.m.t. (6:59:56 a.m. e.s.t.), November 16, 1984.

The crew for this mission was Frederick H. Hauck, Capt. U.S. Navy, Commander; David M. Walker, Cdr. U. S. Navy, Pilot; and Joseph P. Allen, IV, PhD., Anna Lee Fisher, M.D., and Dale A. Gardner, Cdr. U.S. Navy, Mission Specialists.

The ascent phase was nominal in all respects. The SRB (solid rocket booster) motor performance was near predicted levels. External tank and MPS (main propulsion system) performance was nominal. Nominal orbital conditions were achieved at MECO (main engine cutoff), which occurred 513 seconds after lift-off. Following the satisfactory OMS (orbital maneuvering system) 1 and 2 maneuvers, the Orbiter was in the planned 150 by 160 nmi. orbit.

TABLE I. - STS 51-A SEQUENCE OF EVENTS

Event	Actual time, G.m.t
APU Activation (1)	313:12:10:09
(2)	313:12:10:10
(3)	313:12:10:11
SRB HPU activation command (LH-A2)	313:12:14:32.5
MPS start command sequence (engine 3)	313:12:14:53.4
SRB ignition command from GPC (lift-off)	313:12:15:00
MPS throttle-down to 89-percent (engine 3)	313:12:15:14.6
MPS throttle-down to 67-percent (engine 3)	313:12:15:28.4
Maximum dynamic pressure	313:12:15:51
MPS throttle-up to 104-percent (engine 3)	313:12:16:07.1
SRB separation command from GPC	313:12:17:05
MPS throttle-down from 3g acceleration (engine 3)	313:12:22:38.2
Main engine cutoff (MECO)	313:12:23:33.7
External tank separation	313:12:23:51.3
OMS 1 ignition	313:12:25:33
OMS 1 cutoff	313:12:28:04
APU deactivation (1)	313:12:29:32
(2)	313:12:29:28
(3)	313:12:29:27
OMS 2 ignition	313:12:59:43
OMS 2 cutoff	313:13:01:38
Telesat deploy	314:21:04:32
SYNCOM deploy	315:12:56:07
EVA 1 start	317:13:25
PALAPA-B1 retrieved	317:18:13
EVA 1 termination	317:19:25
EVA 2 start	319:11:08
WESTAR VI retrieved	319:14:59
EVA 2 termination	319:16:51
Flight control system checkout	320:08:18:16
APU 3 start	320:08:22:35
APU 3 shutdown	321:10:49:54
APU 2 activation	321:10:55:00
Deorbit maneuver ignition	321:10:58:04
Deorbit maneuver cutoff	321:11:17:16
APU activation (1)	321:11:17:18
(3)	321:11:28:58
Entry interface	321:11:43:49
End blackout	321:11:53:20
Terminal area energy management (TAEM)	321:11:59:56
Main landing gear contact	321:12:00:09
Nose landing gear contact	321:12:00:54
Wheels stop	321:12:21:19
APU deactivation complete (3)	

Performance of all subsystems was normal throughout the first day. Telemetry data indicated that CRT (cathode ray tube) 4 had apparently failed. The crew recycled power to the unit, and shortly thereafter, the display began flashing on and off. The CRT was turned off and not used for the rest of the mission. The second day of the mission was completed as planned, and no new Orbiter problems were identified. All payload and experiment activities were completed. The Telesat (Anik D2)/PAM (payload assist module) spacecraft was deployed at 1:08:49:32 MET (mission elapsed time), within 1 second of the designated time. Although the PAM PKM (perigee kick motor) firing could not be observed by the crew using the RMS wrist camera against the daylight background, data received through the Tanique/Brazil tracking station showed Anik at the expected location and in good health. Later data indicated that the spacecraft was in the desired geosynchronous orbit.

The third day of the mission was completed as planned. One maneuver was performed to raise the orbit to 169 by 171 nmi. and a second maneuver (plane change) was made in preparation for rendezvous with the PALAPA spacecraft on day 5.

All SYNCOM spacecraft predeployment operations were executed in accordance with the checklist. The SYNCOM spacecraft was deployed at 315:12:56:07 G.m.t. Automatic SYNCOM omni antenna deployment and SYNCOM spin-up was confirmed by the crew. A nominal 51-second PKM firing was accomplished and observed with the RMS (remote manipulator system) wrist camera. Later data indicated that the spacecraft had achieved the desired geosynchronous orbital conditions.

The three EMU's (extravehicular mobility units) were checked out and only one problem was noted. Each of the two EMU light assemblies displayed a similar problem - the failure of the left-side light to operate. An IFM (inflight maintenance) procedure was developed for replacing the logic batteries with spares from other equipment. The replacement was successful.

The first of four waste water dumps was performed. The quantity reduction to 10.4 percent was completed between 315:17:00 and 315:17:50 G.m.t., by performing five short dump cycles. The dumps were stopped each time as soon as small icicles formed. The RMS wrist camera was used to view and record the dump.

The fourth day of the mission was satisfactory with only one new problem being encountered. This problem was found in the S-band antenna system when both antenna switches and the switch beam control electronics were all powered simultaneously. However, this anomaly caused no impact to the mission. Three burns were performed and the apogee was raised to 174 nmi. These burns were a 6.0 ft/sec phasing maneuver, a 30.2 ft/sec coelliptic maneuver, and a 2.7 ft/sec phasing maneuver performed between 316:11:56:18.4 and 316:19:52:54.5 G.m.t.

In preparation for the EVA on day 5, the water tank dump and refill was successfully performed on EMU-1 and EMU-2, battery charges were topped off, and the cabin was depressurized to 10.2 psia for the 24-hour prebreathing period required prior to EVA. The second waste water dump was performed between 316:17:40 and 316:18:16 G.m.t. The tank was dumped to 18 percent (about 24.5 pounds).

The fifth day of the STS 51-A mission was highlighted by the successful retrieval and berthing of the PALAPA spacecraft during a 6-hour EVA. In preparation for the rendezvous with the PALAPA, a series of nominal phasing and braking maneuvers was performed using both the OMS and RCS (reaction control system).

The retrieval of the PALAPA spacecraft, although successful, was not accomplished using the primary procedures. EV-1 crewman flew the MMU (manned maneuvering unit) and was able to insert the apogee kick motor capture device (stinger) into the AKM (apogee kick motor) and achieve a hard grapple. The spacecraft was then stopped from rotating and maneuvered into position to be grappled by the RMS. The MMU performance was nominal during the docking and the EVA. The antenna bridge structure, or A-frame, could not be attached as planned to the PALAPA spacecraft because of interference between the bracket crossmember and a waveguide on the PALAPA. Consequently, an alternate plan for backup retrieval of the spacecraft was used. EV-1 manually manipulated the spacecraft while EV-2 removed the stinger and attached the spacecraft adapter. Once this was accomplished, the spacecraft berthing was manually completed by both astronauts.

The sixth day of STS 51-A was a low-activity day in preparation for the second planned EVA on the seventh day. All Orbiter systems continued to operate properly. The third waste water dump to 12 percent remaining was completed at 318:10:15 G.m.t. with no problems reported. The necessary EMU maintenance and recharge activities were also completed.

The major activity on the seventh day of the STS 51-A mission was the successful retrieval of the second spacecraft (Westar) during a 5 hour 43 minute EVA. All Orbiter systems continued to operate properly. The crew reported at about 319:09:00 G.m.t. that neither of the aft payload-bay floodlights would operate. The crew performed a requested test, but the lights still did not operate. Since the forward lights worked properly, the light loss did not impact the EVA operations. The retrieval of the Westar was accomplished using a manual berthing procedure. As with PALAPA, the antenna bridge structure was not used. One crewman, while using the MFR (manipulator foot restraint) on the RMS, manually maneuvered the Westar into position and aligned the spacecraft for berthing. Berthing of the spacecraft was completed with no problems encountered. All MMU systems operated nominally during EVA-2.

At 319:16:15 G.m.t., the final waste water dump to 18 percent remaining was performed.



The crew reported at 320:05:42 G.m.t., that a "hit" of some type occurred on window W7 resulting in an impact area about 1/32 in. in diameter. A structural margin of 24 percent (positive) still existed and this condition did not affect the mission.

The on-orbit FCS (flight control system) checkout began at 320:08:18:16 G.m.t., and ran for 4 minutes 19 seconds using APU (auxiliary power unit) system 3. At APU startup, several bubbles and a slightly low chamber pressure were noted; however, the chamber pressure came up when the load increased. The checkout went smoothly without any problems.

The STS 51-A mission progressed satisfactorily during the last full day on orbit. All Orbiter systems functioned as designed. All planned experiments and payload activities were completed as well as final stowage.

The deorbit maneuver was performed at 321:10:55:00 G.m.t. for 184 seconds. The entry was normal and all PTI (programmed test input) maneuvers were completed. After completing the 304-degree HAC (heading alignment circle) turn angle, the Orbiter was guided to a landing at the Shuttle Landing Facility on runway 33. Rollout required about 9461 ft. An inspection after landing revealed that the Orbiter was in excellent condition and the tile and thermal protection system had experienced only insignificant damage during the STS 51-A mission.

#### VEHICLE ASSESSMENT

##### SOLID ROCKET BOOSTER

All SRB systems performed as expected. The SRB prelaunch countdown was nominal with no problems noted. Performance of both solid rocket motors was near predicted values and well within the allowed envelopes. Propellant burn rates were also near predicted values. Preliminary indications are that SRB separation occurred within 0.37 second of the predicted time. The SRB recovery system performed nominally, with both SRB's impacting within 13 seconds of each other and floating in the normal manner 2.6 miles apart.

##### EXTERNAL TANK

All ET (External Tank) systems performed as expected. There were no ET preflight or flight anomalies, nor was there any significant frost buildup. The only ice observed was on the line bellows and brackets in waived areas, which is normal. Nose cone temperature measurements were different from one another by 4 to 8 degrees F, but this is within required limits.

The ET impacted in the Indian Ocean at about 28.11 deg S. latitude and 78.43 deg E. longitude.

## SPACE SHUTTLE MAIN ENGINE

SSME (Space Shuttle Main Engine) performance data followed trends which were similar to those observed during previous flights. The HPOTP (high pressure oxidizer turbopump) and HPFTP (high pressure fuel turbopump) turbine discharge temperatures during mainstage compared favorably with predicted values.

During prelaunch operations, the HPFTP discharge temperature on engine 3 decayed from a maximum of 540 deg R to a minimum of 397 deg R when the tank was pressurized at 43.7 to 46.7 psia. When tank pressure was vented, the temperature went back up to approximately 420 deg R and stabilized until prepressurization occurred at T-90 seconds. The HPFTP temperature then dropped to approximately 391 deg R on channel A and 400 deg R on channel B, but these levels did not cause a start or flight problem.

## MAIN PROPULSION SYSTEM

Overall performance of the MPS (main propulsion system) was excellent. Liquid oxygen and liquid hydrogen loading was accomplished as planned with no stop flows or anomalies. Liquid oxygen and liquid hydrogen loads relative to predicted values were about 1390 and 840 lbm low, respectively. No significant hydrogen concentrations were observed.

Ascent performance was normal and MECO was near the predicted time.

## ORBITER

### Forward Reaction Control System Thruster F4R Leak Indication

During the SYNCOM separation maneuver, forward RCS thruster F4R was fired. The fuel injector temperature decreased from 84 deg F to 43 deg F over a 2-hour period. The deselect threshold is 25 deg F. It was believed a small leak existed because of contamination in the injector valve seat. The temperature subsequently recovered to 58 deg F, indicating the leak had stopped.

The F4R thruster was reprioritized to number 1 priority and operated properly. Postflight testing showed no evidence of a leak.

### Microswitch Failures

There are five STS 51-A problems that have been identified as involving loss of valve position indications. The valve position indications are derived from limit switches which have a history of conductive and non-conductive particle contamination.

Two of the identified problems occurred previously during the STS 41-D mission, but could not be duplicated during postflight testing. The limit switches were not removed and replaced because of accessibility problems.

There was minimal impact to both STS 41-D and STS 51-A missions as a result of these microswitch failures.

#### Cathode Ray Tube 4 Failure

At about 314:09:48 G.m.t., telemetry indicated that CRT 4 had experienced a DU (display unit) low-voltage power supply bite message. Subsequently, the crew cycled the input power and reported that the screen was cycling on and off about every 2 seconds. CRT 4 was then powered down. Later, at about 317:11:55 G.m.t., CRT 4 was powered up for rendezvous operations and the previously observed conditions repeated. CRT 4 was powered down for the remainder of the flight. There was no mission impact.

#### Left Orbital Maneuvering System Helium Isolation Valve Leak

Following the NC-1 maneuver for rendezvous with the PALAPA, the left OMS fuel-tank ullage pressure increased 8 psi in about 7 hours (equates to 100,000 scch leak). The leak rate following subsequent maneuvers varied from 80,000 to 340,000 scch. The increase in fuel-tank ullage pressure indicated that the helium isolation valve or valves were leaking. When the OMS fuel-tank ullage pressure reached 259 psi, the primary regulator locked up and no additional leakage was observed. This condition did not impact the mission.

Prior to the STS 51-A mission, the left OMS helium isolation leg B valve was leaking at a rate of 3800 scch. Specification leak is 360 scch for two valves. The leakage was waived for the STS 51-A mission since both the primary and secondary regulators did not show any out-of-specification leakage rates and provided operational redundancy.

#### Brake Hydraulic Pressure Increased During Entry

During entry operations between landing gear isolation valve 3 opening at 321:11:42:33 G.m.t. and landing gear 2 isolation valve opening at 321:11:49:02.49 G.m.t., the four brake pressures increased from zero to approximately 900 psi. The pressure initially rose to 200 psi indicating compression of the brake-puck (disc) return springs, then continued to 900 psi indicating compression of the brake assembly. The brake pressure was relieved to normal when landing gear isolation valve 2 was opened. There was no indication of a similar occurrence in brakes supplied by hydraulic system 1.

The landing gear isolation valves are two-way spool valves that always have a small downstream leakage. The brake module switching valves are simple, biased area, pressure-operated, four-way valves with a ball detent in either of two positions. When landing gear isolation valve 3 was opened, the switching valves encountered a hydraulic lock in system 2. Pressure generated in both systems (1500 psi in system 3, 1045 psi in system 2) was sufficient to close both thermal circulation valves in the brake module. All paths to the return hydraulic line were closed except through the servo valves. Leakage through

hydraulic system 2 isolation valve drove the switching valves back toward the primary position until the leakage could pass through the servo valves. The switching valves are designed nominally for simultaneous cutoff of the pressure and return flow slots. Tolerance stacking of the five affected ports can cause the return slots to close first. Restriction of the return path at the switching valve and leakage through landing gear isolation valve 2 caused pressure buildup in the brake system.

### EXTRAVEHICULAR ACTIVITY

Two periods of EVA were planned and completed during the STS 51-A mission. One period was required for the retrieval of each of the two Hughes 376 spacecraft. The total time for both of the EVA periods was 11 hours and 53 minutes. All EMU and MMU systems operated as designed with no problems or anomalies during either period.

#### FIRST EVA

The first EVA took place on schedule on flight day 5 with hatch opening at 317:13:25 G.m.t. and hatch closing at 317:19:25 G.m.t. EVA preparations proceeded nominally with the exception of the EMU helmet-light battery problem, which was discovered during suit checkout on flight day 3. The power switch was in the "on" position and this had caused the batteries to discharge. The crew used an IFM procedure to wire other batteries that were onboard into the EMU lights. The lights then functioned normally for the duration of the mission.

The first major activity during EVA-1 was the checkout of MMU 3 that was located on the port side of the payload bay. After the donning and successful MMU checkout, plus the attachment of the ACD (apogee kick motor capture device), the EV (extravehicular) -1 crewman began the translation to the PALAPA spacecraft. Following the successful docking, the MMU thrusters were used to stop the spacecraft from its 12 deg/sec spin rate and re-orient the vehicle to a position suitable for RMS capture.

After grappling the PALAPA, the RMS lowered the spacecraft into the payload bay with EV-1 and the MMU/ACD still attached. EV-2 cut the omni antenna with the shears provided, and an attempt was made to attach the common bracket clamps to the PALAPA so that the antenna bridge structure (ABS) or "A-Frame" could be attached. At this point, EV-2 found that the common bracket clamps could not be attached to the PALAPA. A waveguide assembly protruded farther outboard on the PALAPA than had been expected and prevented the common bracket clamps from being mounted on the PALAPA's common brackets.

The crew changed to a practiced backup procedure. EV-1 disconnected the MMU from the ACD in the PALAPA, and doffed the MMU in its mounting station. EV-1 then got into the PFR (portable foot restraint), which had been positioned on the starboard side of the Westar pallet, and held on to the top of the PALAPA after it was released by the RMS. EV-1 positioned the PALAPA so that EV-2 could remove the ACD, install the AKM nozzle cover and attach the Hughes 376 adapter assembly to the bottom of the PALAPA. Together, the two crewmembers then manually maneuvered the PALAPA into the PRLA (payload retention latch assemblies), where it was secured for return.

#### SECOND EVA

During day 6, the EMU's were serviced and the procedures to be used for the second EVA were reviewed. Because of the possibility that the configuration of the waveguide on Westar VI was the same as PALAPA, the decision was made to forego the use of the A-frame completely and to manually handle the spacecraft after it had been stabilized by the MMU in a manner similar to that done during the first EVA. The primary difference in the plan for the second EVA was to have EV-1 positioned in the MFR on the RMS instead of being in the portable foot restraint on the side of the pallet. This would allow him to be more optimally positioned by the RMS to handle the spacecraft, thereby reducing the EVA workload and minimizing the risk of damaging the solar panels on the spacecraft. The use of the MMU and ACD was still required because of the inherent danger of the spinning satellite to the Orbiter and to the EV crewman in the MFR.

The second EVA began at 319:11:08 G.m.t. and lasted approximately 5 hours 43 minutes. The EVA was completed with no significant anomalies at 319:16:51 G.m.t. The alternate procedures were satisfactory for the successful retrieval of the Westar VI spacecraft.

#### PAYLOADS AND EXPERIMENTS

##### DEPLOYMENTS

##### Telesat (Anik-D) Spacecraft

The Telesat (Anik-D) spacecraft was deployed from the Orbiter at the planned time of 01:08:49:32 MET. The PAM burn was nominal and the spacecraft was acquired by the ground tracking network on the first transfer orbit. Attempts to observe the PAM burn with the RMS wrist camera were unsuccessful because of the unfavorable sun angle.

Subsequent spacecraft operations, including the apogee motor burn, were all normal, and the spacecraft is on its assigned station in geosynchronous orbit. The spacecraft has been checked out and is operational.

During the predeployment sequence while opening the sunshield, the sunshield stopped its opening movement for 2 seconds midway through the cycle. A slight (0.1 A) current increase was also noted at the same time. All other sunshield opening and closing activities were nominal and postflight attempts to reproduce the anomaly have been unsuccessful.

#### SYNCOM IV/Leasat Spacecraft

The second Space Transportation System-launched SYNCOM IV/Leasat deployment was successfully accomplished as planned at 02:00:41:07 MET. Deployment preparations were nominal including pulling of the 4 cradle-to-spacecraft restraint pins, and arming and firing of the deployment mechanism pyrotechnics. The Orbiter rates at deployment were essentially zero with pitch at +0.004 deg/sec being the only axis above +0.001 deg/sec.

A nominal perigee motor burn occurred 45 minutes after deployment and the spacecraft was acquired by the ground tracking network during the first transfer orbit. (The burn was observed with the RMS wrist camera.) Subsequently, several LAM (liquid apogee motor) firings were accomplished to place the spacecraft in geosynchronous orbit over the equator. The spacecraft is on-station, and undergoing spacecraft and communications-payload checkout.

#### HUGHES SATELLITE 376 RETRIEVALS

##### PALAPA B-2 Spacecraft

The recovery operations began with the completion of the first rendezvous at about 317:13:00 G.m.t. The rendezvous was normal and the EVA egress began at 04:01:10:00 MET. The EVA operations proceeded as planned and the spacecraft was captured by the MMU crewman (EV-1) and grappled by the RMS. When the second crewman attempted to install the antenna bridge structure, it was found that an obstruction between the two common bracket posts on the spacecraft prevented the installation. The alternate procedure was used and this required the EV-1 crewman to stand in the portable foot restraint and manually hold the spacecraft while the EV-2 crewman installed the adapter. The spacecraft was then manually berthed in the PRLA's and the latches closed.

##### Westar-VI Spacecraft

For the retrieval of the Westar-6, a decision was made to omit the antenna bridge structure and repeat the PALAPA retrieval procedure with a change in that the EV-2 crewman would be in the MFR on the RMS, and would thus be in a better position to manually handle the spacecraft after capture. Positioning of the spacecraft was aided by the RMS operator and by leaving the omni antenna still attached until after berthing. Capture by the EV-1 crewman was normal as was the adapter installation and berthing.

### DIFFUSIVE MIXING OF ORGANIC SOLUTIONS

The DMOS payload experienced hardware problems inflight which precluded some of the internal cells from operating properly. The stepper motor that opens the valves between chambers experienced a larger torque than the capability of the motor. Crystals were grown in three of the six chambers and both quality and quantity of these crystals far exceeded the amount that has been previously grown in the laboratory.

### RADIATION MONITORING EQUIPMENT

The RME payload experienced no problems inflight. Postflight analysis indicates that good data were collected.

JSC OV-103 STS 51-A PROBLEM TRACKING LIST

DEC 10, 1984

NO.	TITLE	TIME, G.M.T.	COMMENTS	RESP. MGR.
1	APU 2 WATER SPRAY VALVE SYSTEM A FAILED.	313:12:41:55	CREW SWITCHED TO SYSTEM B, OPERATION NORMAL. BFS FAULT MESSAGE AT 180 DEG F. FOUND BUCKEN GROUND WIRE. REPAIRED AND RETESTED.	W. SCOTT DR 19F014 CLOSURE IN PROCESS
2	SSME 3 HE REGULATOR A OUTLET PRESSURE (V41P1354A) READ LOW.	313:12:31:20	BFS FAULT MESSAGE AT 679 PSIA. AFTER ISOLATION VALVES WERE CLOSED, PRESSURE DECAYED TO ZERO IN ABOUT A MINUTE. FOUND LOOSE TRANSDUCER. REPLACE SEAL AND RETEST.	P. COTA DR 19F015 CLOSURE IN PROCESS
3	INSTRUMENTATION FAILURES:			CLOSURE IN PROCESS
A	SSME 3 GH2 OUTLET TEMPERATURE (V41T1361A) FAILED.	313:12:14:56	READ OFF SCALE HIGH 4 SECONDS BEFORE LIFT OFF. REMOVE AND REPLACE AT KSC.	D. PREVETT CAR 19F001
B	APU 1 EXHAUST GAS TEMPERATURE 2 (V46T0140A) FAILED.	321:11:55	ABOUT 5 MINUTES BEFORE TOUCHDOWN READ LOW. R&R AT KSC.	W. SCOTT DR 19F005
C	SSME 1 LH2 INLET PRESSURE (V41P1100C) DRIFTED UP 1.5 PSI.	313:12:17:30	FROM 150 TO 200 SECONDS AFTER LIFT OFF. FLY AS IS.	P. COTA
D	SSME 2 LH2 INLET PRESSURE (V41P1200C) BIASED HIGH.	313:12:15	READ ABOUT 8 PSI HIGH DURING MAIN STAGE. R&R AT KSC.	P. COTA
4	RIGHT RCS 3/4/5 FUEL AND OXIDIZER CROSSFEE VALVES DID NOT INDICATE CLOSED (V42X3338X AND V42X3239X).	313:13:35 314:17:34	CREW REPORTED TALKBACK MICROSWITCHES READ CORRECT. PROBABLE SHORT IN A TELEMETRY MICRO SWITCH. INTERMITTENT AFTER OMS+2. VALVE SWITCH PLACED IN GPC TO REMOVE POWER FROM VALVES. R&R.	C. HOHMANN CAR 13F001 CLOSURE IN PROCESS
5	CRT 4 FAILED.	314:10:40 317:11:55	DU 4 WAS FLASHING AT A 2-SECOND RATE. CRT 4 POWERED OFF. CRT POWERED ON FOR RENDEZVOUS AND FAILURE REPEATED. REMOVED AND REPLACED AT KSC. VENDOR FOUND UNDER RATED CAPACITOR FAILED.	G. RAINES CAR 19F006 CLOSURE IN PROCESS



JSC OV+103 STS 51+A PROBLEM TRACKING LIST

DEC 10, 1984

NO.	TITLE	TIME, G.M.T.	COMMENTS	RESP. MGR.
6	WATER SPRAY BOILER 1 GN2 REGULATOR OUTLET PRESSURE DROPPED.	313:12:25	DROPPED ABOUT 3 PSIA AND CONTINUED TO DECAY. NO MISSION IMPACT. FOUND A GAULED QD. REMOVED AND REPLACED.	D. HAINES CLOSURE IN PROCESS
7	RMS AFT MANIPULATOR RETENTION LATCH SYSTEM 1 READY+TO+LATCH INDICATION LOST.	314:22:18	TALKBACK INDICATED DEPLOY. CREW USED VISUAL AND CRT SPEC 94 FOR AFT MRL STATUS. INDICATION RECOVERED WHEN RMS WAS STOWED ON DAY 3, 315:18:38 G.M.T. FLY AS IS.	J. PECK CAR 19F007 CLOSURE IN PROCESS
8	LEFT OMS HE ISOLATION VALVE LEAK.	PRELAUNCH POST NC+1	WAIVED FOR STS 41+D. POSTFLIGHT CHECKOUT FOUND OUT+OF+SPEC LEAK IN LEG B. INCREASED LEAK EVIDENT ON STS 51+A AFTER NC+1 BURN. HE PRESSURE HELD AT PRIMARY REG LOCKUP. FOUND LEAK IN BOTH LEGS. R&R AT KSC.	C. HUMPHRIES CAR AC8899
9	FORWARD RCS JET F&R FUEL LEAK INDICATION.	315:13:15	INJECTOR TEMP (V42T1514C) FELL TO 43 DEG F IN 2 HOURS INDICATING A VERY SMALL LEAK. TEMP RETURNED TO NORMAL. JET FIRED PROPERLY DURING FCS CHECKOUT. OPERATION NORMAL. FLY AS IS.	C. HOHMANN CLOSURE IN PROCESS
10	BOTH LEFT SIDE EMU HELMET LIGHTS INOPERATIVE.	315:15:40	DID NOT COME ON DURING EMU CHECKOUT. CREW REPORTED LOW VOLTAGE ON 7 OF 8 LEFT+LOGIC+CIRCUIT BATTERIES. CREW IFM RESTORED OPERATION. EV+2 LEFT LIGHT FAILED AFTER 5 HOURS ON EVA+1. IFM RESTORED FOR EVA+2. CHANGE ACTIVATION PROCEDURE.	R. MARAK ILC+H+0071F ILC+H+0072F CLOSURE IN PROCESS
11	PAYLOAD BAY TV CAMERAS "A" AND "D" HAD SPOTS AND WERE DIFFICULT TO FOCUS.	315:14:00	SMALL WHITE SPOTS ON BOTH CAMERAS. ALSO A DARK SPOT ON CAMERA "A". VIDEO WAS USABLE. R&R.	B. EMBREY JSC+EE+0595F
12	BOTH S+BAND ANTENNA SWITCH ELECTRONICS UNITS AND BEAM SWITCH ELECTRONICS SHOWED SIMULTANEOUS "ON" CYCLES.	315:18:43 317:13:08	OCCURRED SEVERAL TIMES. POSSIBLE GCIL 1 DRIVER INTERMITTENT COMMANDS FOR ANTENNA SWITCH 1. R&R GCIL 1.	H. VANG CAR 19F002 CLOSURE IN PROCESS

JSC OV-103 STS 51A PROBLEM TRACKING LIST

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NO.	TITLE	TIME, G.M.T.	COMMENTS	RESP. MGR.
13	AIRLOCK EMU BATTERY CHARGER/POWER SUPPLY 1 OPEN-CIRCUIT VOLTAGE HIGH.	316:14:25	OPEN-CIRCUIT VOLTAGE RANGED UP TO 26.5 VOLTS. VOLTAGE NORMAL DURING EMU 1 AND 3 CHECKOUT. AT KSC WITH DUAL POWER UNIT FROM OV-099.	R. EGUSQUIZA CAR 19F003 CLOSURE IN PROCESS
14	CREW INTERFACE:			
A	WIRELESS CREW COMMUNICATIONS UNIT "A" HAD A HOT MIKE.	316:22:00	CREW REPORT. R&R AT KSC. FOUND HYBRID COMPONENT SHORTED. REPLACED COMPONENT.	O. SCHMIDT JSC+EE+0594F
B	EVA TORQUE WRENCH SEPARATED FROM TETHER.	317:16:30 EVA+1	CREW REPORTED TETHER ATTACHMENT UNSCREWED FROM WRENCH. REPAIRED AND USED AS A SPARE FOR EVA+2. REDESIGN TO HOLD RETAINER NUT. FIAR.	R. MARAK ILC+H+0073F
C	EVA PORTABLE FOOT RESTRAINT STOWAGE SOCKET JAMMED AND UNIVERSAL JOINT LOOSENED.	317:16:30 EVA+1	CREW FORCED PFR OUT OF STOWAGE SOCKET AND RETIGHTENED UNIVERSAL. WILL CHECK STOWAGE FOR THERMAL TOLERANCES AND CHANGE MANUFACTURING FOR UNIVERSAL JOINT.	R. MARAK
D	ARRIFLEX 16MM CAMERA FAILED.	314:10:50	IFM BYPASSED FAILURE. CAMERA OPERATIONAL. FOUND DEFECTIVE MICROSWITCH IN STANDBY CIRCUIT.	D. YEATES
E	WRIST TETHER HOOK STUCK OPEN.	319:12:47 EVA+2	WRENCH BOUNCED OUT OF OPEN HOOK WHEN EV+2 ATTACHED TETHER TO "D" RING. REVISE WIF PROCEDURES.	R. MARAK
F	MULTI-USE BRACKETS BROKE AT ELBOW.	ON ORBIT	CLUTCH MECHANISM BROKE ON 3 OF 6 BRACKETS. FOUND GREASE CONTAMINATED LOCTITE ON ELBOW BOLT. USE VIBRATITE.	D. YEATES

JSC OV+103 STS 51-A PROBLEM TRACKING LIST

DEC 10, 1984

NO.	TITLE	TIME, G.M.T.	COMMENTS	RESP. MGR.
15	STS 41+D CARRYOVER:			CLOSURE IN PROCESS
A	LEFT OMS FUEL TOTAL QUANTITY (V43Q4331C) FAILED.	313:12:26 STS+41D+8	STOPPED AT 45.8% DURING OMS+1. READ CORRECT AFTER CIRC+1, 55.1%. NO KSC ACTION.	C. HUMPHRIES CAR 14F005
B	FORWARD RCS MANIFOLD 2 FUEL ISOLATION VALVE CLOSE INDICATION FAILED (V42X1327X).	314:20:17 STS+41D+13	READ HIGH BUT VALVE WAS OPEN. CLEARED ABOUT 43 MINUTES LATER. READ ZERO AFTER NPC+1. TALKBACK BARBER POLE, MICROSWITCH SHORTED TO GROUND. CLEARED AGAIN AFTER PALAPA RETRIEVAL. R&R WITH OV+102 ACTUATOR.	C. HOHMANN CAR 14F009
C	RIGHT OMS FUEL TANK ISOLATION VALVE "A" OPEN INDICATION FAILED.	317:14:45 STS+41D+25	AMC 1 STATUS 1 (V79X2251E) SHOWED POWER ON. ISOLATED TO FUEL OPEN MICROSWITCH. PLACED IN GPC TO REMOVE POWER FROM VALVE. FLY AS IS.	C. HUMPHRIES CAR 14F015
D	FLASH EVAPORATOR SYSTEM TOPPING DUCT HEATER B ZONE H FAILED.	316:07:45 STS+41D+1	ONE ACTIVE HEATER STRING IN ZONE H AND F IS FAIL SAFE. R&R THERMOSTAT AT KSC AS TIME PERMITS AFTER STS 51+C.	H. ROTTER CAR AC8418F
E	RIGHT OMS FUEL TOTAL QUANTITY (V43Q5331C) FAILED.	PRELAUNCH STS 41+D	TOTALIZER READING FAILED PRIOR TO FIRST FLIGHT OF OV+103. FLY AS IS.	C. HUMPHRIES DR 19F013
F	RIGHT OMS CROSSFEED B FUEL AND OXIDIZER VALVES CLOSED INDICATIONS FAILED. (V43X5239X AND 5359X).	ON ORBIT STS+41D+24	FAULTY LIMIT SWITCHES. FLY AS IS UNTIL ACCESSIBLE.	C. HUMPHRIES CAR 14F014
16	WCS FAN SEPARATOR 1 AC 1 PHASE "A" CURRENT LOW.	316:14:25	PERIODICALLY LESS THAN NORMAL, 2.0 AMPS VS 2.9 AMPS STARTUP AND 0.5 AMPS VS 0.9 AMPS RUN. T/S DID NOT REPEAT.	E. WINKLER CLOSURE IN PROCESS
17	AFT PAYLOAD BAY FLOOD LIGHTS PORT AND STARBOARD FAILED.	319:09:00	R&R OLD DESIGN LIGHTS AT KSC WITH NEW DESIGN FROM OV+099.	A. FARKAS CLOSURE IN PROCESS

JSC OV-103 STS 51-A PROBLEM TRACKING LIST

DEC 10, 1984

NO.	TITLE	TIME, G.M.T.	COMMENTS	RESP. MGR.
18	FORWARD RCS MANIFOLD 3 FUEL AND OXIDIZER ISOLATION VALVES LOST OPEN INDICATIONS.	319:11:05	LOSS OF OPEN INDICATIONS ON BOTH FU & OX CAUSED DESELECTION OF ALL MANIFOLD 3 JETS. INDICATIONS RETURNED TO NORMAL. CREW RESELECTED AND PLACED SWITCH IN GPC. R&R WITH OV-102 ACTUATORS.	C. HOHMANN CAR 13F001 CLOSURE IN PROCESS
19	STARBOARD OVERHEAD WINDOW (W7) TOOK 1/32 INCH DIAMETER HIT.	320:05:42	CALCULATIONS SHOW POSITIVE STRUCTURAL MARGIN FOR 2 SMALL HITS. FLY AS IS.	O. PIGG CLOSURE IN PROCESS
20	FORWARD DAP PANEL (C3) PITCH AND ROLL ROTATIONAL PULSE BUTTONS FAILED.	320:07:50 (P) 320:08:56 (R)	PITCH CONTACT 1 FAILED OFF. PITCH REPLACED BY CREW WITH SWITCH FROM AFT DAP. NORMAL OPERATION RESTORED. ROLL 2 CONTACTS NOT OPERATING SIMULTANEOUSLY. T/S AT KSC DID NOT REPEAT.	R. BURGHDOFF CLOSURE IN PROCESS
21	STAR TRACKER #2 SHUTTER LATCHUP.	317:10:26 317:11:55 319:08:10	DURING RENDEZVOUS WITH PALAPA TWICE, AND WESTAR ONCE, TARGET SUPPRESS BIT WAS SET. EXPECTED BRIGHT OBJECT SENSOR TO CLOSE SHUTTER FIRST. CREW OPENED SHUTTERS AND ST OPERATED NORMAL. NO KSC ACTION. ANALYSIS COMPLETE IN 1 MONTH.	I. SAULIETIS CLOSURE IN PROCESS
22	LEFT RCS SYSTEM B FUEL TANK ISOLATION VALVE FOR MANIFOLD 3/4/5 LOST OPEN INDICATION.	320:17:55	VALVE PROBABLY OPEN. TALKBACK WENT TO BARBERPOLE. CREW PLACED SWITCH IN GPC. R&R AT KSC.	C. HOHMANN CAR 13F001 CLOSURE IN PROCESS
23	PAYLOAD BAY BLANKETS AND METAL DISCOLORED.	ON ORBIT	POSTFLIGHT INSPECTION FOUND 60 PERCENT OF PLB TURNED YELLOW. BLANKET OPTICAL QUALITIES AND FUNCTION SATISFACTORY. FLY AS IS.	L. LEGER CLOSURE IN PROCESS
24	S-BAND LOWER LEFT ANTENNA PERFORMANCE BELOW NORMAL.	320:22:57:40	DID NOT REGAIN UPLINK FOR ABOUT 12 MINUTES. SUSPECT BEAM SWITCH CONTAMINATION. REMOVED. REPLACE DEGRADED SWITCH. REINSTALL.	D. EGGERS M. SCHMALZ DR 19F016
25	RADAR ALTITUDEMETER 2 SHIFTED DURING LANDING.	LANDING	AFTER 60 FEET ALTITUDE READING DROPPED AND BECAME ERRATIC. R&R AT KSC.	D. RHOADES

JSC OV+103 STS 51-A PROBLEM TRACKING LIST

DEC 10, 1984

NO.	TITLE	TIME, G.M.T.	COMMENTS	RESP. MGR.
26	BRAKE HYDRAULIC PRESSURE INCREASED.	ENTRY	PRESSURE ON 4 OF 8 CHANNELS READ OVER 800 PSI WHEN ISO VALVES WERE OPENED AT 200,000 FEET. SYS 2 ISO VALVE LEAK DROVE SWITCHING VALVES.	W. NORRIS
27	LEFT MAIN LANDING GEAR STRUT LOW.	POST LANDING	POSTFLIGHT INSPECTION FOUND LEFT STRUT 3/4 INCH LOWER THAN RIGHT STRUT. T/S AT KSC.	C. CAMPBELL
28	RIGHT NOSE LANDING GEAR DOOR BENT.	LANDING	POSTFLIGHT INSPECTION FOUND DOOR LIP EDGE NEAR HINGE WAS WARPED. LIP WAS REPAIRED.	G. SANDARS
29	MADS WIDEBAND DATA NOISY AND PCM SNAPSHOT MALFUNCTIONED.	PRELAUNCH	SUSPECT MADS TAPE NOISY. SOME DATA MISSED IN SNAPSHOT MODE. T/S DID NOT REPEAT. SUSPECT PCM UNIT. R&R AT KSC.	C. RITTERHOUSE

PREPARED BY: ROBERT J. WARD

DATE

APPROVED BY: JOSEPH E. MECHELAY

DATE

TABLE II. - STS 51-A PROBLEM TRACKING LIST  
(b) MSFC ELEMENTS

NO.	TITLE	GMT			COMMENTS	PROJECT CONTACT
		D:	H:	M:		
1	LPFTP Discharge Pressure Failure	313:	12:	20	ME-1 LPFTP discharge pressure (Channel B) exceeded the 300 psia upper limit at approximately 318 seconds after liftoff. Postflight inspection revealed no problems with the sensor. Sensor has been sent to the vendor for failure analysis.	SSME R. Bledsoe/EE21
2	HPFTP Discharge Temperature	313:	12:	22	ME-1 HPFTP discharge temperature (CHANNEL B) exceeded the 2900 deg R upper limit at approximately 462 seconds after liftoff. Postflight inspection revealed no problems with the sensor. Sensor has been sent to the vendor for failure analysis.	SSME R. Bledsoe/EE21
3	HPFTP Liftoff Seal Leakage	Postflight	Inspection		ME-3 HPFTP liftoff seal leakage was in excess of 1000 scim's. The requirement is no greater than 300 scim's. The HPFTP has been removed and sent to Rocketdyne (Canoga Park) for failure analysis.	SSME R. Bledsoe/EE21