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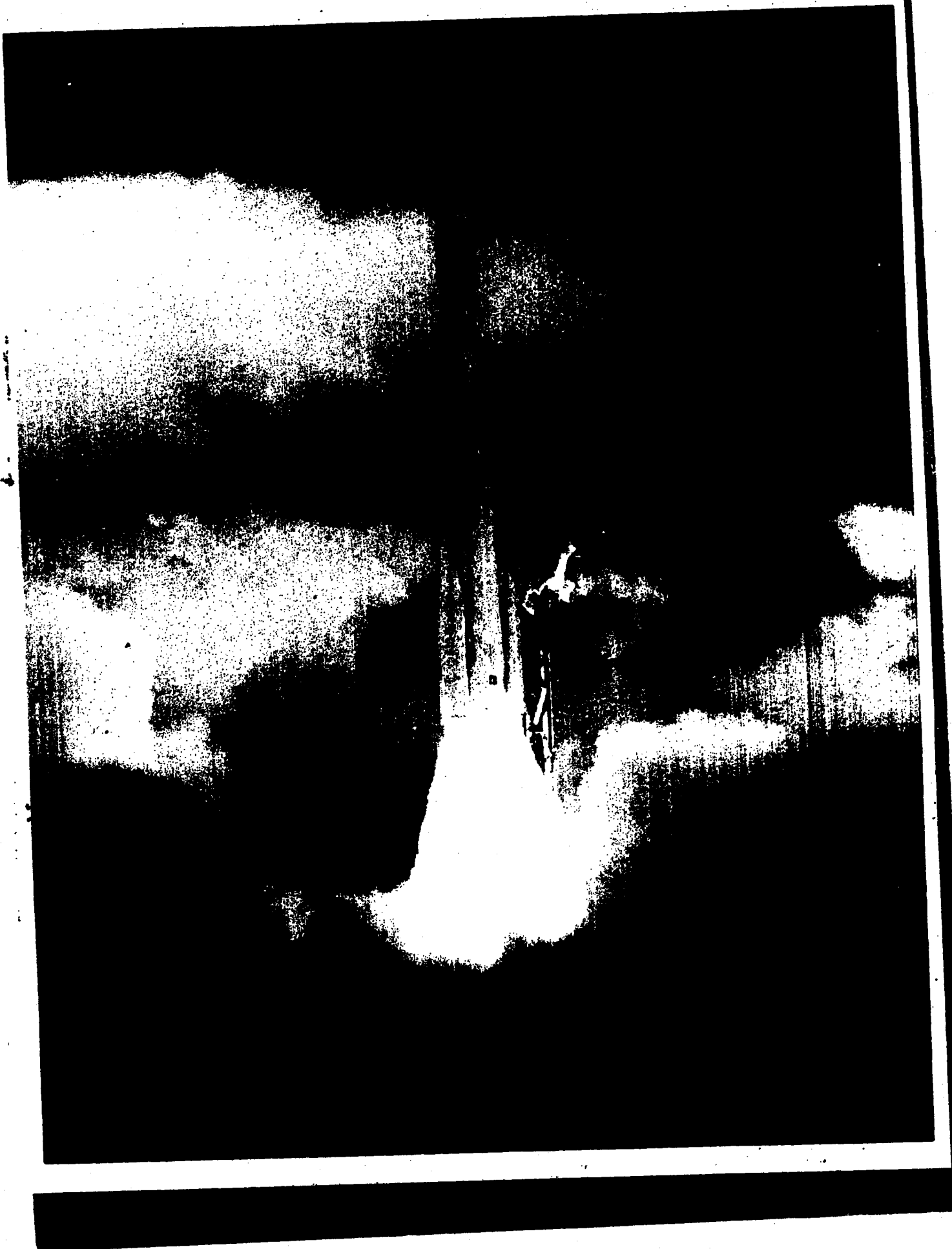
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VWZE 4-2-01

LAUNCH REPORT

LV-2A/389 SS-01A/1174

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6895TH AEROSPACE TEST WING

Vandenberg Air Force Base, California

6 MARCH 1964

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P R E F A C E

This report presents the launch evaluation and detailed analysis of the launching of LV-2A, 389 and SS-01A, 1174 from Vandenberg Air Force Base, California. The report was prepared by the Evaluation Office, Deputy for Space Systems, 6595th Aerospace Test Wing, under the technical cognizance and concurrence of the Lockheed Missile and Space Company Flight Test Evaluation Staff. This report replaces the Launch Report normally published by Lockheed Missiles and Space Company for the Aerospace Test Wing.

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SECTION I

LAUNCH SUMMARY

Launch Code Name: Garden Party
PMR Operations Number: 3444

- A. A space vehicle consisting of LV-2A Booster No. 389 and SS-01A orbital stage No. 1174 was launched on the first attempt from Vandenberg AFB, California, launch complex 75-3, pad 4, at 1338:23.10 PST on 15 February 1964.
- B. The nominal launch objectives were to place the payload in orbit with a 100 nautical mile perigee, a 234 nm apogee and with an inclination angle of 75 degrees. The orbit achieved had a perigee of 101.1 nm, an apogee of 248.4 nm, and an inclination angle of 74.98 degrees.
- C. The 575 minute countdown was initiated at 0355 PST and proceeded without interruption to T-15 minutes (1315 PST) when an eight-minute hold was imposed because of train traffic.
- D. Liftoff was normal and all aspects of the ascent trajectory were near nominal.
- E. All first and second stage booster systems performed satisfactorily. The first stage solid motor burn time and jettison were normal. LV-2A main engine cut-off (MECO) was normal and resulted from guidance command. SS-01A separation was normal. The SS-01A thrust phase was normal. However, due to a slow shutdown of the SS-01A engine, the injection velocity was slightly greater than that required for the specified orbit.

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SECTION II

Conclusions and Recommendations

A. CONCLUSIONS.

1. The booster was successfully counted down and launched. The performance of Stage I subsystems were normal.
2. An abnormally slow SS-01A shutdown is attributed to: (a) a malfunctioning fuel valve or (b) a malfunctioning pilot-operated solenoid valve. The result was a 22 fps excess post-shutdown velocity gain. The fuel valve was 15 months old when installed at LMSC, Sunnyvale. A new pilot-operated solenoid valve was installed at LMSC/VAFB. The only previous anomaly of this nature in the last fourteen vehicles occurred on vehicle 1169; this was also the only other vehicle of the previous fourteen which had a replacement solenoid valve installed at LMSC/VAFB. (See Section V, B.)
3. There were large current transients at start of separation and during ullage rocket burn. (See Section V, C.)
4. Data indicated that the transducer range for the Gyro Block temperature was not high enough. (See Section V, E.)
5. The Program Test Operations Order stated that links 3 and 4 should be measured during launch while the originator intended it to be a prelaunch check only. (See Section VI, I.)

B. RECOMMENDATIONS.

1. Recommend LMSC investigate and determine -
 - a. Effective fuel valve shelf life.
 - b. Effects of solenoid valve installation techniques on valve operation.
- [REDACTED]

B. RECOMMENDATIONS. (Continued)

2. Recommend LMSC continue to investigate the cause of short circuits at separation and the possibility of installing switching circuitry to remove power from ullage rockets after ullage thrust terminations; also consider possible lead placement or shielding change to correct this malfunction.

3. Transducers be selected so that critical parameter readings would still be within the range of calibration.

[REDACTED]

[REDACTED]

SECTION III

Launch Evaluation

A. LAUNCH OBJECTIVES vs RESULTS ATTAINED

The objectives listed below are for the checkout and ascent phase of the test. The orbit phase lies beyond the scope of this report. A complete listing of the objectives can be found in the Systems Test objectives (STO) for Program 162, document number MSC-001081-A.

TABLE 1

Launch Objective Attainment

Objective	Results	Comment
Primary Test Objectives		
1. Place payload in desired orbit	Achieved	
2. Secure Telemetered data for evaluation	Achieved	Agens fuel pump inlet pressure not obtained
3. In order to achieve the primary objectives it is mandatory that the 162 System shall provide or demonstrate the following capabilities:		
a. 162 Booster		
(1) Attain correct position at MECO	Achieved	

TABLE 1 (Continued)

Launch-Objective Attainment

Objective	Results	Comment
(2) Attain correct velocity direction at MECO	Achieved	
(3) Attain correct velocity magnitude at MECO	Achieved	
(4) The BTL guidance system must maintain correct guidance and functional commands to the vehicle	Achieved	
b. SS-01A Airframe and Adapter		
(1) Withstand guidance maneuvers and flight environment	Achieved	
(2) Provide compatibility between booster and satellite stages	Achieved	
c. SS-01A Propulsion System		
(1) Proper retro-rocket operation	Achieved	
(2) Obtain impulse for orbital velocity	Achieved	22 fps excess post-shutdown velocity gain

TABLE 1 (Continued)

Launch Objective Attainment

Objective	Results	Comment
(3) Control vehicle telemetry and S-band beacon operation	Achieved	
(4) Accept and act upon ground commands	Achieved	
g. Aerospace Ground Equipment		
(1) Check out booster and satellite stages	Achieved	
(2) Control, monitor and power the 162 satellite and booster during countdown	Achieved	
h. 162 System Facilities		
(1) Monitor vehicle functions to insure satisfactory flight	Achieved	
(2) Produce adequate telemetry records of inflight data	Achieved	
(3) Properly transmit and verify reception of all commands	Achieved	

[REDACTED]

[REDACTED]

TABLE I (Continued)

Launch Objective Attainment

Objective	Results	Comment
(4) Determine an orbit ephemeris	Achieved	
(5) Provide interstation and intrastation communications	Achieved	

Secondary Test Objectives

- 5. The 162 personnel must demonstrate the capability to:
 - a. Calibrate and operate system checkout equipment Achieved
 - b. Operate SS-01A and payload consoles and related equipment Achieved
 - c. Transport, check out, mate, fuel, and launch the 162 vehicle Achieved
 - d. Communicate within and between operating locations Achieved
 - e. Accomplish checkout, launch, orbital, and recovery, normal and emergency procedures Achieved

TABLE I (Continued)

Launch Objective Attainment

<u>Objective</u>	<u>Results</u>	<u>Comment</u>
6. Determine temperature of satellite structure and components	Achieved	
7. Execute specialized tests	Achieved	

[REDACTED]

B. COUNTDOWN.

1. Launch was accomplished on the second attempt for booster 389. Booster 389 was formerly mated with SS-01A/1170. The first countdown was aborted at 1130 PST, 20 Jan 64, in task 12, after umbilical disconnect was initiated prematurely by high winds and the loss of the vehicle's blanket at 1041 PST.
2. Because of second stage damage, another second stage vehicle, SS-01A/1174, was substituted. The second countdown was initiated at 0355 PST on 15 Feb 64, and proceeded to liftoff with one hold being imposed from 1315 to 1323 PST for range clearance (trains in the area.)
3. Task 3 (see appendix B for task breakdown) was delayed because the Douglas Aircraft Co. (DAC) destruct battery was not connected (R-1 day tasks were still in progress). In task 6, command 3 (item 117) was sent 20 seconds early so the sequence had to be recycled.
4. In task 4, the Lockheed Missile and Space Co. (LMSC) control gas trailer developed a leak in a regulator; therefore, a backup trailer was used. The fuel vent regulator ranged too high and had to be reset in task 16.
5. The terminal count proceeded to liftoff with no anomalies.

C. PAD DAMAGE.

Pad damage was normal for a LV-2A launch and pad turnaround time will not be affected.

D. FLIGHT ANALYSIS.

In the following summary of events, the times for command guidance sequences are derived from the SS-01A telemetry; other event times are derived from both the LV-2A and SS-01A telemetry and referenced to the receipt of the liftoff signal. Injection conditions and orbital parameters were obtained from guidance equipment printout and observation of orbital passes, respectively.

TABLE 2

Significant Events

<u>Item</u>	<u>Predicted</u>	<u>Actual</u>
Liftoff		
System Time		77903.10
PST		1338:23.10
Solid Motor Burnout		
Web Burnout (Mean)	27.00	28.08
Thrust Termination (Mean)	40.00	41.50
Solid Motor Jettison (Mean)	65.00	65.03
Begin LV-2A Steering	92.00	92.41
End LV-2A Steering	144.85	143.97
MECO (S1 Command)		147.50
MECO	148.85	147.58
VECO	157.85	156.52
Separation (S2 Command)	161.85	160.94
Separation Complete	164.35	163.44
Ullage Rocket Ignition	166.85	165.39
SS-01A Ignition	169.85	168.39
SS-01A Thrust Attainment (90% P _c)	171.15	169.54

TABLE 2 (Continued)

Significant Events

Item	Predicted	Actual
Begin SS-OLA Steering	179.85	180.05
End SS-OLA Steering	353.88	352.41
Enable Velocity Meter	355.38	354.97
SS-OLA Engine Shutdown Command	414.25	414.14
VTS Verloort Radar Loss		404 sec
VTS Telemetry Data Fade (Link 1)		441 sec
VTS Telemetry Data Fade (Link 2)		449 sec

TABLE 3

Injection Conditions

Parameter	Unit	Predicted	Guidance Evaluation	Actual
Injection Altitude	nm	100.060	101.369	101.09
Flight Path Angle	deg	-0.001	+0.0092	Not Available
Period	min	90.686	90.681	90.862
Inclination Angle	deg	75.00	74.988	74.98
Inertial Velocity	fps	25811.814		25,833

TABLE 3A

Orbital Parameters

Parameter	Unit	Predicted	Actual
Apogee Altitude	nm	234.65	248.39
Perigee Altitude	nm	100.50	101.09
Eccentricity	deg	0.018614	0.02037
Period	min	90.67	90.862
Inclination Angle	deg	75.00	74.98

[REDACTED]

E. COMMAND GUIDANCE SYSTEM.

1. General - The command guidance system performed satisfactorily during ascent to fulfill primary objectives. During active guidance, the vehicle responded normally to the steering orders transmitted by the command guidance system and the desired trajectory was achieved. All commands were transmitted within specified time tolerance and no beacon transmitter pulse dropouts occurred during guidance participation.

2. Guidance -

a. Command guidance of the LV-2A vehicle was initiated at T+92.41 seconds. The first steering orders were yaw-right and pitch-down of maximum amplitude, reducing to moderate amplitude after 5 seconds of steering correction. Termination of booster guidance was at T+143.97 seconds. MECO was effected by the guidance command S1 at T+147.50 seconds.

b. Separation of the SS-01A from the booster was initiated by the guidance command S2 at T+160.94 seconds. The inertial reference gyros, after uncaging at T+156.52 seconds, produced proper signal outputs to the flight control system and provided short term attitude references. Second stage telemetry data shows that steering began at T+180.04 seconds with very light pitch-up and yaw-left orders. Steering remained extremely light until termination at T+352.41 seconds. The final guidance command S3 enabled the velocity meter at T+354.97 seconds. Table 2 summarizes the pertinent guidance system event times.

c. During an evaluation phase immediately following the S3 command, the guidance equipment computed certain injection conditions and orbital parameters that should result, based on trajectory dispersions from nominal values at the time of the evaluation. The evaluation results are compared with predicted and actual values in Table 3.

[REDACTED]

SECTION IV

LV-2A SYSTEMS ANALYSIS

A. AIRFRAME.

1. Environmental Conditions.

a. Structural Loading - All transient and steady state loads were normal for a TAT vehicle. Maximum acceleration was 6.44g's occurring at MECO and the maximum combination loading due to acceleration plus vibration was 6.92g's at T+136.5 seconds.

b. Vibrations - 17 to 20 cps structural oscillations occurred from T+120 to T+143 seconds. Maximum peak-to-peak amplitude was 3.7g's at T+136.5 seconds. All vibrational measurements were within specified limits.

c. Skin and Internal Temperatures - All skin and internal temperatures monitored during the ascent flight were normal.

d. Pressures - All tank pressures were within limits.

2. Functional Conditions.

a. Separation - Refer to Section V, A-3a.

b. Solid Motor Jettison - The separation process was initiated by the booster programmer command at T+65.03 seconds. Satisfactory separation was evidenced by Sequence II, channel 10 of the LV-2A telemetry.

B. PROPULSION.

1. System Designations. The propulsion systems in this flight consisted of a Rocketdyne YLR 79-13 liquid propellant main engine with baffled injector, two LR 101-11 vernier engines, and three Thiokol model TX 33-52 solid propellant motors.

2. Main Engine Performance.

a. Start Sequence - The start sequence was nominal. See Table 4 for start sequence event times.

[REDACTED]

b. Events - Fuel and LOX float switch actuation occurred at T+137.18 and T+140.91 seconds respectively. Main engine cutoff (MECO) occurred at T+147.58 seconds as a result of BTL command.

c. Propellant Utilization - The residual propellants at MECO were 440 pounds of LOX and 300 pounds of fuel. Propellant consumption based on total fuel and LOX remaining in the tanks was 99.3 percent.

d. Pressurization and Propellant Supply - The pressurization and propellant supply systems performed satisfactorily during flight.

e. Thrust Chamber Performance -

(1) Chamber Pressure - Main engine chamber pressure was satisfactory during flight. 17 to 20 cycle per second vibrations were recorded from T+120 to T+143 seconds with an approximate 25 psia peak-to-peak level at T+137.5 seconds.

(2) Flow Rates - The fuel and LOX average flow rates from liftoff to float switch actuation were 217.73 and 457.85 pounds per second respectively; from float switch actuation to MECO they were 217.08 and 412.85 pounds per second. This is normal because of the decreasing oxidizer flow rate history.

(3) Mixture Ratio - The average mixture ratio from liftoff to float switch actuation was 2.11.

(4) Thrust - Thrust was determined from chamber pressure data. Total and main engine thrust were 354,100 and 182,800 pounds respectively.

f. Table 5 lists power plant parameters, expected values at T+25 seconds, actual values and times of occurrence.

3. Vernier Engine Performance.

a. VECO occurred at T+156.52 seconds. This was 9.02 seconds after MECO command as controlled by the vernier engine timer.

b. The start sequence was nominal. See Table 4 for event times.

c. Thrust Chamber Performance -

(1) Vernier engine chamber pressure was higher than the expected value. Thrust was determined from chamber pressure data.

[REDACTED]

[REDACTED]

(2) Vernier engine thrust at T+25 seconds was 1,100 pounds per engine. Although only vernier engine number two was being monitored, it is assumed as a result of normal operations that number one produced the same thrust.

4. Solid Motor Performance. Solid motor performance was satisfactory:

a. Average times for significant parameters -

(1) Web Burnout - 28.08 seconds

(2) Solid Motor Thrust Termination - 41.50 seconds

(3) Solid Motor Jettison - 65.03 seconds

b. Solid Motor Thrust at T+25 seconds -

(1) SM #1 - 55,400 pounds

(2) SM #2 - 57,600 pounds

(3) SM #3 - 56,100 pounds

5. Overall Evaluation of System Performance. Performance of the propulsion system was satisfactory throughout the flight.

TABLE 4

Engine Start Sequence

Channel	Event	Time (Sec)
	Propellant transfer complete	0.000
2	Start tanks pressurizing signal	9.490
3	Missile tanks pressure switches pick-up	10.089
4	Vernier engine ignition signal	10.095
7	Vernier engine lock-in signal	10.100
15	Lox valve control signal	10.100
8	Vernier engine propellant valve control signal	10.101
19	Gas generator igniters firing signal	10.107
11	Vernier engine #2 propellant valve leaves closed position	10.151
16	Main lox valve leaves closed position	10.170
9	Vernier engine #1 propellant valve leaves closed position	10.182
17	Main lox valve arrives at open position	10.233
10	Vernier engine #1 propellant valve arrives at open position	10.262
12	Vernier engine #2 propellant valve arrives at open position	10.272
20	Gas generator ignition links broken	10.485
18	Main engine ignition detector links broken	10.590

TABLE 4 (Continued)

Engine Start Sequence

Channel	Event	Time (Sec)
13	Vernier engine fuel injector pressure switches picks up	10.670
39	Main fuel tank pressurizing	10.680
21	Gas generator blades and main fuel valve control signal	10.681
24	Gas generator blade valve leaves closed position	10.725
25	Gas generator blade valve arrives at open position	10.740
22	Main fuel valve leaves closed position	10.814
23	Main fuel valve arrives at open position	10.940
	Liftoff	11.568

TABLE 5

Values of Selected Parameters

<u>Parameter (units)</u>	<u>Time From Liftoff (in seconds)</u>	<u>Expected Value (at 25 seconds)</u>	<u>Measured Value</u>
Vernier Engine #2 Cham- ber Pressure (psia)	-2		16
	5		356
	25	355	368
	100		362
	147		326
	153		300
	160		16
	(SOLO)		
Main Engine Chamber Pressure (psia)	-2		18
	5		590
	25	598	604
	100		575
	147		549
	160		4
Fuel Pump Inlet Pressure (psia)	-2		57
	-0.53		30
	5		61
	25	54	55
	100		42
	147		65
	160		10
LOX Pump Inlet Pressure (psia)	-2		58
	5		57
	25	62	60
	100		43
	147		39
	160		31

TABLE 5 (Continued)

Values of Selected Parameters

<u>Parameter (Units)</u>	<u>Time From Liftoff (in seconds)</u>	<u>Expected Value (at 25 seconds)</u>	<u>Measured Value</u>
LOX Pump Inlet Temperature (°F)	-2		-291.2
	5		-293.2
	25		-293.2
	100		-288.0
	147		-282.8
	160		-281.8
Hydraulic Supply Pressure (psia)	-2		3015
	5		3180
	25	3200	3115
	100		3100
	147		3100
	160		2330
Hydraulic Return Pressure (psia)	-2		106
	5		53
	25	50 to 90	53
	100		79
	147		79
	160		89
Turbopump Speed (rpm)	-2		0
	5		6220
	25	6240	6350
	100		6260
	147		6050
	160		75

TABLE 5 (Continued)

Values of Selected Parameters

<u>Parameter (Units)</u>	<u>Time From Liftoff (in seconds)</u>	<u>Expected Value (at 25 seconds)</u>	<u>Measured Value</u>
Turbine Inlet Temperature (°F)	-2		70
	5		1140
	25	1200	1160
	100		1130
	147		1070
	160		790
Fuel Tank Top Pressure (psia)	-2		41
	5		34
	25	24	22
	100		11
	147		9
	160		9
LOX Tank Top Pressure (psia)	-2		48
	5		39
	25	43	42
	100		33
	147		33
	160		33
Solid Motor #1 Chamber Pressure (psia)	-2		12
	5		488
	15		482
	25	510	492
	28.1		496
	45		3

TABLE 5 (Continued)

Values of Selected Parameters

<u>Parameter (Units)</u>	<u>Time From Liftoff (in seconds)</u>	<u>Expected Value (at 25 seconds)</u>	<u>Measured Value</u>
Solid Motor #3 Chamber Pressure (psia)	-2		19
	5		498
	15		490
	25	510	498
	28.08		505
	45		13
Solid Motor #2 Chamber Pressure (psia)	-2		23
	5		502
	15		497
	25	510	510
	27.76		510
	45		14
Gas Generator Lox Injector Pressure (psia)	-2		-5
	5		635
	25	650	643
	100		643
	147		623
	160		-13

[REDACTED]

C. ELECTRICAL.

All first stage electrical equipment operated satisfactorily. The missile battery voltage was 30 volts before liftoff. It dropped to 27.2 at ignition of the solid motors and recovered in 1.5 seconds to 29 volts and remained above this value for the remainder of the booster phase. The missile 400 cps inverter voltage level was about 112.6 volts at liftoff. For the first 15 seconds after liftoff, data indicated the inverter output fluctuated approximately once per second with an excursion of about 1 volt. These surges reached a maximum of 113.6 volts. The 112.6 volt output value gradually rose to about 113.0 volts at MECO. Telemetry battery voltage was 27.6 volts throughout the flight. Actuator potentiometer positive and actuator potentiometer negative were about 25.4 and 25.3 volts respectively. Both actuator voltages reflect the voltage fluctuations that appear in data for the missile inverter voltage. (See Table 6)

D. FLIGHT CONTROL.

Performance of the control system was satisfactory. Liftoff transients were small. Thrust misalignments at liftoff were -0.02 degrees in pitch and -0.05 degrees in yaw. Roll moment caused by solid motor misalignment was 538 foot pounds counterclockwise. Maximum main engine deflections during the period of highest aerodynamic load were -0.8 degrees in pitch and $+1.35$ degrees in yaw. Maximum attitude errors after initiation of BTL guidance were $+1.5$ degrees in pitch, -1.5 degrees in yaw and $+0.3$ degrees in roll; maximum attitude rates were -1.0 deg/sec in pitch, $+2.15$ deg/sec in yaw, and negligible in roll. Thrust misalignments at MECO were -0.06 degrees in pitch and -0.04 degrees in yaw. Attitude errors at SS-01A gyro uncage were $+0.4$ degrees in pitch, $+0.1$ degrees in yaw and negligible in roll. Attitude rates at SS-01A separation were 0.1 deg/sec in pitch and negligible in yaw and roll. Twenty cycles per second oscillations were apparent in the yaw and roll rate data from T+125 to T+142 seconds. All programmer events were executed satisfactorily in both value and time.

TABLE 6

LV-2A Electrical Summary

Component	Liftoff	Jettison Solids	Steering Initiated	MECO	Separation
Missile Battery Voltage	30/27.2v	29.1v	29.3v	28.7v	28.8v
Telemetry Battery Voltage	27.6v	27.6v	27.6v	27.6v	27.6v
Actuator Pot Positive	25.4v	25.4v	25.4v	25.3v	25.5v
Actuator Pot Negative	-25.3v	-25.3v	-25.3v	-25.3v	-25.2v
Control In-verter 400cps	*112.6/113.6v	112.7v	112.6v	113.0v	112.8v
5 Volt absolute	5.0v	5.0v	5.0v	5.0v	5.0v
Instrumentation Ground	0v	0v	0v	0v	0v

*Surges at a little less than one cycle per second for the first 15 seconds of flight.

E. HYDRAULICS/PNEUMATICS.

The hydraulic/pneumatic systems functioned properly throughout the flight. No leaks were detected.

F. INSTRUMENTATION.

Instrumentation returned satisfactory data for all monitored functions. Valid data was also received from special temperature sensors installed in the engine section and transition section.

G. AEROSPACE GROUND EQUIPMENT.

The aerospace ground equipment concerned with the first stage satisfactorily supported checkout and launch of the vehicle.

SECTION V

SS-01A System and Analysis

A. SPACEFRAME.

The environmental and functional performance of the spaceframe was satisfactory throughout the ascent phase.

1. Environmental Conditions.

a. Structural Loading - All transient and steady state loads were normal for a TAT vehicle. Refer to Section IV, A-2a.

b. Vibrations - All vibration loads were normal. Refer to Section IV, A-2b for maximum longitudinal vibrations. Maximum oscillations in the "y" Axis (yaw) with a peak-to-peak amplitude of 2.22g's and frequency of 49 cps occurred at T+414.5 seconds.

c. Temperatures - All vehicle skin, structural, and component temperatures were normal throughout the ascent phase. A maximum nose fairing temperature of 250°F was reached at T+150 seconds.

d. Pressures - All vehicle pressures were normal during the ascent phase.

2. Functional Conditions.

a. Pyrotechnic - All critical pyrotechnics functioned satisfactorily.

b. Separation - Clean, complete separation occurred at T+163.44 seconds with a separation time of 2.5 seconds. Satisfactory separation was evidenced by the gas valve current.

c. Alignment - All alignments were within limits except for the SS-01A turbine exhaust duct misalignment of approximately 18.9 min (specification ± 15 min). The degree of misalignment is minor compared to most previous SS-01A vehicles.

[REDACTED]

B. PROPULSION.

1. System Designation. The SS-01A propulsion system used in this flight consisted of a USAF Model XLR81-BA-9 rocket engine. The pressurization system utilized a 900 cubic inch storage sphere. There was one burn period.

2. System Performance. The SS-01A vehicle performed satisfactorily to achieve orbit. However, an excess post shutdown velocity gain appears to be responsible for a somewhat higher-than-expected energy level of the final orbit. This conclusion is substantiated by orbital data.

a. Events - The SS-01A engine was ignited at T+168.39 seconds, reached thrust attainment at T+169.54 seconds, and was shut down by velocity meter command at 414.14 seconds.

b. Pressurization System - The helium pressurization system operated satisfactorily during engine operation. The helium bottle pressure was 3092 psig at ignition and nearly zero at shutdown.

c. Transients - The start transient was normal. Fuel valve and pressure switch actuations occurred 0.95 and 1.15 seconds after main power relay, respectively. The shutdown signal occurred 245.75 seconds after ignition, and 244.60 seconds after thrust attainment. The shutdown transient was slow in that a post shutdown velocity gain of 22 fps above expected was encountered. The problem is ascribed to a malfunction of either the fuel valve or the pilot operated solenoid valve. The latter is de-energized at shutdown, thereby stopping fuel pressure to the opening side of the fuel valve. While contamination or obstruction in the pilot operated solenoid valve is a plausible cause for the slow shutdown transient, the valve was new when installed on the vehicle. The fuel valve, on the other hand, was 15 months old. Conclusions and recommendations for this malfunction are give in Section II.

d. Thrust Chamber Operation - Steady state average chamber pressure was 505.9 psia. Propellant flow rate during steady state operation was 54.59 lb/sec. Average thrust during steady state operation was 15,978 lb.

e. Specific Impulse - Specific impulse, as determined from velocity meter data by the inverse acceleration method, was 291.36 seconds. The value determined from statistical correlation of acceleration, chamber pressure, and turbine speed data was 292.7 seconds.

f. Data Summary - Performance of the propulsion system is summarized in Table 7.

TABLE 7

Propulsion System Performance

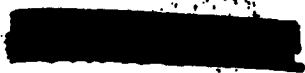
<u>Parameter</u>	<u>Actual</u>	<u>Expected</u>
Average Thrust (lb)	15978	15973
Average Chamber Pressure (psia)	505.9	505.8
Average Flow Rate (lb/sec)	54.59	54.61
Average Oxidizer Flow Rate (lb/sec)	39.19	39.21
Average Fuel Flow Rate (lb/sec)	15.40	15.40
Average Mixture Ratio	2.545*	2.545
Specific Impulse (sec)	292.7	292.5
Oxidizer Tank Pressure (psig)		
Liftoff	32.1	30
Shutdown	9.2	10
Fuel Tank Pressure (psig)		
Liftoff	39.4	38
Shutdown	9.7	13

TABLE 7 (Continued)

Propulsion System Performance

<u>Parameter</u>	<u>Actual</u>	<u>Expected</u>
Helium Supply Pressure (psig)		
Liftoff	3044	3000
Shutdown	≈ 0	≈ 0
Burn Duration (sec)	244.60	243.15
Post Shutdown Velocity Gain (ft/sec)	48	26
Propellant Residual at Shutdown Signal (lb)	114	189

*Based on expected value.



C. ELECTRICAL.

1. The SS-01A vehicle electrical system performance was satisfactory to accomplish the launch phase of the flight. Missile battery voltage was within specifications and had a maximum of about one volt drop during a current surge at the T+160.94 seconds separation command. The current surge at the separation command (LV-2A from SS-01A) was a 300 milli-second in duration reaching a peak of about 54 amperes. Data indicated a possible pyrotechnic bus to pyrotechnic return short circuit. No other equipment is known to have malfunctioned at this time.

2. A second current surge occurred just after separation was complete. This was a 180 milli-second surge of two pulses reaching 47 amperes maximum. With this surge, there was about a 0.5 volt drop in the missile battery voltage reading. The project office determined that at this time this was a normal payload power requirement; therefore, a normal current surge.

3. A third high current drain occurred during the ullage rocket burn period and reached 28 amperes maximum total current. This current drain was characteristic of that normally associated with ullage rocket igniter shorts.

TABLE 8

SS-01A Electrical Summary

Component	Liftoff	MECO	Separation	Ignition	Steering Terminated	Shut-down
+28 VDC Supply Unregulated	27.2v	27.0v	1 v drop 26.7/25.7	26.5v	26.5v	26.5v
+28 VDC Supply Regulated	28.3v	28.3v	28.4v	28.4v	28.3v	28.3v
-28 VDC Supply Regulated	-28.2v	-28.2v	-28.2v	-28.2v	-28.2v	-28.2v



TABLE 8 (Continued)

SS-01A Electrical Summary

Component	Liftoff	MECO	Separation	Ignition	Steering Terminated	Shut-down
+28 VDC Current Monitor	19.0 amps	19.0 amps w/surge to 23.6 amps	*Large current surges	18 amps increasing to 28 amps	24 amps	21 amps
+28v Pyro Bus	28.6v	28.6v	28.4v	28.1v	28.1v	28.1v
28 VDC Reg DC/DC Converter	28.0v	28.3v	28.0v	28.1v	28.3v	28.0v
400 CPS 1 Phase Power Ampl	117.0v	117.0v	117.3v	117.7v	117.0v	117.0v
400 CPS 3 Phase Inverter #1	116.3v	117.4v	116.8v	117.5v	116.3v	116.3v
Inverter Type 1A No. 1 D/P	108.1v	106.1v	106.1v	107.6v	107.8v	107.8v
400 CPS 3 Phase Bus Phase AB	116.3v	116.3v	116.3v	116.7v	116.3v	116.3v

* There were large current surges at separation command and again at separation complete. A two-pulse current surge at separation complete lasted a total 180 milli-seconds and reached a peak value of 47 amperes. The other surge was at separation command and lasted about 300 milli-seconds and reached approximately 54 amperes maximum.

[REDACTED]

[REDACTED]

D. FLIGHT CONTROL.

1. General. Available data indicates that the second stage guidance and control system performed satisfactorily during ascent, providing proper responses to ground guidance commands, attitude and velocity control, and sequencing of inflight events.

2. Attitude Control. The inertial reference package gyros, operating in the caged mode, sensed changes in attitude throughout first stage powered flight. After uncaging at VECO, T+156.52 seconds, the gyros began indicating second stage deviations about the inertially referenced gyro input axis triad. Transients resulting from stage I/II separation, ullage rocket ignition and pitch programming were negligible and normal recoveries were experienced. At second stage engine ignition, T+168.39 seconds, the induced transients resulted in the following maximum excursions of gyro demodulator outputs and engine gimbal positions:

Pitch Demodulator	-1.24 degrees
Yaw Demodulator	+1.52 degrees
Roll Demodulator	3.50 degrees
Pitch Engine Gimbal Angle	-1.19 degrees
Yaw Engine Gimbal Angle	-1.02 degrees

After damping of the initial engine ignition transients, the control system stabilized in pitch and yaw with the following offsets due to the normal thrust vector misalignments:

Pitch Demodulator	+0.25 degrees
Yaw Demodulator	+0.35 degrees
Pitch Gimbal Angle	+0.64 degrees
Yaw Gimbal Angle	-0.59 degrees

[REDACTED]

[REDACTED]

The roll transient was suppressed by gas valve activity. The second stage then established a minus 1.54 degree offset condition of the roll gyro to counteract the negative roll moment of 1.46 ft-pound, apparently caused by a 0.32 degree misalignment of the turbine exhaust duct. There were negligible transients experienced when steering was initiated by BTL ground guidance at T+180.04 seconds, since only light trajectory corrective action was required. (See Section III E) The transients encountered at burnout were light and the data indicated the vehicle was achieving a stable attitude when TM fade occurred at T+440 seconds. The control jet pulsing and movements of the hydraulic actuators were effected with the proper gains and polarity in response to gyro error signals from the inertial reference package to make necessary vehicle attitude changes as required by the standard D-timer program, horizon sensor and ground guidance pitch and yaw steering commands. The total gas consumption through TM fade was computed to be approximately 6.90 pounds. The hydraulic pressure was maintained at a steady level of approximately 2900 psi during the thrust period.

3. Horizon Sensor. The horizon sensors began producing proper outputs at T+158.67 seconds which were representative of the vehicle attitude relative to the earth. The roll attitude exhibited by the horizon sensor was larger than expected achieving a maximum of a positive 5.00 degrees. This error in roll attitude was corrected when jet control pneumatics were initiated after Stage I/II separation. Horizon sensor supervision over the roll gyro was initiated at T+161.50 seconds and over the pitch gyro at T+425.55 seconds, with the proper gains.

4. Standard D Timer. The Standard D-Timer began its event sequencing control at MECO, T+147.55 seconds, and provided the required event initiating signals during ascent of the second stage at the proper times.

5. Velocity Meter. The velocity meter, after its enable at T+354.97 seconds by command guidance, responded to vehicle acceleration and produced the engine shutdown command after the required sensible velocity had been gained. However, an excessive engine tail-off thrust (See Section V B for discussion) caused the vehicle to gain an increment of velocity 22 fps above the predicted value. The injection velocity obtained from orbital simulation reflected this higher than expected velocity gain.

[REDACTED]

[REDACTED]

E. INSTRUMENTATION AND SPACE/GROUND COMMUNICATIONS.

1. Telemetry Summary. The instrumentation for the SS-01A satellite vehicle was transmitted over link 1. Performance of this link was satisfactory in providing all the data for checkout and post-launch evaluation of the vehicle subsystems during ascent. All subcarriers were present at liftoff, and all commutator wave forms were clean.

2. Configuration. The vehicle telemetry system assigned to the ascent phase consisted of 13 continuous FM/FM channels and five commutated FM/FM channels (all 5 RPS x 60 positions, one of which was wired as a 30 position). The instrumentation for this vehicle was approximately the same as previous vehicles for this program except for 13 additional subsystem C parameters placed on channel F.

3. Measurement Malfunctions.

a. B1 (15-01-15) Fuel Pump Inlet Pressure--This measurement appeared to be normal until approximately T+306.3 sec. when it jumped high and out of band.

b. D129 (17-01-14) Gyro Block Temperature--This measurement was operating at 5 volts (138.5°F) throughout the flight. Analysis of the data indicates proper transducer action throughout the ascent portion of the flight until loss of signal. It appears that the choice of the transducer range for this measurement was not sufficiently high enough to produce the data within the 0.0 volts to 5.0 volt band limits.

4. S-Band Beacon. Telemetry data indicates satisfactory response of the S-band beacon to VERLORT radar interrogation from liftoff to horizon signal fade at T+404 sec. Extraneous radar interference was relatively light throughout the launch phase.

5. H-Timer. Orbital timer (type VIII) performance appeared satisfactory throughout the launch phase. The following settings, programmed at liftoff, were in the same position at the time of link 1 telemetry fade. (T+441 seconds)

Timer Step Position

263

Orbital Period

5440 sec

Reset Monitor	Pre-Reset Enable
Increase/Decrease	Increase
Re-entry Enable/Disable	Disable
Re-entry Selector	Re-entry Pass Select (SPC-9)

F. AEROSPACE GROUND EQUIPMENT (AGE).

The aerospace ground equipment concerned with the second stage satisfactorily supported checkout and launch of the vehicle with the following exceptions:

1. A leak was noticed at 1232 PST in the LMSC Control Gas Supply Trailer regulator. A backup trailer was used instead. The regulator problem is under investigation.
2. A LMSC fuel vent regulator had to be adjusted at 1301 PST.

SECTION VI
RANGE SUPPORT

A. METRIC OPTICS.

1. General. Metric optic coverage and plots of the optical data were of fair quality. Optical coverage was given at four points per second for 9.5 seconds. Because of an overcast, duration of optical coverage was limited. Pitch and yaw attitude was presented for 5 seconds and apparent roll angle for 7.9 seconds. The LA-24 tracking camera was not in operation because of an overcast that caused zero visibility. Table 9 summarizes the data provided.

TABLE 9

PMR Tabular Optic Data

Coordinates	Duration (Seconds)	Sample Rate (Points/sec)	Remarks
Tangent Plane			
X, Y, Z	10 to 9.5	4	Optical coverage was limited because of a low overcast.
$\dot{X}, \dot{Y}, \dot{Z}, V$	10 to 9.5	4	
$\ddot{X}, \ddot{Y}, \ddot{Z}, A$	10 to 9.5	4	
Pitch and Yaw	10 to 5.0	4	
Roll	10 to 7.9	10	

B. METRIC RADAR.

1. General. Metric radar coverage and plots of the radar data were satisfactory. After second stage separation, track continued on the satellite vehicle. Table 10 summarizes the data provided.

2. Data Summary.

TABLE 10

FMR FPS-16 Tabular Radar Data
(Tranquillon Peak)

Coordinates	Duration (T+ Seconds)	Data Frequency (Samples/Sec)	Remarks
Tangent Plane			
X, Y, Z	12.40-214.65	4	
• • • X, Y, Z, V	12.40-214.65	4	
•• •• •• X, Y, Z, A	12.40-214.65	4	
Polar and Polar-to- Polar Transforma- tion.			
R, A, E	12.40-212.15	4	Also polar-to-polar transformation from FPS-16 radar site (radar 023001) to VAFB radar site.

TABLE 10 (Continued)

Coordinates	Duration T+ Seconds	Data Frequency (Samples/Sec)	Remarks
Curvilinear			
X, Y, Z	12.40-214.65	4	
$\dot{X}, \dot{Y}, \dot{Z}$	12.40-214.65	4	
Inertial Velocity			
$\dot{X}, \dot{Y}, \dot{Z}, V$	12.40-214.65	4	
Flight Path Angle			
Gamma	12.40-214.65	4	

C. TELEMETRY.

PMR tracking and magnetic tape recording of the LV-2A telemetry signal were satisfactory. Douglas Aircraft Co. reported that the real time data received from Naval Missile Facility Point Arguello (NMFFA) telemetry tracking station was not satisfactory for post launch evaluation. The reference channel E-1, 5 volt absolute was reading five percent low throughout the launch. This problem was evidence of improper calibration of the recorders and of accumulative drift. Because of these problems, launch observers found it difficult to reliably evaluate the go/no-go parameters.

D. MISSILE FLIGHT SAFETY.

During their active tracking periods all the flight safety systems indicated that the vehicle was within the established safe flight limits. Missile flight safety surveillance of the vehicle ascent trajectory was accomplished by means of tracking data acquired by electronic and optical equipment. The following were the track times of the electronic equipment at NMFFA and Vandenberg Air Force Base (VAFB) except as noted.

TABLE 11

Electronic Tracking Times

Equipment	Acquisition	Fade	Slant Range at Fade (k = 1000)
FPS-16 No. 1	T+12 sec	T+210 sec	450 k yds
FPS-16 No. 2	T+41 sec	T+160 sec	22 k yds
FPS-16 No. 4 (Pt Mugu)	T+34 sec	T+238 sec	480 k yds
M-33	T+8 sec	T+85 sec	26 k yds
Verlort	T+14 sec	T+150 sec	194 k yds
FPN 33 No. 1	Liftoff	4350 ft alt	
FPN 33 No. 2	Liftoff	5346 ft alt	
Cotar No. 1	T+3 sec	T+254 sec	
Cotar No. 2	T+2 sec	T+305 sec	

The FPS-16 No. 2 lost track early and had a short tracking range because it locked onto one of the solid motors after jettison.



E. FREQUENCY INTERFERENCE CONTROL.

The frequency interference monitoring results for launch time indicated that all the specified frequency bands were clear. The flight test frequency bands are normally monitored by FMR ground stations at Point Mugu, Point Arguello, and San Nicolas Island and by two airborne facilities flying various flight paths at 10,000 ft along the launch corridor.

TABLE 12

Operational Frequencies Monitored

<u>Function</u>	<u>Frequencies (mc)</u>
Telemetry	228.2, 232.4, 237.8, 246.3, and 257.3
Acquisition Beacon	242.0
S-Band Beacon	2850 and 2920
Command Destruct	416
BTL Guidance	8530 and 9570
Zeke & Zombie	134.64 and 141.54



F. METEOROLOGY.

1. Surface Weather. The weather conditions for the pad area at launch time were as follows:

Sky Cover	Overcast
Visibility	15 miles
Precipitation	None
Obstructions to Visibility	Overcast at 2500 feet
Temperature	56 degrees F
Relative Humidity	83 percent
Wind Direction	280 degrees
Wind Speed	10 knots, gusts to 30
Barometric Pressure	29.790 inches of mercury

2. Upper Winds. Rawinsonde soundings prior to and immediately following launch indicated no severe wind drift or wind shear problems. The launch upper winds data (T-9), based on a balloon released at 1358 PST, are plotted in Appendix D.

3. Structural Wind Loading. The percentage of vehicle structural and control limits, as computed by Lockheed, Sunnyvale were as follows:

	Upper Winds		
	T-12 Hour	T-6 Hour	T-3 Hour
Structure Limit (percent)	32	38	44
Control Limit (percent)	49	50	48

G. ENGINEERING SEQUENTIAL PHOTOGRAPHY.

1. Qualification. A review of quick-look film indicated that engineering sequential photography was satisfactory with the following exceptions:

a. Light striking timing edge.

(1) Item 11.15 (lower missile and launcher at liftoff)

(2) Item 11.17 (fuel lines at base of launcher)

b. No code elements present; only 100 pps signal.

(1) Item 11.23 (tracking of first stage at liftoff)

c. No camera run; camera malfunction.

(1) Item 11.12 (ignition of main, vernier, and solid engines) Timing, when present, was code IRIG-B.

2. Photo Quality. Photographic quality (exposure and coverage) was satisfactory.

H. DOCUMENTARY PHOTOGRAPHY.

Documentary photography was reported as satisfactory.

I. 6594th SUPPORT.

1. Radar. The Mod II Verloort radar satisfactorily tracked the S-Band beacon from liftoff to horizon signal fade at T+404 seconds. Beacon response was good and the automatic track mode was maintained throughout the ascent phase.

2. Telemetry. The TLM-18 and Tri-Helix antenna systems satisfactorily tracked link 1 from liftoff to horizon signal fade at T+449 seconds. The signal strength level on link 1 was nominal and data was recoverable to T+441 seconds.

VTS unnecessarily monitored the signal strengths on links 3 and 4 during the launch phase. The Program Test Operations Order No. 63-6 flight supplement for operation No. 3444, page 29, telemetry read-out requirements stated "VTS verify the presence of a carrier on links 3 and 4". The operations order should have stated that this was only a prelaunch requirement.

The signal strength levels showed that the TIM-18 antenna system was detecting radiation on links 3 and 4 although these vehicle transmitters were supposed to be off. The signal strength levels for both links appeared to be in the order of -100 dbm from liftoff to approximately T+100 seconds. It was determined that the equipment was turned off as programmed. Two possible sources which may explain the detected radiation are:

a. The T/M receivers were sufficiently detuned to pick up adjacent frequency radiations.

b. The T/M receivers were properly tuned and frequency interference was present.

The Frequency Interference Control (FIC) frequency monitoring results did not specify that radiation was present on these two assigned link frequencies during the launch.

APPENDIX A

Configuration and Preparation

I. VEHICLE CONFIGURATION.

A. Stage I. For a general description of the DSV-2C and its systems, refer to model specification DS-2340, dated 31 August 1962. Modifications made at VAFB to increase the reliability of the system, are included in the Booster Launch Test Directive.

The gross weight of booster 389 (Douglas model DSV-2C) was 135,481 pounds, of which 99,085 pounds were useable liquid propellants and 27,847 pounds were three solid motors.

Major components of the system, identified by serial number, were:

	<u>Serial Number</u>
Booster, DSV-2C	389
(SM-75)	(62-12164)
Solid Motor Number 1	267
Solid Motor Number 2	269
Solid Motor Number 3	268
Rocketdyne MB-3 ULR 79-13 Main Engine	006004
Rocketdyne Right Vernier Engine	334946
Rocketdyne Left Vernier Engine	334945
Flight Controller	5337
Main Engine Pitch Actuator	DE 36W

[REDACTED]

[REDACTED]

Serial Number

Main Engine Yaw Actuator	DE 37W
Right Vernier Pitch/Roll Actuator	833
Right Vernier Yaw Actuator	937
Left Vernier Pitch/Roll Actuator	246
Left Vernier Yaw Actuator	192
Roll Rate Gyro	1306
Pitch Rate Gyro	1238
Yaw Rate Gyro	1248
Control Inverter	R-405

B. STAGE II. Configuration consisted of a basic Agena D vehicle (SS-01A) with the following optional equipment installed:

Flight Control Patch Panel Kit

Auxiliary Nitrogen Tank Kit

Engine Cone Auxiliary Structural Kit

Aft Section Auxiliary Structural Kit

Propellant Pump Kit

Single Start Kit

Ampere Hour Meter Kit

Battery Kit

Safe and Arm Plug Kit

[REDACTED]

Orbital Programmer Adapter Kit

Auxiliary FM - TM Adapter Kit

S-Band Beacon Adapter Kit

S-Band Beacon Decoder Adapter Kit

Beacon Orbit Antenna RF Switch Kit

Acquisition Transmitter Adapter Kit

TM Orbital Antenna Switch Kit

Coax Cable Kit

The following program peculiar equipment was installed:

BTL Missile Guidance Group

Power Supply Type 1-A Kit

Diagnostic Monitoring Module Assembly

P-14 System A Kit

"J" Box Tracking Lights Kit

Panel Assembly-Lifeboat Equipment

Research Mod Kit

Discoverer Research Payload Aft Equipment Rack Left Hand Side

Electronic Recovery Timer

Research Payload, 90° Panel System.

C. Weight Breakdown.

	<u>Weight (lbs)</u>
1. At liftoff	152,921
a. LV-2A Expendables to solid motor burnout	49,942
2. At solid motor burnout	102,979
a. LV-2A Expendables to solid motor jettison	22,223
3. At solid motor jettison	80,756
a. LV-2A Expendables to MECO	54,736
4. At LV-2A MECO	26,020
a. Vernier expendables	75
5. At LV-2A VECO	25,945
a. LV-2A jettison	8,832
6. At LV-2A/SS-01A separation	17,113
a. SS-01A Expendables to shutdown	13,372
7. At SS-01A engine shutdown	3,741

II. PREPARATION AND HISTORY STAGE I.

- 6-4-63 Booster 389 arrived; receiving inspections were completed.
- 6-21-63 The hydraulic accumulator was removed and sent to the hydraulic laboratory for repair of a leak.
- 7-3-63 The all-systems test was completed.
- 7-8-63 Booster 389 was weighed and placed in storage.
- 9-9-63 Booster 389 was transported to Pad 5; booster indexing was completed and launcher checks with the booster were started.
- 9-16-63 A new pneumatic package was installed.
- 9-25-63 The flight controller was removed and sent to the electrical laboratory for checkout because the left vernier engine pitch commands were out of tolerance.
- 9-29-63 An all systems test was completed.
- 10-2-63 A dry countdown was completed.
- 10-3-63 A single and dual propellant loading exercise was completed.
- 10-4-63 R-4 day preflight procedures were started, but problems in the SS-01A prevented completion.
- 10-7-63 The flight controller was removed and sent to the electrical laboratory for checkout of possible damage from a shorted rate gyro excitation.
- 10-10-63 An all-systems test was completed. The flight controller and ignition and separation J-box were removed and sent to the electrical laboratory for checkout because the programmer tape had run off.
- 10-15-63 An all-systems test was completed.

- 10-29-63 The VECO time delay was removed for use on booster 400.
- 10-31-63 Because of a change in schedule, booster 389 was demated and put in temporary storage in the pad shelter.
- 11-7-63 Booster 389 was transported to Pad 4.
- 12-2-63 The flight controller was removed and sent to the electrical laboratory for a trajectory change.
- 12-16-63 Installation of special instrumentation in the booster was completed (four thermocouples in the engine section and one in the guidance section.)
- 12-18-63 Three vernier engine actuators were replaced.
- 12-21-63 Booster electrical checks, an all-systems test, and a dry countdown was completed.
- 12-23-63 A new main engine flame guard was installed and checked out. A single and dual propellant loading exercise was completed.
- 12-27-63 R-4 day preflight procedures were completed.
- 12-28-63 Preflight procedures were stopped because of problems in the SS-01A.
- 1-13-64 Booster leak checks were rerun because of time limit expiration. A dry countdown was completed.
- 1-15-64 R-5 day preflight procedures were completed.
- 1-16-64 R-4 day preflight procedures were completed.
- 1-17-64 R-3 day preflight procedures were completed. The feedback potentiometer on vernier engine No. 1 was replaced with one from booster 407. The vernier engine No. 2 chamber pressure transducer was removed for calibration.

- 1-18-64 R-2 day preflight procedures were completed. A dry countdown and BTL phasing and polarity tests were completed.
- 1-19-64 R-1 day preflight procedures were completed.
- 1-20-64 The task countdown was initiated and progressed normally until a malfunction in the SS-01A caused the launch to be cancelled. The solid motors were demated, and the vehicle was brought to the horizontal position.
- 1-21-64 The SS-01A was demated.
- 1-22-64 A special check of the booster and AGE was performed to assure that no damage was incurred during a rain storm.
- 2-7-64 All the feedback potentiometers on the vernier engines and the main engine were replaced, and the actuators were recalibrated.
- 2-10-64 R-4 day procedures were completed. Portions of booster electrical checks were rerun to verify the system after engine potentiometer replacement.
- 2-11-64 R-3 day preflight procedures were completed. An all-systems exercise was also completed.
- 2-12-64 Data from the all-systems test indicate excessive output from the roll gyro; therefore, the flight controller was removed and sent to the electronics laboratory for checkout. The launch was postponed 24 hours.
- 2-14-64 R-1 day preparations completed. A dry countdown and BTL phasing and polarity checks were completed.
- 2-15-64 Successful launch of LV-2A 389.

III. PREPARATION AND HISTORY STAGE II.

12-27-63 Vehicle arrived, and receiving inspection started.

12-30-63 Receiving inspection completed. Vehicle placed on standby - paced by Vehicle 1170 - Launch +10 days.

1-3-64 Further slip directed - Launch +22 days.

1-6-64 Accelerated schedule directed - Launch +20 days.

1-7-64 Transmitter changed per EWO 10-07007.

1-13-64 Mods. per EJA 53918 - Installation of DRP Module 231.

1-22-64 SS/B checks completed. Schedule accelerated to replace vehicle 1170. Launch +16 days.

1-24-64 SS/D validations completed.

1-27-64 Mods. and L/B J-box installed.

1-29-64 Mods. Aft structure - EWO 10-07021 Discover Research Payload fit and alignment.

1-30-64 -29 commutator received, installed and checked out.

2-2-64 DRP fit, Booster adapter fit and moved to MAG range.

2-9-64 DRP mated.

2-11-64 Weigh and mate vehicles, post-mate gyros.

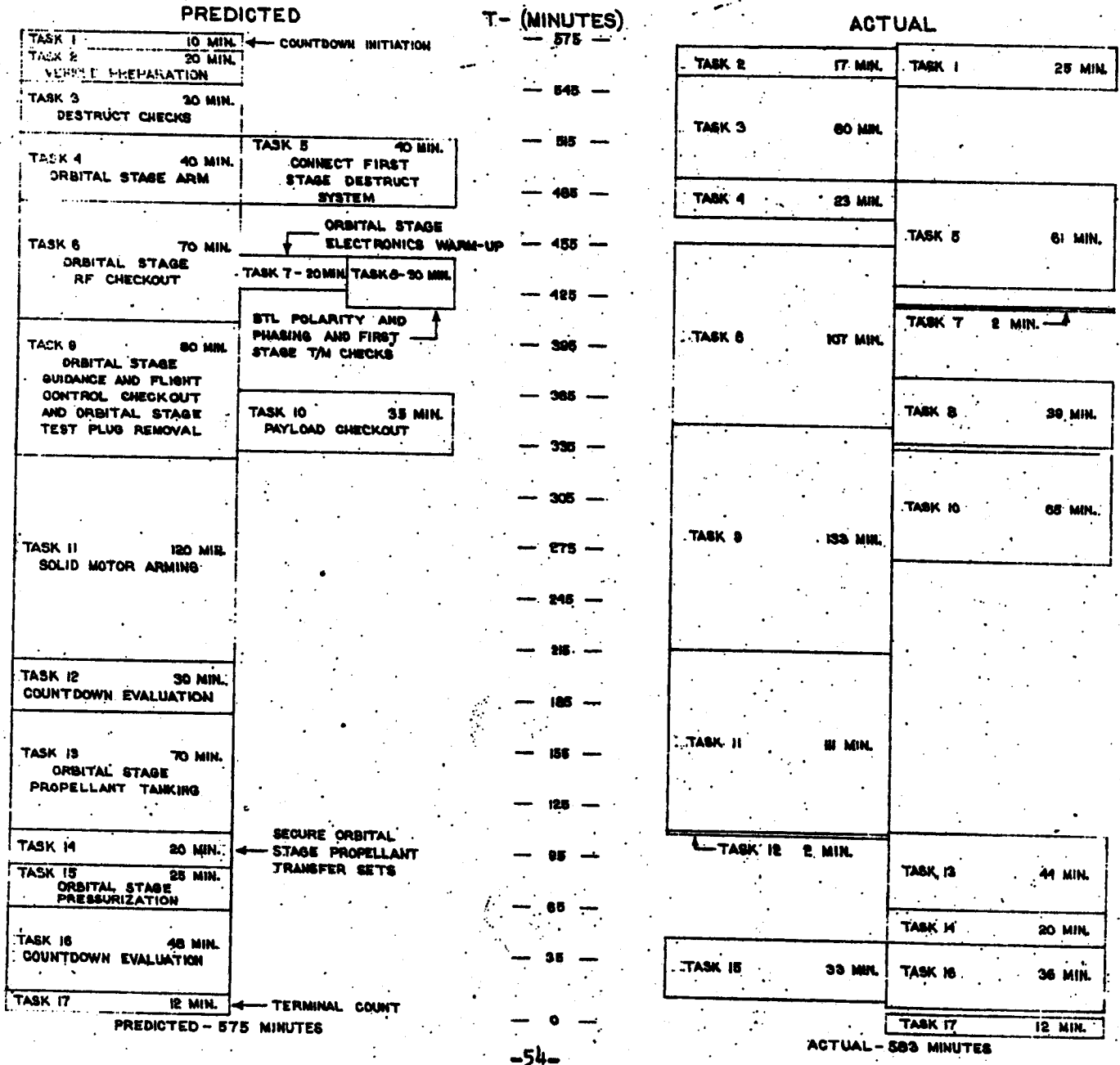
2-12-64 Connected batteries and forward panels installed.

2-13-64 DAC all systems run - Control Electronics Assembly problems. Close out front end.

2-14-64 Advance Payload, DAC solids installed, RF checks were made.

2-15-64 Successful countdown was initiated at 0355.

APPENDIX B COUNTDOWN INTEGRATION CHART



APPENDIX B

Countdown

Task	Length		Time		Remarks
	Nominal	Actual	Begin	End	
1. Countdown Initiation	10	25	0355	0420	Normal
2. Vehicle Preparation	20	17	0358	0415	Normal
3. Destruct Checks	30	60	0415	0515	Douglas destruct battery not connected
4. Orbital Stage Arm	40	23	0516	0539	Normal
5. Connect 1st Stage Destruct System	40	61	0516	0617	Normal
6. Orbital Stage RF Checkout	70	107	0554	0741	Command 3 Erroneously sent--Test Re-run
7. Orbital Stage Electronics Warm-up	20	2	0628	0630	Normal
8. BTL Polarity & Phasing & 1st stage Telemetry checks	30	39	0711	0750	Normal
9. Orbital Stage Guidance & Flight Control Checkout & Orbital Stage Test Plug Removal	80	133	0741	0954	Incompatibility with Task 8

APPENDIX B (Continued)

Countdown

Task	Length		Time		Remarks
	Nominal	Actual	Begin	End	
10. Payload Checkout	35	65	0753	0858	
11. Solid Motor Arming	120	111	0954	1145	Normal
12. Countdown Evaluation	30	2	1145	1147	Normal
13. Orbital Stage Propellant Tanking	70	44	1143	1227	Normal
14. Secure Orbital Stage Propellant Trans. Sets	20	20	1227	1247	Leak in Control Gas Trailer Regulator
15. Orbital Stage Pressurization	25	33	1247	1320	Normal
16. Countdown Evaluation	48	36	1247	1323	Fuel Vent Regulator Adjusted. Hold for Trains
17. Terminal Count	12	12	1326	1338	Normal

AUTOMATIC SEQUENCE OF THE TERMINAL COUNT

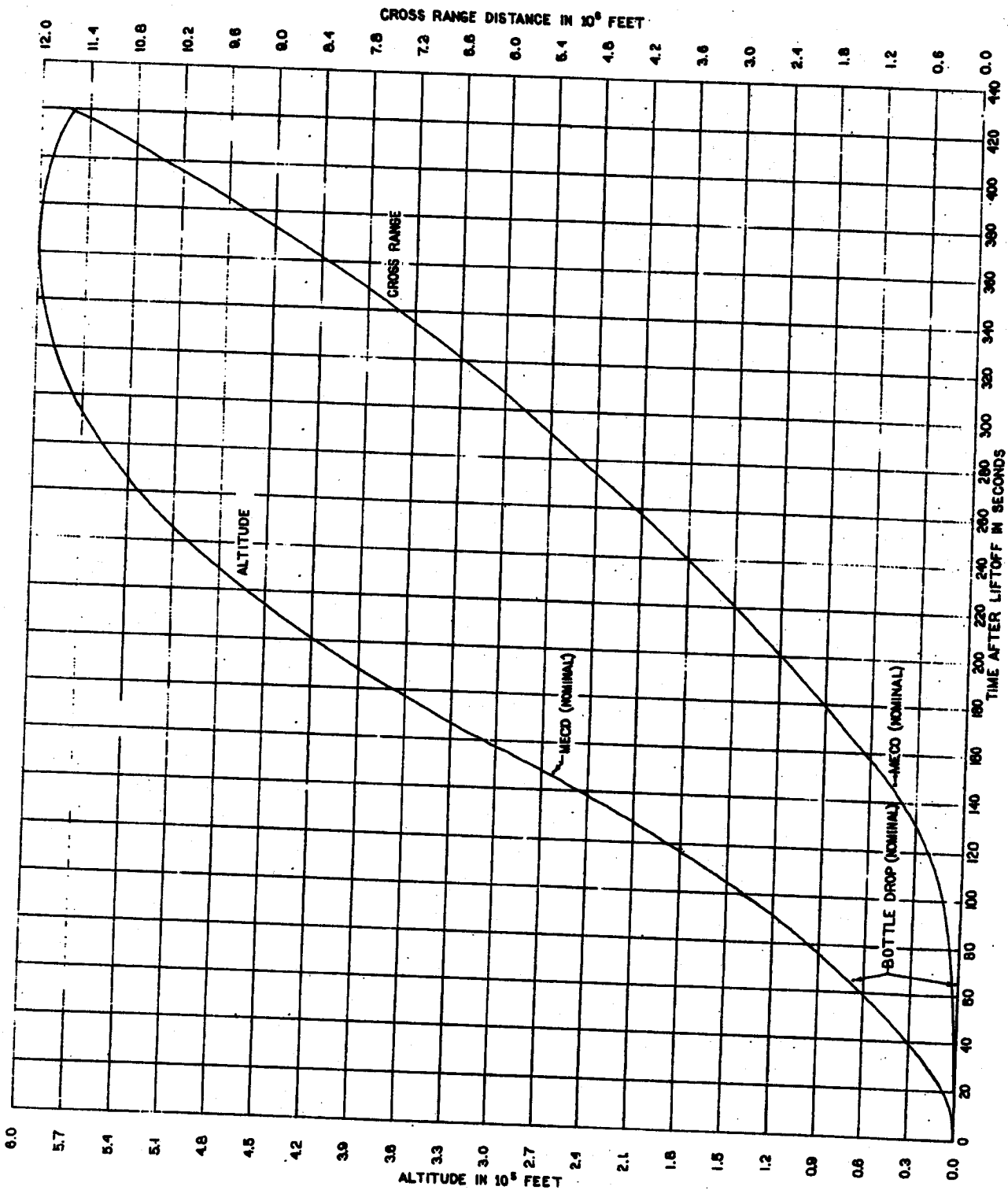
The terminal countdown was initiated at 1327:08 PST.

	<u>Phase Time</u>	<u>Total Time</u>
PHASE I		
Phase I complete	0:32	0:32
PHASE II		
Phase II complete	0:35	1:07
PHASE III		
Phase III complete	0:56	2:03
PHASE IV		
Main lox tank vent valve open	2:00	
Fuel rapid load to 97%	4:53	
Fuel fine load to 100%	5:22	
Lox rapid load to 95%	6:07	
Phase IV complete	6:07	8:10
PHASE V		
Lox transfer resume	1:30	
Lox rapid load to 99%	1:49	

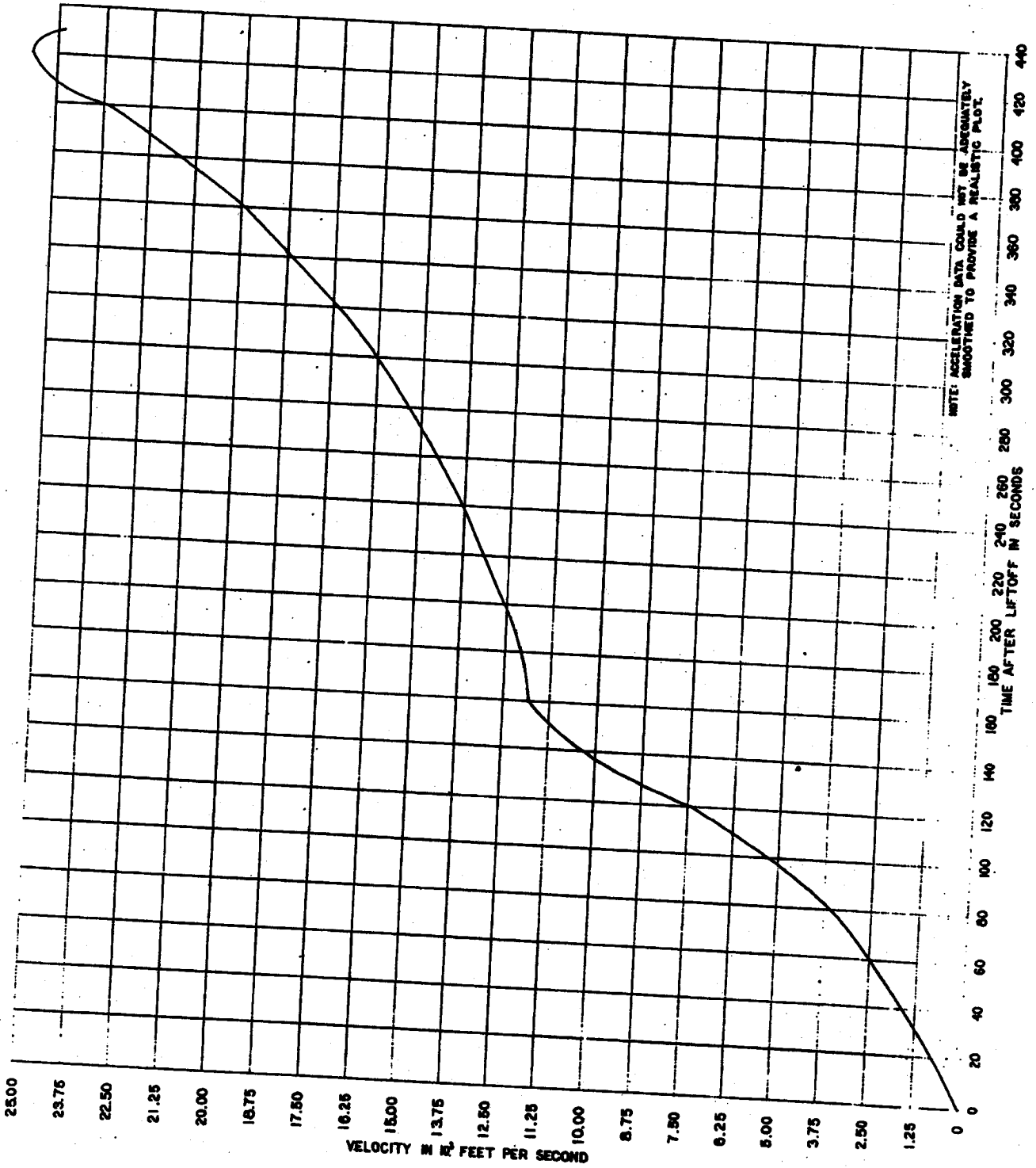
AUTOMATIC SEQUENCE OF THE TERMINAL COUNT (Con't)

		<u>Phase Time</u>	<u>Total Time</u>
PHASE V (Con't)			
Lox fine load to 100%		3:01	
Phase V complete		3:10	11:20
Total countdown operating time:	11:20		
Total hold time:	0:00		
Predicted operating time:	11:20		
Deviation:	0:00		

APPENDIX C - FIGURE 1
VEHICLE TRAJECTORIES

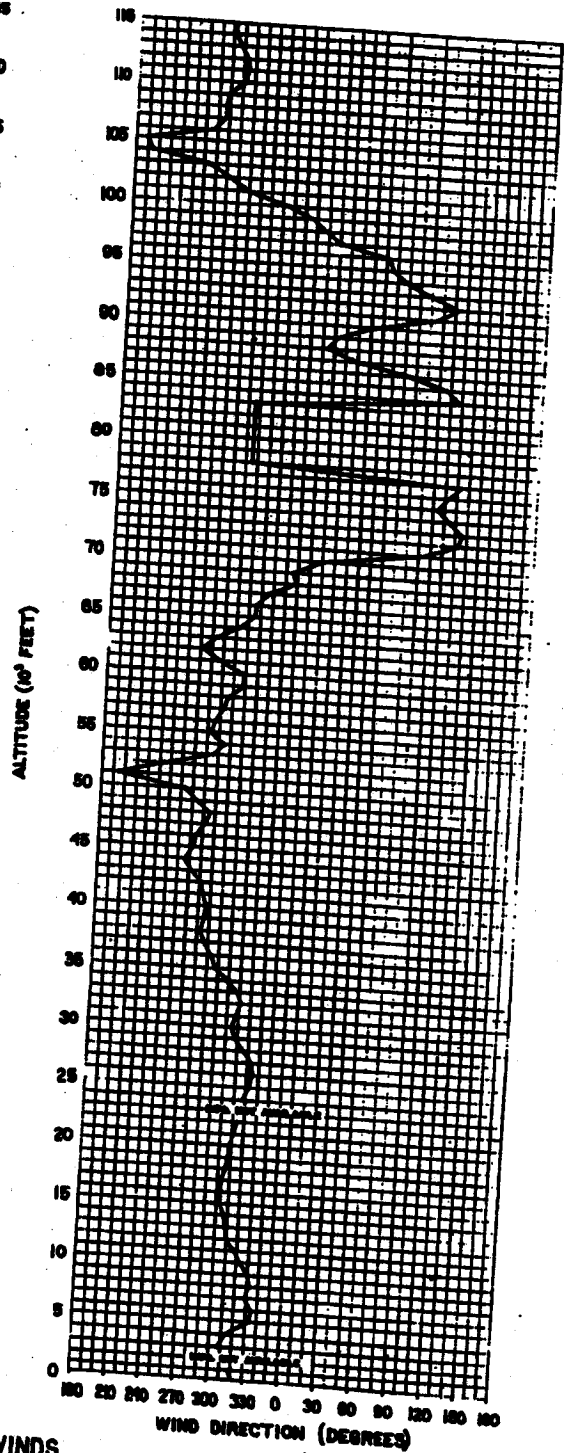
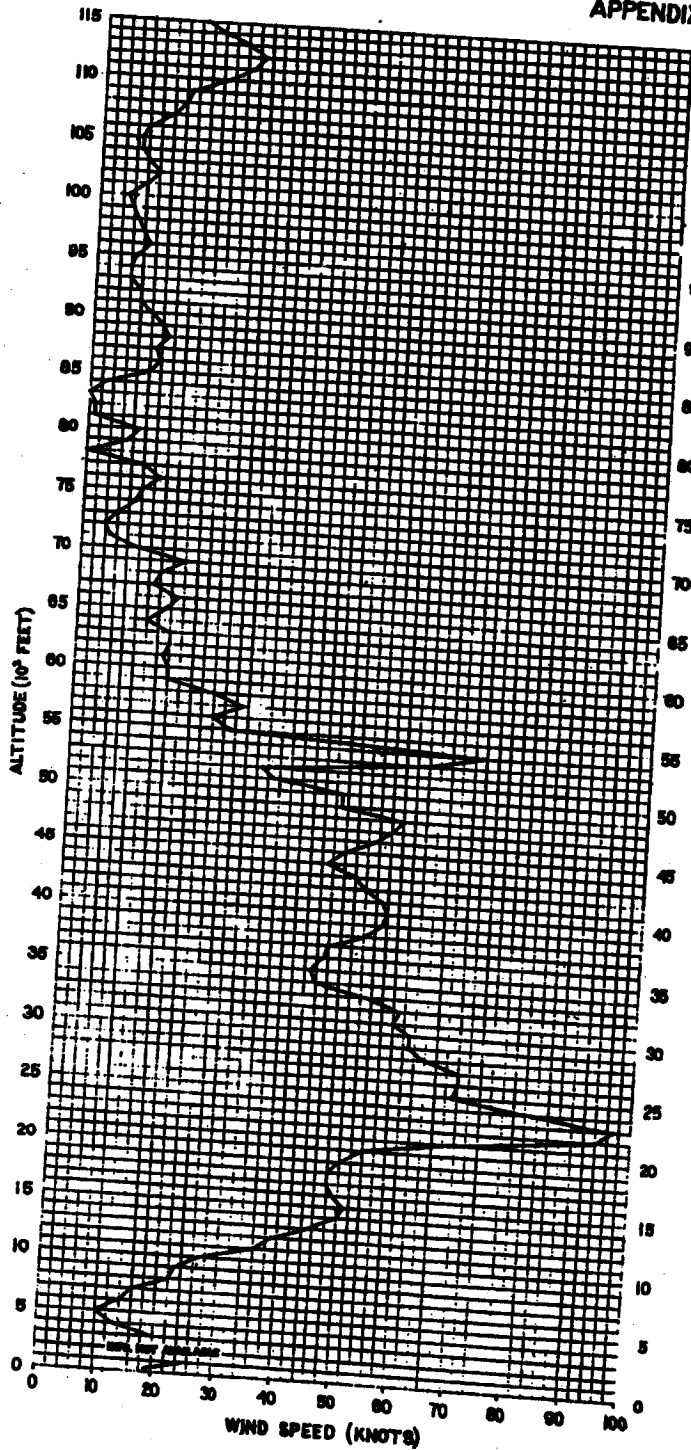


APPENDIX C - FIGURE 2
VEHICLE VELOCITY & ACCELERATION



60

APPENDIX D



LAUNCH(T-0) UPPER AIR WINDS

60

FLIGHT NO. AND
TEST REPORT NO.

SERIAL
NUMBER

PAID
NO.

DATE AND
TIME

GENERAL
ADJUSTMENTS

TEST RESULTS OR SUMMARY OF
OPERATIONS

WINDS DURING PERFORMANCE

FLIGHT DESCRIPTION

PERFORMANCE AND
GENERAL REMARKS

1
220053

1022/143

h

2-25-59
1349:14
FRT

Probable
(not
confirmed)

Simulated
explosive

Hydraulic motor circuit
separated from pyrotechnic
circuit.

Malfunction during condition
caused slight reduction, retro-
rocket, nitrogen tanks, and
hydrazine burner during the
fire when hydraulic motor was
turned on. Nozzle problem.
Launch was aborted.

Altitude: 180.0 deg
Velocity: 150 m
Acceleration: 25,000 g's
Roll: 0.0 deg
Pitch: 94 m/s
Yaw: 77.3 m
Aspect: 400 m

2
220089

1028/170

h

4-13-59
1318:42
FRT

Yes

Simulated
research
(RSC). No

HEM fuel incorporated.
Hydrazine burner action dur-
ing engine burning phase,
and gain altered to
tighten control system.

Premature S-01 engine shut-
down by command - control
system, but believed occur-
ring from a main power relay
malfunction. Orbit achieved,
but insufficient S-01 thrust
caused loss of re-
covery timing. Capsule
ejected with re-entry over
Spitzkoppe.

Altitude: 182.4 deg
Velocity: 150.0 m
Acceleration: 25,000 g's
Roll: 90 deg
Pitch: 80.7 m/s
Yaw: 150 m
Aspect: 700 m

3
220139

1028/174

h

6-6-59
1309:21
FRT

No

RSC
(also
payload)

Parachute timer incor-
porated.

Premature S-01 engine shut-
down from either propellant
imbalance or malfunction
prevented further reaching
orbital velocity. Increased
time - varying or elimi-
nating of engine shut-down.

Altitude: 182.0 deg
Velocity: 150 m
Acceleration: 25,000 g's

4
220145

1028/179

S

6-25-59
1307:45
FRT

No

Advanced
engineering
test (ART)

None.

Vehicle behavior but better
than normal S-01 and S-02
performance; increased
S-01 payload to propellant
ratio and pressure engine
shutdown occurred to prevent
reaching orbital velocity.
Recovery system intact.
Ballistic miss failed to re-
test.

Altitude: 177.5 deg
Velocity: 145.0 m
Acceleration: 25,000 g's

5
220210

1029/192

h

8-13-59
1200:08
FRT

Yes

ART. No

Vehicle and payload weight
reduced. Fuel slosh sensors
removed. Vector computer
installed. Propellant
capacity increased. S-1
fuel used in S-01. Ballis-
tic V increased to yield ellipti-
cal orbit and longer period.

Reentry due to propellant
imbalance. High propellant
utilization. Vehicle oriented
but not recovered. Recovery
system believed not incor-
porated due to engine shut-
down on recovery battery.
Capsule in orbit.

Altitude: 180.0 deg
Velocity: 150 m
Acceleration: 25,000 g's
Roll: 90 deg
Pitch: 80.7 m/s
Yaw: 150 m
Aspect: 700 m

6
220214

1028/200

S

8-13-59
1228:44
FRT

Yes

ART. No

Joint removed from nose and
used to improve capsule
thermal characteristics.
Weight further reduced by
13 lbs.

Recovery system intact. High
altitude recovery from propellant
imbalance. Propellant dur-
ing operation. S-01 roll
proper but for descent
control problem. Capsule
ejected and recovered.
Recovery system intact but
did not descend.

Altitude: 180.0 deg
Velocity: 150 m
Acceleration: 25,000 g's
Roll: 90 deg
Pitch: 80.7 m/s
Yaw: 150 m
Aspect: 700 m

7
M5936-51

1051/206

h

11-7-59
1229:11
FRT

Yes

ART. No.

Approximate FTV-1050, ex-
cept as follows: Vector com-
puter installed with down-
ward expansion angle (15.0
deg) to allow better control
at apogee. Modified control,
i.e., telemetry installed,
reassigned control between
altitude shell and capsule.
New vehicle telemetry and
telemetry for ballistic.
Fire position indicator device
and instrumentation were in-
stalled to provide altitude data.

Recovery system intact. High
altitude recovery from propellant
imbalance. Propellant dur-
ing operation. S-01 roll
proper but for descent
control problem. Capsule
ejected and recovered.
Recovery system intact but
did not descend.

Altitude: 170 deg
Velocity: 150 m
Acceleration: 25,000 g's
Roll: 90 deg
Pitch: 80.7 m/s
Yaw: 150 m
Aspect: 700 m

8
M5936-50

1050/212

S

11-20-59
1155:04
FRT

Yes

ART. No.

Similar to FTV-1051 with the
exception that a sounding
device has been added to the
top-up output in order to
detect excessive overloads
and/or inverter failure.

Acceleration malfunction re-
sulted in excessive velocity
and excessive orbit. S-01
engine operated as propellant
imbalance. Reentry system
during S-01 reentry firing.
Ballistic miss failed to re-
test. Recovery system intact
but did not descend.

Altitude: 172 deg
Velocity: 150 m
Acceleration: 25,000 g's
Roll: 90 deg
Pitch: 80.7 m/s
Yaw: 150 m
Aspect: 700 m

9
M5936-52

1050/218

h

1-1-60
1251:45
FRT

No

ART.

Similar to FTV-1050 with the
exception of the following:
a. ART Doppler navigation
transmission transmitter
added.
b. Two lights (Red-Blue)
added for ground acqui-
sition.
c. Control gas mixture
changed to provide total
impulse of 1250 lb/sec
instead of 1200 lb/sec.

Ballistic miss failed to re-
test. Reentry system torn
from S-01. No engine pressure
lost. S-01, with S-02 recover-
ing to low velocity, failed to
reach burst velocity. S-01
pitch actuator malfunction re-
sulted in vehicle tumbling.
Recovery system intact. S-01
engine cutoff at 15.0 sec.
Reentry occurred about 100 m
down-range.

Altitude: 173 deg

10
M5936-53

1051/223

S

2-19-60
1215:14
FRT

No

ART.

Similar to FTV-1052

A malfunction occurred in the
S-01 pitch control loop
causing the S-01 vehicle to
enter into a divergent pitch
oscillation immediately after
14:00. The oscillation
caused the vehicle trajectory
to deviate. The vehicle was
destroyed by High Altitude Flight.

Altitude: 182 deg
(178 deg intended)

FLIGHT NO. AND LINC REPORT NO.	VEHICLE SERIAL NUMBER	LAUNCH DATE AND TIME	ORBITAL ACQUISITION	CAPSULE TYPE AND RECOVERY	VEHICLE CONDITION	FLIGHT DESCRIPTION	INJECTION AND ORBITAL PARAMETERS
11 445936-55	1055/234	5 4-15-60 1230:37 PST	Yes	ART. No	Similar to FTV-1052	Liftoff and HW-2 boost normal. S-OI engine cutoff procedure due to error in calibration of command-5 integrator scale factor. The resulting approximately 1 min shorter than planned period did not affect recovery. Horizon-compass transmits during orbit. Failure to recover capsule attributed to spin deficiency.	Azimuth: 172 deg Altitude: 168.7 m Velocity: 26,025 fpm Inclination: 80.37 deg Eccentricity: 0.032 Period: 92 min Perigee: 106.0 m Apogee: 379.3 m
12 445936-53	1053/160	5 6-29-60 1230:44 PST	No	Diagnostic, No	Similar to FTV-1052	Orbital injection not achieved due to an erratic horizon-compass output. As a result, negative flight path angle caused the S-OI to re-enter the atmosphere. HW-2 boost somewhat low in velocity and altitude. From 150 to 160 sec, 27-sec HW-2 oscillations occurred. A moment on the S-OI after burnout indicated blocking of an oxidizer vent muffler outlet.	Azimuth: 171.7 deg Altitude(max): 157.7 m Altitude(MO): 104.7 m Injection Angle: -7 deg
13 445936-57	1057/231	5 8-10-60 1237:54 PST	Yes	Diagnostic, Yes - first capsule recovery. Recovery made by helicopter at sea.	Vehicle weight reduced for heavier payload. ART beacon, and optical tracking lights removed. Horizon compass modified to reduce transmission susceptibility. Gun jet system replaced spin rockets on payload.	Successful liftoff achieved on first countdown. Boost altitude high but within tolerance. HW-2 pitch plane oscillations after 134 sec attributed to pitch-rate feedback loop. A similar but lesser moment than with S-OI 1053 (oxidizer vent muffler problem) noted. All systems performed to launch, boost, and inject the S-OI into near polar orbit under controlled attitude and in a condition suitable to effect recovery.	Azimuth: 174 deg Altitude: 160.2 m Velocity: 25,786 fpm Inclination: 82.87 deg Eccentricity: 0.032 Period: 94.1 min Perigee: 157.7 m Apogee: 434.1 m
14 445936-56	1054/237	4 8-18-60 1257:07 PST	Yes	ART, Yes - first successful air recovery.	ART beacon and optical tracking lights restored. Continued use of gun jet spin system on payload.	Liftoff on first countdown. ART beacon restored, and injection velocity within specifications. Estimated attitude instability during orbital passes 1 and 2. Roll rate stabilized by pass 3, sharply reducing overall gas consumption. Capsule recovered 430 m down-range from predicted impact area by C-119 aircraft.	Azimuth: 172.4 deg Altitude: 180.4 m Velocity: 26,126 fpm Inclination: 79.48 deg Eccentricity: 0.046 Period: 94.24 min Perigee: 119.1 m Apogee: 507.5 m
15 445936-58	1050/246	5 9-13-60 1513:09 PST	Yes	ART, No	Similar to FTV-1056	Launch successful on first countdown. Liftoff abnormal in that S-OI umbilicals ejected before actual liftoff. HW-2 boost normal. HW-2 oscillation noted. Necessary drop in thrust following S-OI engine ignition. Pneumatic attitude control system (gun jet) malfunction depleted control gas before recovery pass. Capsule located about 950 m southeast of predicted impact point. Small prevented sea recovery before capsule out.	Azimuth: 175 deg Altitude: 171.4 m Velocity: 26,025 fpm Inclination: 80.91 deg Period: 94.2 min Perigee: 131.4 m Apogee: 478.7 m
16 445936-61	1061/253	4 10-26-60 1236:09 PST	No	ART	First S-OI (Model 4005)	Launch on second attempt. Inoperative S-timer prevented programming of S-OI functions. In separation, combined vehicle followed ballistic trajectory after HW-2 burnout. HW-2 vendor and main engine out off nearly simultaneously. HW-2 structural oscillations during final 23 sec of boost.	
17 445936-62	1068/297	5 11-18-60 1244:34 PST	Yes	ART, Yes - air recovery	Similar to 1061 (S-OI)	Satisfactory launch after initial cancellation on previous day due to umbilical connector J-700 (S-timer) being separated from S-OI when the transporter-erector was lowered. All systems performed to launch, boost, and inject the S-OI into near-polar orbit under controlled attitude and in a condition suitable to effect recovery. Capsule recovery by aircraft at predicted point of descent. S-OI longitudinal oscillations prior to 1800 similar to models 160, 246, and 253.	Azimuth: 172 deg Altitude: 118 m Velocity: 26,270 fpm Inclination: 81.8 deg Eccentricity: 0.032 Period: 94.45 min Perigee: 114.5 m Apogee: 614.1 m
18 445936-03	1103/296	4 12-7-60 1220:39 PST	Yes	ART, Yes - air recovery	S-OI with 8096 engine (anal start - not used on this launch). HW-2 Mach-3 engine (145,000-lb thrust) used for first time with S-OI vehicle.	Launch on first attempt. Liftoff and HW-2 boost normal. Higher amplitude longitudinal oscillations (1.5 g) than with previous vehicles. All S-OI functions effected. Orbit close to that desired. Aerial capsule recovery after 45 passes (3 days), the longest time in orbit before initiating re-	Azimuth: 172 deg Altitude: 156.9 m Velocity: 25,840 Inclination: 81.49 deg Eccentricity: 0.0307 Period: 93.67 min Perigee: 152.8 m Apogee: 437.3 m

FLIGHT NO. AND LASC REPORT NO.	VEHICLE SERIAL NUMBER	LAUNCH PAD NO.	LAUNCH DATE AND TIME	ORBITAL ACHIEVEMENT	CAPSULE AND RECOVERY	FLIGHT DESCRIPTION	INJECTION AND ORBITAL PARAMETERS
19 445936-02	1101/258	5	2-20-60 1236:51 PST	Yes	Radiometer SR-1 non-re- coverable capsule.	S-OI with SR-1 engine. SRV-2 with Black-1 engine.	<p>Launch on second attempt. Liftoff and SRV-2 boost normal. All S-OI functions satisfactory. Orbital boost satisfactory to obtain orbital status. Attitude control lost after orbital injection because of depletion of control gas, apparently due to a malfunction in the gas valve control amplifier.</p> <p>Asimuth: 172 deg Altitude: 134.2 m Velocity: 25,650 fps Inclination: 83.5 deg Eccentricity: 0.033 Period: 92.9 min Perigee: 133.5 m Apogee: 400.5 m</p>
20 445936-06	1104/298	4	2-17-61 1225:02 PST	Yes	AKT. No	S-OI with SR-1 engine (dual start not used). SRV-2 Black 2 engine (145,000-lb thrust). Open loop test of SRL guidance system. Scheduled 4-day active orbital life.	<p>Launch on second attempt. Liftoff, SRV-2 boost, and S-OI boost satisfactory to obtain orbit but S-OI guidance difficulties during boost and intermittent on orbit. SRV-2 17-61 ops longitudinal oscillations of about 1.5 g's prior to MDO. Orbital timer malfunction on pass 31 precluded recovery attempt.</p> <p>Asimuth: 172 deg Altitude: 203.5 m Velocity: 25,690 fps Inclination: 80.91 deg Eccentricity: 0.0346 Period: 95.31 min Perigee: 186 m Apogee: 501 m</p>
21 445936-02	1102/261	5	2-18-61 1157:58.1 PST	Yes	Nonrecoverable radiometer.	S-OI with SR-1 engine equipped and programmed for first dual start.	<p>Launched on first attempt. Liftoff and boost phase normal although oscillations were noted in accelerometer and booster propellant pressure data. Boost phase and orbital stage boost phase normal except for excess velocity gain. Orbit period and eccentricity were high as a result of the high injection velocity. Engine restart and operation for 1 sec during first pass was accomplished.</p> <p>Asimuth: 171.6 deg Altitude: 127.3 m Velocity: 25,010 fps Inclination: 80.7 deg after first burn Eccentricity: .0383 after first burn Period: .0589 after second burn Perigee: 93.9 min after first burn Apogee: 97.8 min after second burn Perigee: 159 m after second burn Apogee: 670 m after second burn</p>
22 445936-05	1105/300	4	3-30-61 1234:43 PST	No	AKT	S-OI with SR-1 engine (dual start not used). SRV-2 with Black 2 engine and SRL guidance.	<p>Launch on first attempt. Liftoff and SRV-2 boost normal. SRL guidance actively used for the first time, successfully computed and transmitted SRV-2 steering and sequence commands and discrete for S-OI engine start and velocity gain. Orbit not attained due to control system malfunction - loss of hydraulic pressure approximately 20 sec prior to engine shutdown. Resulting loss of attitude control caused excessive injection velocity vector and possibly low injection velocity due to premature engine shutdown.</p> <p>Asimuth: 172 deg</p>
23 445936-06	1106/307	5	4-8-61 1121:08 PST	Yes	AKT. No	Similar to 22	<p>Launch on first attempt. Liftoff, SRV-2 boost, and S-OI orbital injection were normal. Added instrumentation indicates that stress on S-OI from 20-ops SRV-2 oscillations is less severe than previously calculated. Between pass 6 and pass 7 the horizon scanner failed; between pass 9 and pass 10 control gas was suddenly lost. Capsule recovery was not affected due to vehicle tumbling.</p> <p>Asimuth: 172 deg Altitude: 189.8 m Velocity: 25,650 fps Inclination: 82.3 deg Eccentricity: 0.026 Period: 94.1 min Perigee: 185.5 m Apogee: 436.6 m</p>
24 445936-08	1108/302	4	6-8-61 1416:08 PST	No	AKT	Similar to 22	<p>Launch on first attempt. S-OI transient voltage dropout just prior to liftoff, clearing with additional 7-100 release. SRV-2 boost and guidance normal. During boost, S-OI aft section registered successive heating starting at T+20 sec, indicating small fire; voltage transient dropout occurred from T+77.5 to T+87.3 sec and T+137 to T+144 sec; at T+144 sec, telemetry was lost. Failure of the electrical power system, probably as a result of fire, prevented normal functioning of S-OI sub-systems, precluding orbital injection.</p> <p>Asimuth: 172 deg</p>
25 445936-07	1107/303	1	6-16-61 1603:52 PST	Yes	AKT. Yes - sea recovery	S-OI, SRV-2 MRL with Black 2 main engine, Black 1 vernier engines.	<p>Launch on first attempt and first launch from complex 75-1, recently modified to SRV-2/S-OI configuration. Technical hold, 88.15 min. Liftoff normal. SRV-2 covered largest roll program to date: 87 deg 30 min. Error in first step of pitch program corrected by command guidance after steering commands initiated. All S-OI sub-systems operated properly to establish a near-axial orbit. Capsule ejection on</p> <p>Asimuth: 172 deg Altitude: 188 m Velocity: 25,645 fps Inclination: 82.1 deg Eccentricity: 0.031 Period: 90.87 min Perigee: 180 m Apogee: 256 m</p>

FLIGHT NO. AND
MASC REPORT NO.

VEHICLE
SERIAL
NUMBER

LAUNCH
DATE AND
TYPE

ORBITAL
ACHIEVEMENT

CAPSULE TYPE
AND RECOVERY

VEHICLE DESCRIPTION

VEHICLE DESCRIPTION

INJECTION AND
ORBITAL PARAMETERS

26
445936-09

1109/308

5 7-7-61
1629:46
FOT

Yes

ART. Yes -
air recovery

Similar to 25

Launch on first attempt. SLV-2 thrust greater than predicted after slow engine start sequence. S-OI coupling P-100 appeared to hang up on the vehicle at midlitch release with corresponding drop in battery-bus and regulated 28V powers. Greater S-OI eccentricity and orbital period attributed to integrator error.

Azimuth: 172 deg
Altitude: 146.8 km
Velocity: 26,000 fps
Inclination: 82.95 deg
Eccentricity: 0.042
Period: 95 min
Perigee: 146.2 km
Apogee: 308.1 km

27
445936-10

1110/322

4 7-21-61
1535:00.46
FOT

No

ART

Similar to 25

Lift-off on first attempt. Immediately after lift-off, a malfunction in the autopilot caused the vehicle to enter into divergent pitch accelerations. At T+59.2 sec, a -3 g moment which increased beyond calibration limit, was measured by the S-OI accelerometer, starting destruction of the vehicle. At T+60 sec, the vehicle was enveloped in flame, and at T+78.7 sec the vehicle exploded. The cause of the malfunction is attributed to an open circuit in the SLV-2 flight controller pitch-rate loop.

28
445936-11

1111/309

1 8-3-61
1704:22
FOT

No

ART. (re-
coverable)-
No
ERP (non-
recoverable)

Similar to 25 but with
SLV-2 control system
modifications for im-
proved reliability.

Launch on second attempt. Lift-off and boost, guidance and engine cutoff were normal. All S-OI systems operated satisfactorily until T+398.3 sec when loss of hydraulic pressure, possibly from a rupture on the high pressure side of the hydraulic pump, resulted in loss of pitch and yaw control and precluded orbital attainment.

29
445936-12

1112/323

4 8-31-61
1300:06
FOT

Yes

ART - Yes.
Sea recovery.

Similar to 20

Launch on second attempt. Lift-off, boost, and guidance normal. All S-OI systems operated to place vehicle in orbit. Hydraulic pressure T/N showed fluctuations for first 10 sec after ignition. Eccentric orbit attributed to improperly set geocentric rate bias program. Capsule ejection, re-entry, and recovery executed on pass 33.

Azimuth: 172 deg
Altitude: 160 km
Velocity: 25,570 fps
Inclination: 82.06 deg
Eccentricity: .0898
Period: 91.5 min
Perigee: 104.7 km
Apogee: 353.1 km

30
445936-13

1113/310

5 9-12-61
1259:23
FOT

Yes

ART-L - Yes.
Aerial recovery
on pass
33.

ERP Kit 68 added.

Launch on first attempt. Lift-off, boost, and guidance normal. All S-OI systems operated to place vehicle in orbit. Potential problem resulted from a higher than predicted S-OI engine thrust level in that the required velocity gain sensed by the integrator occurred only 0.14 sec after the integrator had sent the shutdown signal before it was armed. If the integrator had sent the shutdown signal before it was armed, the engine would have burned to propellant depletion, causing excessive velocity.

Azimuth: 172 deg
Altitude: 153.7 km
Velocity: 25,735 fps
Inclination: 82.7 deg
Eccentricity: .024
Period: 92.4 min
Perigee: 150.8 km
Apogee: 345.7 km

31
445936-14

1114/304

1 9-17-61
1630:14
FOT

Yes

ART-L - No.

ERP Kit 28 added.

Launch on first attempt. Lift-off, boost and guidance normal. All S-OI systems operated to place vehicle in orbit. Capsule ejection not effected due to loss of 600-ops, 3-phase power prior to recovery pass.

Azimuth: 172 deg
Altitude: 151 km
Velocity: 25,615 fps
Inclination: 82.7 deg
Eccentricity: .0126
Period: 90.54 min
Perigee: 150.29 km
Apogee: 255.24 km

32
445936-15

1115/328

4 10-13-61
1122:34
FOT

Yes

ART-L - Yes.
Aerial recovery
on pass 18.

No ERP Kit.

Launch on first attempt with but 1 min 32 sec hold time. S-OI pressurization and terminal count were run simultaneously to meet "wind-up" requirements after an S-OI propellant transfer problem. Lift-off, boost, and orbital injection were all executed satisfactorily. Capsule re-entry and air recovery were achieved on orbital pass 18.

Azimuth: 172 deg
Altitude: 148 km
Velocity: 25,449 fps
Inclination: 81.63 deg
Eccentricity: .0128
Period: 90.85 min
Perigee: 144.5 km
Apogee: 250.9 km

33
445936-16

1116/329

5 10-23-61
1221:52
FOT

No

ART-L

No ERP Kit.

Launch on first attempt. Lift-off and boost normal. S-OI hydraulic control malfunction caused a lifted trajectory and ultimately tumbling of the vehicle, precluding orbital injection.

FLIGHT NO. AND DESC REPORT NO.	SERIAL NUMBER	PAD NO.	DATE AND TIME	CRITICAL ACHIEVEMENT	CAPSULE TYPE AND RECOVERY	FLIGHT DESCRIPTION	INJECTION AND ORBITAL PARAMETERS	
34 445936-17	1117/330	1	11-5-61 1200:32 PST	Yes	ART-L - No. IMP Kit 4B added.	Launch on second attempt (first attempt aborted due to Superbug 2LV-2 engine sequence). Liftoff, boost, separation and coast normal. S-O thrust phase normal except for engine shutdown. Shutdown occurred from propellant substitution instead of command due to the cutoff command signal preceding arming of the circuitry. Successive injection velocity resulting caused an overly eccentric orbit. No recovery attempted due to loss of attitude control (gas valve malfunction) during pass 8.	Apogee: 172 deg Altitude: 151 m Velocity: 26,115 fps Inclination: 82.5 deg Eccentricity: .054 Period: 97.1 min Perigee: 157 m Apogee: 628 m	
35 445936-18	1118/326	4	11-15-61 1327:46 PST	Yes	ART-L - Yes. Aerial recovery.	Two radiometers added.	Launch on first attempt after 80 min of hold time, primarily for train schedules. Liftoff, boost, separation and coast normal. S-O orbital injection velocity 113 fps low due to accelerometer-integrator error. Capsule air recovery effected on pass 18.	Apogee: 172 deg Altitude: 153 m Velocity: 25,508 fps Inclination: 81.56 deg Eccentricity: .0063 Period: 89.81 min Perigee: 150 m Apogee: 196 m
36 445936-19	1119/325	4	11-18-61 1245:22 PST	Yes	ART-L - Yes. Sea recovery on pass 6h (first 4-day recovery)	IMP Kit 5B.	Launch on first attempt with 70 min of hold time for train schedules. Liftoff, boost, separation and coast normal. The S-O engine exhibited higher than usual 1/2p and thrust. Intermittent fluctuation of hydraulic pressure noted during first 10 sec of S-O burn.	Apogee: 172 deg Altitude: 153 m Velocity: 25,662 fps Inclination: 81.8 deg Eccentricity: .013 Period: 91.6 min Perigee: 150 m Apogee: 257 m
37 445936-20	1120/327	4	1-13-62 1341:02.50 PST	No.	ART-L - No recovery	Reheatsys Heat II engine thrust increased from 167,000 to 170,000 lbs by changing propellant mixture ratio. First operational use of a 10-sec delay in terminal count to ensure readiness of various range support functions.	Launch on first attempt after hold in phase IV of terminal count to replace shear pin in flammeter drive shaft. Liftoff, boost, flight control, and ground guidance normal. Separation on schedule, but an electrical transient during process resulted in loss of link 2 telemetry power and a blown fuse in AB power bus to inertial reference package. S-O ignition normal. No thrust vector control due to IMP power failure. One sec after S-O thrust attainment, vehicle began to tumble and engine shutdown occurred 9 sec later. Velocity gain nil. Orbit not achieved.	
38 445936-23	1122/341	4	2-27-62 1139:20.50 PST	Yes.	ART-L - Yes. Aerial recovery on pass 6f.	Power Supply Sub-system (SS/C) modified.	Successful liftoff achieved on first countdown. S-O boost phase proceeded normally from liftoff through roll and pitch programs and with correct ground guidance commands. Vehicle separation was normal. S-O coast phase was stable and control gas consumption normal. S-O propulsion exhibited normal start, stable thrust characteristics, providing the desired impulse for attainment of a near-circular orbit. Aerial recovery of the capsule successfully accomplished after 4 days in orbit (pass 6f), the longest orbital period before capsule recovery yet achieved.	Apogee: 172 deg Altitude: 129.9 m Velocity: 25,720 fps Inclination: 82.31 deg Eccentricity: 0.018 Period: 90.62 min Perigee: 127.7 m Apogee: 251.9 m
39 445936-24	1124/331	5	4-17-62 1653:46.96 PST	Yes	ART-L - Yes.	IMP kit. First use of pure nitrogen control gas.	Successful liftoff achieved on first countdown. S-O boost phase satisfactory, including the first planned "dog leg" in the booster trajectory to achieve an orbit inclination angle of 74 deg. All S-O sub-systems performed satisfactorily except for abnormally large amount of post-shutdown impulse resulting from delayed closure of main fuel valve. Aerial recovery of the capsule successfully accomplished on 3rd orbit.	Apogee: 172 deg Altitude: 130.11 m Velocity: 25,807 fps Inclination: 73.49 deg Eccentricity: 0.0277 Period: 90.73 min Perigee: 130.06 m Apogee: 319.92 m
40 445936-25	1125/333	4	4-28-62 1630:12.45 PST	Yes	ART-L - No. Recovery attempt unsuccessful on pass 6f.	IMP kit. Second use of pure nitrogen as control gas.	Successful liftoff achieved on first countdown. S-O liftoff and boost normal. FM/AV channels of S-O telemetry failed at liftoff. Second programmed "dog leg" and orbit inclination angle of 75 deg achieved. A second roll maneuver to compensate for roll induced by simultaneous pitch and yaw programs proved successful. Vehicle separation was normal. S-O engine ignition was normal but a slight error in pitch attitude during the thrust interval resulted in higher than expected altitude and flight path angle. Orbit	Apogee: 172 deg Altitude: 134.8 m Velocity: 25,529 fps Inclination: 73.25 deg Eccentricity: 0.0268 Period: 91.13 min Perigee: 126.5 m Apogee: 299.0 m

FLIGHT NO. AND
INCIDENT REPORT NO.

VEHICLE
SERIAL
NUMBER

LAUNCH
DATE AND
TIME

ORBITAL
ACHIEVEMENT

CANNON TYPE
AND PRODUCE

VEHICLE ORBITAL PARAMETERS

FLIGHT DESCRIPTION

EMERSON AND
ORBITAL PARAMETERS

h1
445936-26

1126/334

5 5-29-62
1235:52.17
FRT

Yes

ART - Yes.
Aerial recovery.

Similar to 1125.

Launch on first attempt. The countdown was delayed slightly in tank 7 when difficulty was encountered in resetting the orbital timer. Four holds were also imposed for range clearance (twice), and 2 for abnormal 100 per cent ICR lead indications caused by recycling of phase V. SEV-2 boost phase, separation, coast phase and orbital injection all satisfactorily accomplished. Control gas consumption appeared to be slightly above normal but not excessive enough to endanger mission objectives. At time of telemetry signal loss, all vehicle sub-systems critical to the attainment of mission objectives were functioning properly. Successful capsule ejection and aerial recovery occurred on pass 63.

Azimuth: 172 deg
Altitude: 128.8 m
Velocity: 25,692 fpm
Inclination: 76.35 deg
Eccentricity: 0.0257
Period: 94.03 min
Perigee: 128.7 m
Apogee: 102.8 m

h2
445936-28

1128/336

1 5-29-62
1700:44.03
FRT

Yes

ART - Yes.
Aerial recovery.

Similar to 1126.

Launch on second attempt. First countdown aborted due to S-OI horizon scanner malfunction. SEV-2 boost phase satisfactory except for pitch flight path deviation. NEDO occurred due to propellant depletion resulting in deficient velocity and altitude at coast apogee. A greater than expected consumption of control gas was the result of an excessive roll torque caused by exhaust stack misalignment. All S-OI sub-systems functioned properly. Successful capsule ejection and aerial recovery occurred on 12th orbit.

Azimuth: 172 deg
Altitude: 120.1 m
Velocity: 25,679 fpm
Inclination: 74.16 deg
Eccentricity: 0.0128
Period: 90.06 min
Perigee: 275.7 m
Apogee: 128.0 m

h3
445936-27

1127/335

h 6-1-62
1731:27.75
FRT

Yes

ART - No.

Similar to 1128. NFA (direct-frequency-coast) instrumentation for turbo-pump added to booster.

Launch on first attempt. Relatively few technical difficulties and no holds during countdown. SEV-2 boost phase satisfactory; orbit obtained appears to be nearest to nominal of any SEV-2/S-OI configuration launched to date. S-OI sub-systems performed satisfactorily to attain mission objectives. Excessive roll torque, apparently related to exhaust stack misalignment, was again evident. Successful capsule ejection occurred on pass 65; however, recovery was not accomplished.

Azimuth: 172 deg
Altitude: 132.3 m
Velocity: 25,715 fpm
Inclination: 76.26 deg
Eccentricity: 0.0152
Period: 90.63 min
Perigee: 132.43 m
Apogee: 257.95 m

h4
445936-29

1129/339

h 6-22-62
1730:46.80
FRT

Yes

ART - Yes.
Aerial recovery.

None.

Launch on first attempt. Failure of lift-off signal resulted in orbital ejection by launch abort. NEDO occurred slightly later than predicted. Excessive expenditure of control gas to maintain control during thrust interval attributed to turbine exhaust misalignment. All other systems performed satisfactorily. Successful capsule ejection and aerial recovery on pass 50.

Azimuth: 172 deg
Altitude: 130.45 m
Velocity: 25,633 fpm
Inclination: 75.1 deg
Eccentricity: 0.00795
Period: 89.68 min
Perigee: 130.59 m
Apogee: 195.54 m

h5
445936-51

1151/340

1 6-27-62
1809:08.15
FRT

Yes

ART - Yes.
Aerial recovery on pass 63.

First S-OIA. Modification included a horizon sensor; a velocity meter; pulse generating circuitry; on/off (non-proportional) central valves; dual-level pressure regulation system; a motor operated valve and orifice used for tank pressurization; primocord separation method.

Launch on first attempt. SEV-2 boost normal except NEDO occurred from propellant depletion prior to transmission of guidance command. A slight deficiency in velocity was evident at coast apogee. Separation, coast, and orbital boost normal. Significant deviations from nominal trajectory conditions existed at orbital injection due to a velocity meter malfunction which permitted the S-OI engine to burn to propellant depletion.

Azimuth: 172 deg
Altitude: 130.8 m
Velocity: 25,985 fpm
Inclination: 76.06 deg
Eccentricity: 0.0268
Period: 91.68 min
Perigee: 130 m
Apogee: 141.9 m

h6
445936-30

1130/342

5 7-20-62
1756:39.51
FRT

Yes

ART - Yes.
Aerial recovery.

None.

Launch on second attempt. First countdown scrubbed due to S-OI helium leak. SEV-2 boost phase adequate. NEDO occurred from propellant depletion almost simultaneously with ground guidance command. All S-OI sub-systems performed satisfactorily after separation to attain mission objectives. Orbit obtained appears to be most precise of any SEV-2/S-OI vehicle to date. Successful capsule ejection and aerial recovery on 33rd revolution.

Azimuth: 172 deg
Altitude: 674,447 ft
Velocity: 25,725 fpm
Inclination: 70.30 deg
Eccentricity: 0.01405
Period: 90.431 min
Perigee: 126.5 m
Apogee: 242.8 m

401-4 - 100.
Aerial recovery

FAIRLY LIGHT OF BOOSTER
MODEL RM-2102-1100 and
telemetry kit.

Launch on first attempt.
SEV-2 boost phase satisfactory except pitch program appeared slightly deficient in pitchover rates. WDO occurred normally, separation smooth, and coast and orbital boost phases adequate. All S-O vehicle sub-systems functioned properly to obtain mission objectives. Capsule ejection and aerial recovery on 6th revolution.

Asimuth: 172 deg
Altitude: 675,000 ft
Velocity: 25,679 fps
Inclination: 71.09 deg
Eccentricity: 0.01605
Period: 90.718 min
Perigee: 127.8 mi
Apogee: 281.3 mi

40
R03054-52

1152/348 1 8-1-62
1717:29.39
FDR

ASX-L - Yes.
Aerial recovery on 6th orbit.

Second S-OIA configuration. Booster especially equipped to study 30-sec oscillations.

Launch successful on second attempt. Range priority forward ejection of first countdown. Greater than expected thrust from SEV-2, resulting in slightly high pitch flight path angle. Central gas pressure transducer inoperative shortly after liftoff. Estimated above nominal consumption of central gas during S-OI thrust interval to counteract roll torque. Orbital performance reported as satisfactory.

Asimuth: 172 deg
Altitude: 680,000 ft
Velocity: 25,740 fps
Inclination: 82.24 deg
Eccentricity: 0.0161
Period: 90.78 min
Perigee: 129.7 mi
Apogee: 282.2 mi

40
R03054-53

1153/349 2 8-20-62
1800:136
FDR

ASX-L - Yes.
Aerial recovery

Similar to 1152.

Launch successful on second attempt. Failure of S-OI coast antenna caused cancellation of first countdown. SEV-2 boost phase adequate and coast apogee conditions satisfied. Separation processes smooth followed by orbital injection. S-OI guidance errors resulted in errors in velocity, altitude, and elevation flight angle, and the attainment of an orbit which differed considerably from the nominal. Orbital performance reported as satisfactory. Successful capsule ejection and aerial recovery occurred during 6th orbit.

Asimuth: 172 deg
Altitude: 125.4 mi
Velocity: 25,785 fps
Inclination: 66.2 deg
Eccentricity: 0.0169
Period: 90.32 min
Perigee: 111.1 mi
Apogee: 250.7 mi

50
445936-32

1132/348 5 9-1-62
1339:08.93
FDR

ASX-L. No recovery.

None.

Liftoff on first countdown. SEV-2 boost and ascent normal. All S-OI systems operated to plan vehicle in orbit. A loss deviation noted in S-OI thrust interval, but overall performance not affected. All sub-systems functioning properly at time of VTS telemetry fade to permit attainment of mission objectives. Orbital performance reportedly satisfactory. Capsule recovery on pass 63. Recovery not accomplished.

Asimuth: 172 deg
Altitude: 188.6 mi
Velocity: 25,709 fps
Inclination: 82.83 deg
Eccentricity: 0.0279
Period: 94.43 min
Perigee: 186.6 mi
Apogee: 424.5 mi

51
445936-33

1213/350 4 9-17-62
1646:18.07
FDR

ASX-L - Yes.
Surface recovery during 17th orbit.

None.

Launch on third attempt (first attempt cancelled due to S-OI integrator problem which precluded launching within time window; countdown scheduled for the following day cancelled before initiation due to payload problem; second attempt cancelled in task 10 due to failure of S-OI liftoff system solenoid valve to activate). Liftoff, boost, separation and coast normal. All vehicle sub-systems performed satisfactorily to provide adequate trajectory conditions for orbital injection. Orbital period attained approximately 7.2 min higher than nominal, indicative of an excess in injection velocity of approximately 200-fps and is attributed to an error in velocity measurement by accelerometer-integrator combination. At signal fade at VTS, all sub-systems were functioning properly to permit attainment of mission objectives.

Asimuth: 172 deg
Altitude: 128.9 mi
Velocity: 29,945 fps
Inclination: 61.76 deg
Eccentricity: 0.016
Period: 93.32 min
Perigee: 129 mi
Apogee: 416 mi

52
R03054-54

1154/351 2 9-29-62
1634:49.58
FDR

ASX-L - Yes.
Aerial recovery during 19th orbit (liftoff).

None.

Launch on second attempt (first attempt cancelled when disengaged prematurely). Liftoff, boost, separation, and coast normal. All vehicle sub-systems performed satisfactorily to provide adequate trajectory conditions for orbital injection; however, injection errors resulted as follows: 40 fps excess in velocity; 6 mi low in altitude; -0.2 deg elevation flight path angle; 0.5 deg in azimuth flight path angle. Orbital performance reportedly satisfactory except SEV-2 horizon sensor failed subsequent to 20th revolution.

Asimuth: 172 deg
Altitude: 119 mi
Velocity: 25,780 fps
Inclination: 69.14 deg
Eccentricity: 0.0162
Period: 90.32 min
Perigee: 121.4 mi
Apogee: 239.4 mi

FLIGHT NUMBER AND
INFO REPORT NO.

VEHICLE
SERIAL
NUMBER

PAD
NO.

LAUNCH
DATE AND
TIME

ORBITAL
ACCOMPLISHMENT

CAPTURE TIME
AND RECOVERY

[REDACTED]

FLIGHT DESCRIPTION

INJECTION AND
ORBITAL PARAMETERS

54
R030427-01

1401/353

2 10-06-62
0914:39.30
FRT

Yes

GRD P/L -
Recoverable.

Modified S-GIA.

Launched on first attempt. Ground guidance lost at T+69 sec. (No steering orders or maneuvers were transmitted.) S-2 airframe sub-systems performed satisfactorily. NEDD occurred due to propellant depletion. Critical events signalled by airframe backups. No S-GI time-to-fire or velocity-to-be-gained adjustments. S-GI sub-systems functioned satisfactorily, but the specific impulses of the propulsion system was low. S-GI shutdown due to fuel depletion. Significant trajectory errors at orbital injection (due to earlier loss of ground guidance). Orbital performance was satisfactory. Successful recovery accomplished.

Asimuth: 172 deg
Altitude: 182 m
Velocity: 25,465 f/s
Inclination: 81.97 deg
Eccentricity: 0.014
Period: 91.02 min
Perigee: 123 m
Apogee: 243 m

55
R05936-36

1134/356

4 11-5-62
1404:32.08
FRT

Yes

AMP-L - Yes.
Aerial re-
covery during
65th orbit.

None.

Launched on second attempt. First attempt aborted when payload telemetry system power supply failed. Liftoff time not properly generated. S-GIA sub-systems released by "fly-away." S-V-2 sub-systems performed satisfactorily. NEDD occurred due to propellant depletion (planned). S-V-2 coast apogee conditions satisfactory. S-GIA sub-systems functioned satisfactorily. S-GIA engine shutdown from propellant depletion (also planned). Orbit attained satisfactory.

Asimuth: 172 deg
Altitude: 113 m
Velocity: 28,992 f/s
Inclination: 71.33 deg
Eccentricity: 0.2902
Period: 148 min
Perigee: 110 m
Apogee: 3080 m

56
R05936-35

1135/349

4 11-05-62
1400:24.33
FRT

Yes

AMP-L - Yes.
Aerial re-
covery during
61st orbit.

None.

Launched on first attempt. Boost phase satisfactory. Propellant depletion shutdown. Separation smooth. Coast phase normal. S-GI main engine provided proper orbital injection conditions. Orbital performance satisfactory. Successful capsule ejection and recovery on 65th orbit.

Asimuth: 172 deg
Altitude: 130.3 m
Velocity: 25,728 f/s
Inclination: 74.98 deg
Eccentricity: 0.0256
Period: 90.74 min
Perigee: 130.3 m
Apogee: 259.3 m

57
R030564-55

1135/344

2 12-4-62
1330:35.6
FRT

Yes

AMP-L - No.
Unsuccessful
recovery on 32nd
pass.

None.

Launched on first attempt. Boost phase adequate. Separation and coast normal. S-GI engine provided impulse for proper injection conditions. Orbital performance satisfactory. Successful capsule ejection and recovery on 61st orbit - longest orbital time to date.

Altitude: 131.1 m
Velocity: 25,660 f/s
Inclination: 65.18 deg
Eccentricity: 0.0160
Period: 89.90 min
Perigee: 131.8 m
Apogee: 213.9 m

58
R030564-56

1154/360

5 12-14-62
1326:07.00
FRT

Yes

AMP-L - Yes.
Aerial re-
covery during
65th orbit.

None.

Launched on first attempt. Liftoff and mid-air ejection normal. Booster telemetry failed at T+0.15 sec. Propellant depletion NEDD before attainment of required velocity. Coast apogee velocity and altitude significantly different than nominal. Significant deviation in S-GIA injection conditions and orbital parameters due to combination of S-V-2 velocity deficiency and S-GIA attitude error. Orbital performance reportedly satisfactory. Low perigee orbit necessitated early recovery attempt. Successful capsule ejection and re-entry on 32nd pass. Damage during retrieval attempt resulted in loss of capsule.

Altitude: 119.6 m
Velocity: 25,630 f/s
Inclination: 65.16 deg
Eccentricity: -0.8
Period: 88.98 min
Perigee: 83 m
Apogee: 206 m

Launched on first attempt. Boost phase adequate to satisfy coast apogee criteria. Separation and coast normal. S-GIA engine provided impulse for near-nominal orbital injection. Flight path angle at injection slightly negative. Orbital performance reportedly satisfactory. Successful capsule ejection and aerial recovery on 65th orbit.

Altitude: 126.5 m
Velocity: 25,730 f/s
Inclination: 70.95 deg
Eccentricity: 0.0151
Period: 90.53 min
Perigee: 125 m
Apogee: 251 m

[REDACTED]

FLIGHT NO. AND
LINE REPORT NO.
59
R00054-57

VEHICLE
SERIAL
NUMBER
1157/349

PAR
NO.
1

LAUNCH
DATE AND
TIME
1-7-63
1309:49.06
NET

GENERAL
ACCOMPLISHMENT
Yes

CAPOUSE TYPE
AND RECOVERY
None

ART-L - Yes.
See recovery
during 65th
orbit.

INJECTION AND
ORBITAL PARAMETERS

Altitude: 125 m
Velocity: 25,765 fps
Inclination: 82.24 deg
Eccentricity: 0.0167
Period: 90.61
Perigee: 120 m
Apogee: 259 m

Launched on first attempt. Booster performance adequate to provide near-normal coast apogee conditions. Separation and coast phase normal. S-GIA engine provided impulse for near-normal orbital injection. Flight path angle at injection slightly negative. S-GIA orbital performance reportedly unsatisfactory due to horizon sensor malfunction prior to fifth orbit. Successful capsule ejection occurred on 65th orbit; however, re-entry occurred outside the planned area. The capsule was recovered from the water.

60
445936-59

1159/354

5

2-28-63 No
1348:30.22
NET

ART - No
recovery

Standard S-GIA except for extension of forward rack to incorporate special payload. First SIV-2A booster.

Launched on second attempt. First attempt cancelled in task 12 because of difficulty with solid booster circuitry. One hold imposed (10 min) for S-GIA additive pump problem and range clearance. Solid booster No. 2 failed to ignite at liftoff and did not jettison. Data indicate solid motor No. 2 was not electrically connected to the booster and did not receive a firing signal. Loss of control occurred as a consequence of the failure of No. 2 to burn and resulted in flight termination and SIV-2A breakup at approximately T+127 sec. The S-GIA vehicle apparently remained intact until T+219 sec.

61
445936-64

1164/360

4

3-18-63 No
1313:00.90
NET

ART (SIV) -
No recovery

First vehicle to have air-borne portion of HEL guidance system in S-GIA vehicle. Second SIV (SIV-2A) booster.

Launched on first attempt. Forty-three min hold time. Liftoff normal. Booster objectives achieved. S-GIA failed to attain orbit. Loss of pneumatic control shortly after separation due to an electrical malfunction (temporary short in auto/aux J-box). Loss of roll control during thrust interval prevented proper execution of guidance. Fracture shutdown of engine, which was indirectly associated with the electrical malfunction, precluded orbital attainment.

Altitude: 99.1 m
Velocity: 24,833 fps
Orbit conditions were not attained.

62
445936-60

1160/376

5

4-1-63 Yes
1501:00.36
NET

ART-L - Yes.
Aerial recovery on 49th orbit.

None.

Launch on first attempt. No holds imposed. Ninety min delay time. Liftoff normal. SIV-2 performance excellent. Near-normal coast apogee conditions. S-GIA subsystems functioned satisfactorily. Near-normal trajectory conditions for orbital injection provided. On-orbit problems reported were: loss of liftoff control gas evidenced by exponential decay in sphere pressure; malfunction of single-phase lift-off inverter evidenced by low output during later revolutions. Despite these problems, successful capsule ejection and aerial recovery were effected on 49th orbit.

Altitude: 127.4 m
Velocity: 25,734 fps
Inclination: 75.36 deg
Eccentricity: 0.0156
Period: 90.65
Perigee: 127.4 m
Apogee: 256 m

63
R030427-11

1411/372

1

4-26-63 Yes
1412:57.07
NET

ART-L -
No recovery

None.

Launch on second attempt. First conditions cancelled because of inability to actuate S-GIA lifeboat solenoid valve. Two holds imposed in final countdown for range clearance (10 min). SIV-2 boost phase satisfactory. Coast apogee target conditions attained. Sporadic SIV-2 yaw control during initial 40 sec of flight. Inadvertent S-GIA horizon sensor bias angle resulted in a +2.5 deg flight path angle and a +20 mile deviation in altitude at injection. Useful orbit not attained. Low perigee and positive flight path angle caused vehicle to re-enter during first revolution.

Altitude: 181.0 m
Velocity: 25,257 fps
Inclination: --
Eccentricity: 0.043
Period: 90.82 min
Perigee: 25 m
Apogee: 330 m

64
445936-65

VEHICLE
SERIAL
NUMBER
1161/368

PAD
NO.
5

LAUNCH
DATE AND
TIME
5-18-63

ORBITAL
ACCOMPLISHMENT
Yes

CAPSULE TEST
AND RECOVERY
Similar to
1161. Recov-
ery on 13rd
orbit.

None.

VEHICLE CHANGES RECORDED

FLIGHT DESCRIPTION

Launched on fourth attempt. Two count-downs on 7 May and 8 May cancelled because of excessive upper air winds; one on 17 May cancelled because of questionable integrity of S-GIA primary. The hold in final count-down (23 min). Liftoff and boost phase normal. Nearly exact orbit space conditions obtained by S-V-2. Guidance of the S-GIA vehicle less accurate than predicted. Injection errors in altitude, flight path angle, and inertial velocity resulted in deviations from nominal orbit. After injection, removal of power to ground guidance beacon and application of power to payload (S-GIA events) did not occur due to an apparent short. Attainment of orbital station objectives were thus precluded. Vehicle recalled after 33 orbits.

HEAVY AND
ORBITAL PARAMETERS

Altitude: 75.25 km
Velocity: 11,830 fps
Inclination: 74.61 deg
Eccentricity: 0.0717
Period: 91.188 min
Perigee: 85.1 km
Apogee: 282.0 km

65
403056-61

1161/368

6-12-63
1658:38.03
FUT

Yes

QSD payload;
recovery on
65th orbit

SL missile-borne guidance
system in S-GIA vehicle.

Launched on second attempt. First count-down cancelled in terminal count because of difficulty with S-V-2 engine clear checks. No hold in final count-down. A large roll torque in S-V-2 within first second after liftoff. Departure azimuth in error by 5 deg. Trajectory such that it necessitated range safety to consider a destruct. Approval commands properly cancelled to correct error. S-V-2 objectives subsequently achieved. S-GIA subsystems functioned satisfactorily. Residual amount of control gas consumed during thrust interval to overcome a roll torque. Orbital performance satisfactory. Aerial recovery on 65th orbit.

Altitude: 107.9 km
Velocity: 25,765 fps
Inclination: 81.83 deg
Eccentricity: 0.01851
Period: 90.79 min
Perigee: 106.6 km
Apogee: 240.3 km

66
445936-66

1166/381

6-26-63
1737:26.16
FUT

Yes

Aerial re-
covery on
65th orbit

Carried R-11 subsatellite

First R-11 launch from this com-
mand. Launch on first attempt.
No holds - 37 min. Liftoff
normal. NROD from propellant
depletion. Slight velocity de-
ficiency at coast space.
S-GIA subsystems functioned
satisfactorily. Velocity de-
ficiency overcome. Orbit de-
tained near-nominal. Orbital
performance reportedly satis-
factory. Capsule ejection,
recovery and recovery on 65th
revolution. R-11, which was
subsequently launched from the
S-GIA, was reported to have
performed satisfactorily.

Altitude: 130.0 km
Velocity: 25,732 fps
Inclination: 81.61 deg
Eccentricity: 0.01538
Period: 90.596 min
Perigee: 110.15 km
Apogee: 221.84 km

67
403047-12

1161/368

7-18-63
1700:10.58
FUT

Yes

AST-1 -
aerial re-
covery on
65th orbit.

Similar to 1161

Launch on second attempt. First
attempt 17 July aborted - S-V-2
destruct receiver No. 2 abnormal.
No hold in final count-down.
Liftoff normal. Boost phase
adequate. Abnormal control
torquants due to flight con-
trol problem during latter por-
tion of boost. S-GIA subsys-
tems performed satisfactorily.
An electrical short occurred
at separation - no apparent ef-
fect except loss of link 2 T/M.
Orbital performance reportedly
satisfactory.

Altitude: 130.4 km
Velocity: 25,717 fps
Inclination: 82.67 deg
Eccentricity: 0.0144
Period: 90.84 min
Perigee: 111.5 km
Apogee: 216 km

FLIGHT NO. AND
LPRC REPORT NO.
68
445936-67

VEHICLE
SERIAL
NUMBER
1167/382

PAID
NO.
2

LAUNCH
DATE AND
TIME
7-30-63
1700:26.63
FRT

ORBITAL
ACCOMPLISHMENT
Yes

CAPSOLE TEST
AND RECOVERY
AES-L. Yes -
Aerial recovery
on 3rd pass.

VEHICLE CHANGE RECOMMENDATION
Missile-borne portion of
SFL guidance system in-
stalled in S-OIA.

FLIGHT DESCRIPTION

Launched on first attempt. No
hold. Liftoff and orbital
ejection normal. MECO from
propellant depletion. Slight
velocity deficiency. Subsequent
guidance commands and S-OIA
thrust compensated for the defi-
ciency. Control gas consumption
during thrust interval greater
than expected - extraneous roll
torque counteraction. Orbit ob-
tained near nominal. Orbital
performance of all subsystems re-
portedly satisfactory. Success-
ful capsule ejection, re-entry,
recovery on 3rd pass.

IMMERSION AND
ORBITAL PARAMETERS

Altitude: 95.2 n.mi.
Velocity: 25,884 fpm
Inclination: 78.77 deg
Eccentricity: 0.0223
Period: 90.63 min
Perigee: 91.0 n.mi.
Apogee: 252.3 n.mi.

69
4430564-68

1162/377

4

8-26-63
1729:53.13
FRT

Yes

AES-L. Yes -
Aerial recovery
on 6th revolution.

Missile-borne portion of
SFL ground guidance in
S-OIA vehicle.

Launch on second attempt. No
hold. First attempt cancelled
at 7-2.6 sec - defective relay
in MECO AGL engine ignition cir-
cuitry. Liftoff less pressure;
otherwise liftoff normal. MECO
from propellant depletion (planned).
All ground guidance directives
properly transmitted and executed.
Required coast capsule conditions
provided by SFL-SL. Orbit obtained
near nominal. Orbital performance
of all subsystems reportedly sat-
isfactory. Capsule ejection, re-
entry and recovery on 6th revolu-
tion.

Altitude: 98.2 nm
Velocity: 25,822 fpm
Inclination: 75.02 deg
Eccentricity: 0.01961
Period: 90.62 min
Perigee: 97.89 nm
Apogee: 260.35 nm

70
445936-69

1169/394

5

8-29-63
1311:03.92
FRT

Yes

AES-L. Yes -
recovery on
6th revolution.

None

Launch on first attempt. One
hold imposed (30 min) because of
intermittent operation of a pro-
cedure switch on launcher. Boost
phase satisfactory, proper coast
capsule conditions provided. Two
S-OIA anomalies evident during
coast - an anomalous current
transient at separation and a
delayed engine shutdown. No
damage from current transient;
anomaly in injection velocity -
gain from delayed shutdown. Or-
bital mission objectives satisfied.

Altitude: 143.4 nm
Velocity: 25,377 fpm
Inclination: 81.885 deg
Eccentricity: 0.00226
Period: 90.80 min
Perigee: 143.8 nm
Apogee: 180.2 nm

71
445936-63

1163/383

2

9-23-63
1600:00.20
FRT

Yes

AES-L. Yes -
on 4th revolu-
tion

Launch on first attempt; no holds
imposed - no major difficulties
encountered. Liftoff normal.
Boost launch objectives satis-
fied. MECO by propellant deple-
tion as planned; however, prop-
ellant utilization less than the
ideal. S-OIA subsystems performed
satisfactorily to provide proper
orbital injection conditions. Or-
bital performance reportedly sat-
isfactory. Successful capsule
ejection, re-entry and aerial
recovery on 4th revolution.

Altitude: 98.85 nm
Velocity: 25,817 fpm
Inclination: 78.777 deg
Eccentricity: 0.01910
Period: 90.609 min
Perigee: 99.2 nm
Apogee: 237 nm

72
4430758

1601/386

4

10-29-63
1319:03.72
FRT

Yes

AES-L. Yes -
on fifth day

Carried P-11 substellite.

Launched on first attempt. One
hold (51 min) for train. Lif-
toff normal. Boost phase satis-
factory. Separation and coast
normal. All SE-OIA subsystems
functioned normally to provide
near-nominal injection conditions
at shutdown. Orbital performance
reportedly satisfactory. Capsule
ejection, re-entry and recovery
on fifth day. P-11, subsequently
launched from the SE-OIA, was re-
ported to have performed satis-
factorily.

Altitude: 187.7 nm
Velocity: 25,715 fpm
Inclination: 89.915 deg
Eccentricity: 0.01496
Period: 90.859 min
Perigee: 155.6 nm
Apogee: 192.6 nm

FLIGHT NO. AND
LESC REPORT NO.

VEHICLE
SERIAL
NUMBER

PAD
NO.

LAUNCH
DATE AND
TIME

ORBITAL
ACHIEVEMENT

CAPSULE TYPE
AND RECOVERY

[REDACTED]

PLANE DESCRIPTION

INJECTION AND
ORBITAL PARAMETERS

73
R00767

1171/400

2

11-9-63
1207:54.51
PST

No

ART-1; no

Booster non-RT/standard
SS-OIA

Launched on first attempt. Two holds for trains - eight min. Boost phase unsatisfactory. Deterioration of flight control system at T+113 sec; complete loss of control at T+138 sec. Deterioration of flight control preceded by loss of main engine flame shield at lift-off. Exposure of control system wiring to excessive temperatures probably responsible for decay in control system performance. Separation due to structural failure. Both stages tumbled but remained basically intact. Evidence of damage in forward end of S1N-2 and payload separation from SS-OIA. SS-OIA subsystems normal until flight termination; remained in steady status after break-apart.

74
R030780

1172/606 PALO 1 11-27-63 Yes
Pad 1 1315:40.13

ART-1; no

Similar to 1171

First launch of this configuration vehicle from PALO. Launch on first attempt. One hold for 12 min - range clearance. Error in countdown procedure resulted in cessation of tank preoxidation after SS-OIA propellant loading. Boost phase satisfactory despite lower structural strength of SS-OIA. Trajectory conditions near-normal. Longer than predicted SS-OIA engine burn duration because of low thrust. Mission objectives and near-normal orbit attained. Link 1 telemetry not attached to orbital assignment after injection. Orbital performance reportedly satisfactory; however, attempted recovery on 1st pass unsuccessful.

Altitude: 99.6 mi
Velocity: 25,779 fps
Inclination: 69.99 deg
Eccentricity: 0.01577
Period: 90.17 min
Perigee: 98.1 mi
Apogee: 211.5 mi

75
R030777

1168/390 Pad 2 12-21-63 Yes
1345:41.7

ART-1; no

Carried P-11 Subsatellite

Launch on first attempt. One hold (15 min) range clearance - trains. Lift-off normal. Excessive maneuvers in roll and yaw immediately after lift-off, apparently associated with thrust misalignment of solid motors. Thrust misalignment increased such that by T+26 sec the required yawer engine deflections reached limits (sec) in roll and the main engine reached -1.6 deg in yaw. After 26 sec the required engine deflections decreased to near-zero by T+40 sec. No cause for the misalignment has been determined. No adverse effects noted in LV-2B performance. SS-OIA subsystem performance satisfactory. Slight gyro effect during thrust interval due to turbine exhaust stack misalignment. Orbit attained near-normal. Subsequent ejection of P-11 satisfactory. Capsule ejection, re-entry and air recovery successful on fifth day.

Altitude: 99.7 mi
Velocity: 25,758 fps
Inclination: 64.88 deg
Eccentricity: 0.01407
Period: 89.98 min
Perigee: 99.5 mi
Apogee: 200.6 mi

76
VORZ 4-2-01
(AF Evaluation
Office Report No.)

1174/389 4 2-15-64 Yes
1336:23.10
PST

Successful
Air recovery

LV-2B/SS-OIA;
RT Guidance
in SS-OIA

Launched on first attempt. One hold for trains. Lift-off normal. HMOO from guidance command. Stage II separation was normal; however, due to a slow shutdown of the stage II engine, the injection velocity was slightly greater than required.

Alt: 101.1 mi
Vel: 25,833 fps
Incl: 74.98°
Eccen: 0.02077
Period: 90.66 min
Peri: 101.09 mi
Apo: 218.39 mi

Program 162 Vehicles Launched: 76
Vehicles Orbited: 59
Capsules Recovered: 40
Airs: 34
Seats: 6

of four payloads, three of which were orbited, were non-recoverable types.

DISTRIBUTION

QUANTITY

RECIPIENT

18

LMSC/VAFB

1

TWOCE Office, STC, 6594th ATW, Sunnyvale, Calif.

1

NASA (Test Support Office) P.O. Box 435, Lompoc, Calif.

10

Douglas Aircraft Corp, VAFB, Calif.

10

DDC, Arlington Hall Station, 4000 Arlington Blvd,
Arlington 12, Va.

1

SSD (SSZAE-1) AF Unit Post Office, Los Angeles 45, Calif.

1

SSD (SSZAE-2/LTC Gooper), AF Unit Post Office,
Los Angeles 45, Calif.

1

6595th ATW, VWZD, VAFB

4

6595th ATW, VWZE, VAFB

1

SSD (SSVXE) AF Unit Post Office, Los Angeles 45, Calif.