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APOLLO SPACECRAFT FLIGHT SUMMARY REPORT

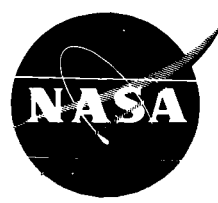
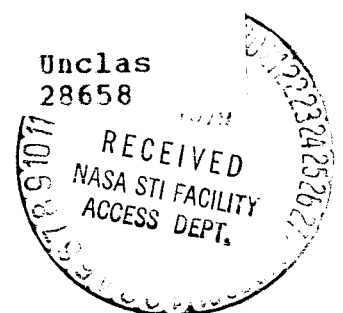
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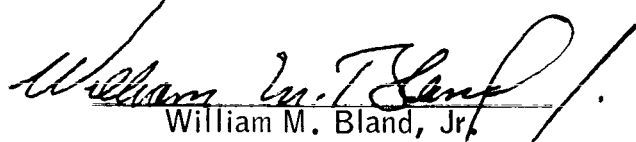
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NASA PROGRAM APOLLO WORKING PAPER NO. 1168
APOLLO SPACECRAFT
FLIGHT SUMMARY REPORT

Authorized for Distribution



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Houston, Texas

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
Houston, Texas
April 12, 1965

PREFACE

The Apollo Spacecraft Flight Summary Report contains a brief summary of pertinent data for each completed Apollo Mission. The contents of this document includes: flight data, test vehicle and prelaunch data, spacecraft description, test objectives and a summary of the test results for each completed mission.

For additional details, the reader should refer to the Postlaunch Report for each specific mission. (See "List of References" included as an appendix to this report.)

Revisions to this report will be supplied as they are prepared.

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1.0 INTRODUCTION

The subsequent even-numbered pages of this report contain a tabular listing of pertinent data for each completed Apollo Mission. The odd-numbered pages contain an illustration of the flight profile for each completed mission. A fold-out, attached to this page, contains numerous headings which define the tabular material listed on the even numbered pages.

Listed below is the nomenclature for the spacecraft on each Apollo Mission with the general purpose for the associated mission. This table lists all missions, including all future missions which have been scheduled to date. Further vehicle assignment is not firm. Updating of this list will be completed as the information becomes available.

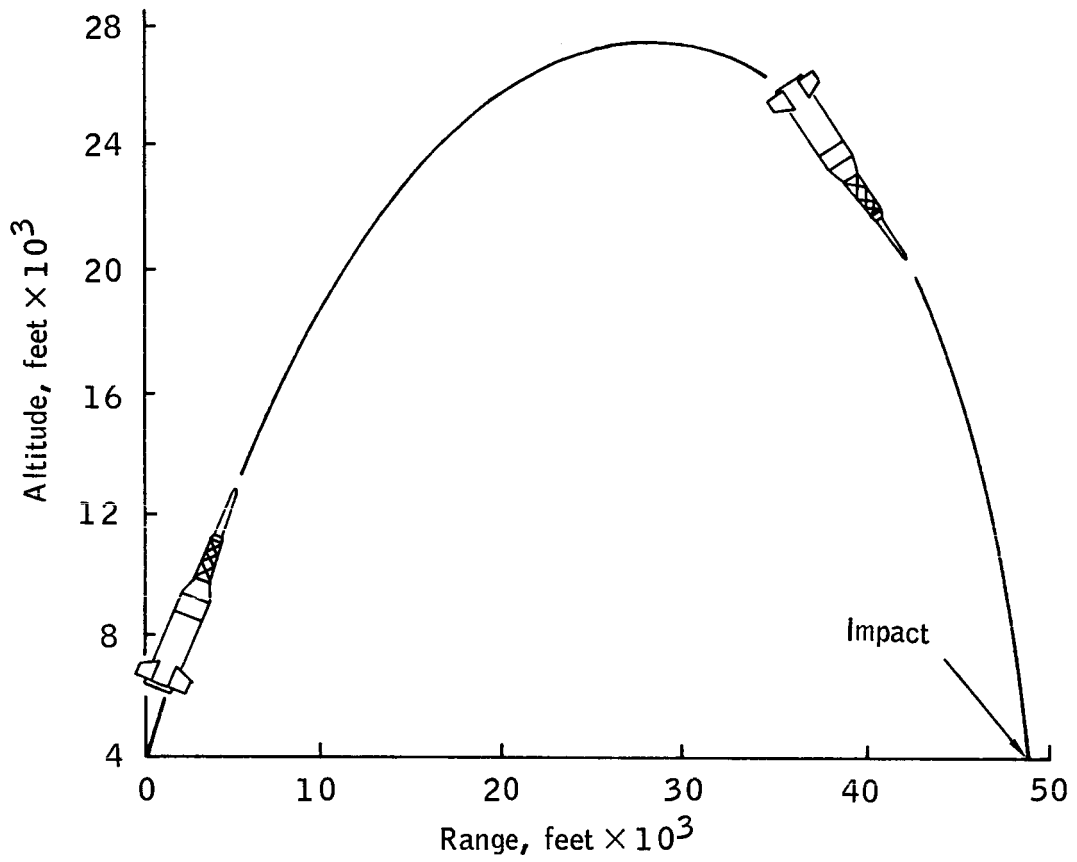
<u>Mission</u>	<u>Spacecraft</u>	<u>Purpose</u>
QTV	----	Little Joe II qualification
PA-1	BP 6	Pad abort
A-001	BP 12	Transonic abort
A-101	BP 13	Launch environment
A-102	BP 15	Launch environment
A-002	BP 23	High α Q abort
A-103	BP 16	Micrometeoroid experiment
A-104	BP 26	Micrometeoroid experiment
A-105	BP 9	Micrometeoroid experiment
A-003	BP 22	High altitude abort
PA-2	BP 23A	Pad abort
A-004	SC 002	High altitude abort
A-201	SC 009	Unmanned supercircular reentry
A-202	SC 011	Unmanned supercircular reentry
A-203	SC 012	Manned orbital flight
A-204	SC 014	Manned orbital flight
A-205	SC 015	LEM propulsion
A-501	SC 017	Unmanned supercircular reentry
A-502	SC 020	Unmanned supercircular reentry

APOLLO LITTLE JOE II QUALIFICATION TEST VEHICLE (QTV)

Test objectives.- The major objectives of this mission were to demonstrate the capability of the launch vehicle to perform the launch phase of Apollo Mission A-001 with the associated rocket combination.

Launch date, time, and site	28 August 1963, 09:00 AM - MST, WSMR - Launch Complex 36			
Spacecraft description:	Vehicle number	Configuration	Weight at launch	Measurements
Command module	None	Dummy payload	24,000 lbs	-
Service module		-	-	-
Adapter		-	-	-
Launch escape subsystem	Predicted thrust	-	-	-
Launch escape motor	None	Inert	Total 24,000 lbs	Total 0
Tower jettison motor	None	Inert		
Pitch control motor	None	Inert		
Spacecraft subsystems				
Instrumentation & communication	None			
Telemetry	None			
Radar	None			
Electrical power	None			
Environmental control	None			
Guidance & navigation	None			
Stabilization & reaction control	None			
Command module	None			
Service propulsion	None			
Sequential control	None			
Emergency detection	None			
Display & control	None			
Crew systems	None			
Earth landing system	None			
Launch vehicle description:	Little Joe II, model 12-50-1			
Weight	57,000 lbs			
Engines	1 Algol and 6 Recruits			
Fuel	Solid propellant			
Thrust	303,000 lbs			
			Measurements	
			Total	Telemetered
			52	52
				Satisfactory
				52
Prelaunch data:				
Launch vehicle delivered at site	17 July 1963			
Spacecraft delivered at site	18 July 1963			
Vehicle stacked	26 July 1963			
Countdown holds	None			

Conclusion.- The mission was successful and all test objectives were satisfied with the exception of the Algol motor thrust termination. Postlaunch analysis indicated that the primacord did not detonate.



Test point conditions
 Mach number : 0.98
 Dynamic pressure: 675 psf
 Altitude: 20,440 ft, msl
 Time: 26.1 sec

Test vehicle impact
 Time: 99.07 sec
 Range: 48,450 ft

Little Joe II qualification test vehicle flight profile

APOLLO MISSION PA-1 (BP 6)

Test objectives.- The object of this test was to demonstrate the capability of the Apollo spacecraft to abort from the launch pad.

7 November 1963, 09:00 AM - MST, WSMR - Launch Complex 36

Vehicle number	Configuration	Weight at launch	Measurements
BP 6	Boilerplate	9,000 lbs	78
	None	-	-
	None	-	-
Predicted thrust	R and D	6,500 lbs	20
155,000 lbs	Live	Total 15,500 lbs	Total 98
33,000 lbs	Live		
2,500 lbs	Live		
			Satisfactory 96

R and D telemetry

1-PAM/FM/FM, 12 cont channels, 1-90 X 10 mult, and 1-0/B tape recorder

None

Batteries: 2 pyro and 1 main

None

None

None

None

None

None

None

None

None

R and D parachutes: 1 drogue, 13.7 ft dia; 3 pilot, 10 ft dia; 3 main, 88.1 ft

None

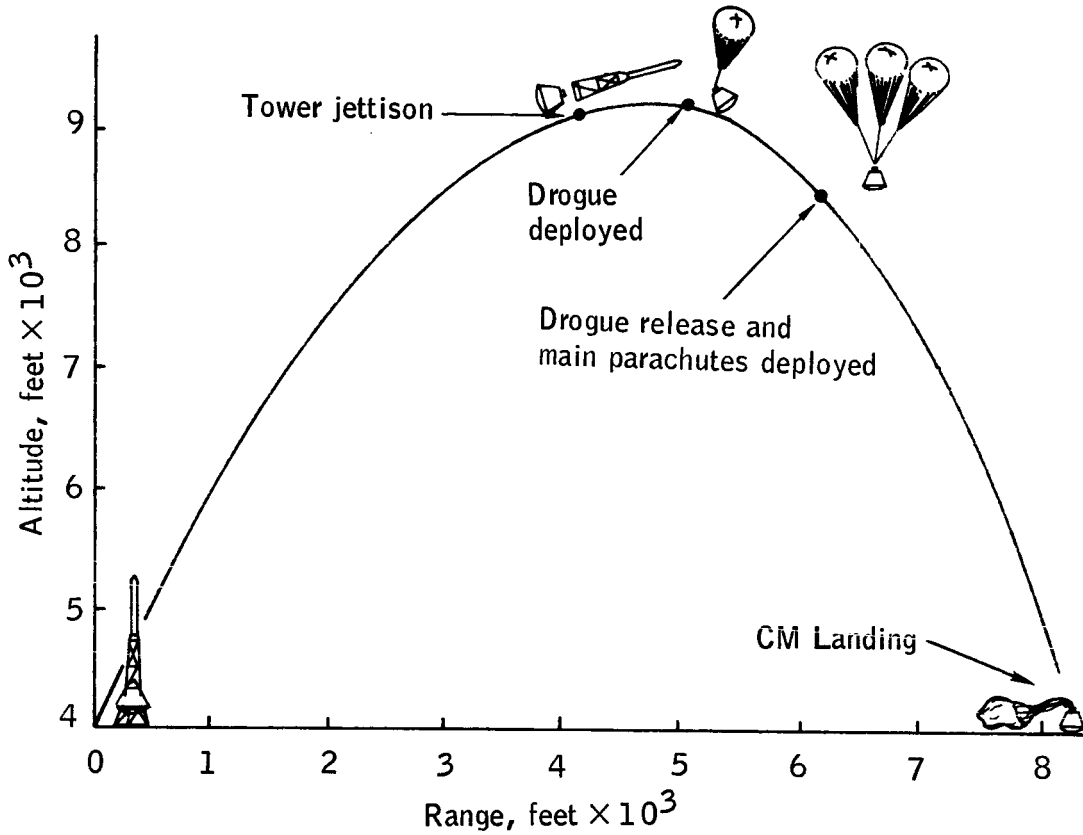
N/A

2 July 1963

19 October 1963

None

Conclusion.- The mission was successful and all test objectives were satisfied.



Test conditions at max "Q"

Mach number: 0.66
 Dynamic pressure: 514 psf
 Altitude: 9,270 ft, msl
 Time: 4.4 sec

Launch escape subsystem impact

Time: 43.7 sec
 Range: 11,980 ft

Command module landing

Time: 161.1 sec
 Range: 8,220 ft

Mission PA-1 (BP 6) flight profile

APOLLO MISSION A-001 (BP 12)

Test objectives.- The test objectives of this mission were to determine the aerodynamic and operational characteristics of the launch-escape vehicle during a transonic abort.

13 May 1964, 06:00 AM - MST, WSMR - Launch Complex 36

Vehicle number	Configuration	Weight at launch	Measurements
BP 12	Boilerplate	9,000 lbs	123
	Boilerplate	9,000 lbs	7
	Part of LV	-	-
Predicted thrust	Operational	7,000 lbs	10
140,000 lbs	Live	Total 25,000 lbs	Total 140
31,000 lbs	Live		
2,000 lbs	Live		
			Satisfactory 137

R and D telemetry, radar, and 3 each 16mm O/B cameras
 1-PAM/FM/FM, 10 cont channels, 1-90 X 10 mult, 1-90 X 1 $\frac{1}{4}$, and 1-O/B tape rec
 2 each C-Band transponders
 Batteries: 1 main, 2 pyro, 2 logic, 3 camera
 Provisional equipment cooling system
 None
 None
 None
 None
 R and D mission sequencer
 None
 None
 None
 R and D parachutes: 1 drogue, 13.7 ft dia; 3 pilot, 10 ft dia; 3 main, 88.1 ft

Little Joe II, model 12-50-2

58,000 lbs

1 Algol and 6 Recruits

Solid propellant

300,000 lbs

Total	Measurements	
	Telemetered	Satisfactory
3	0	3

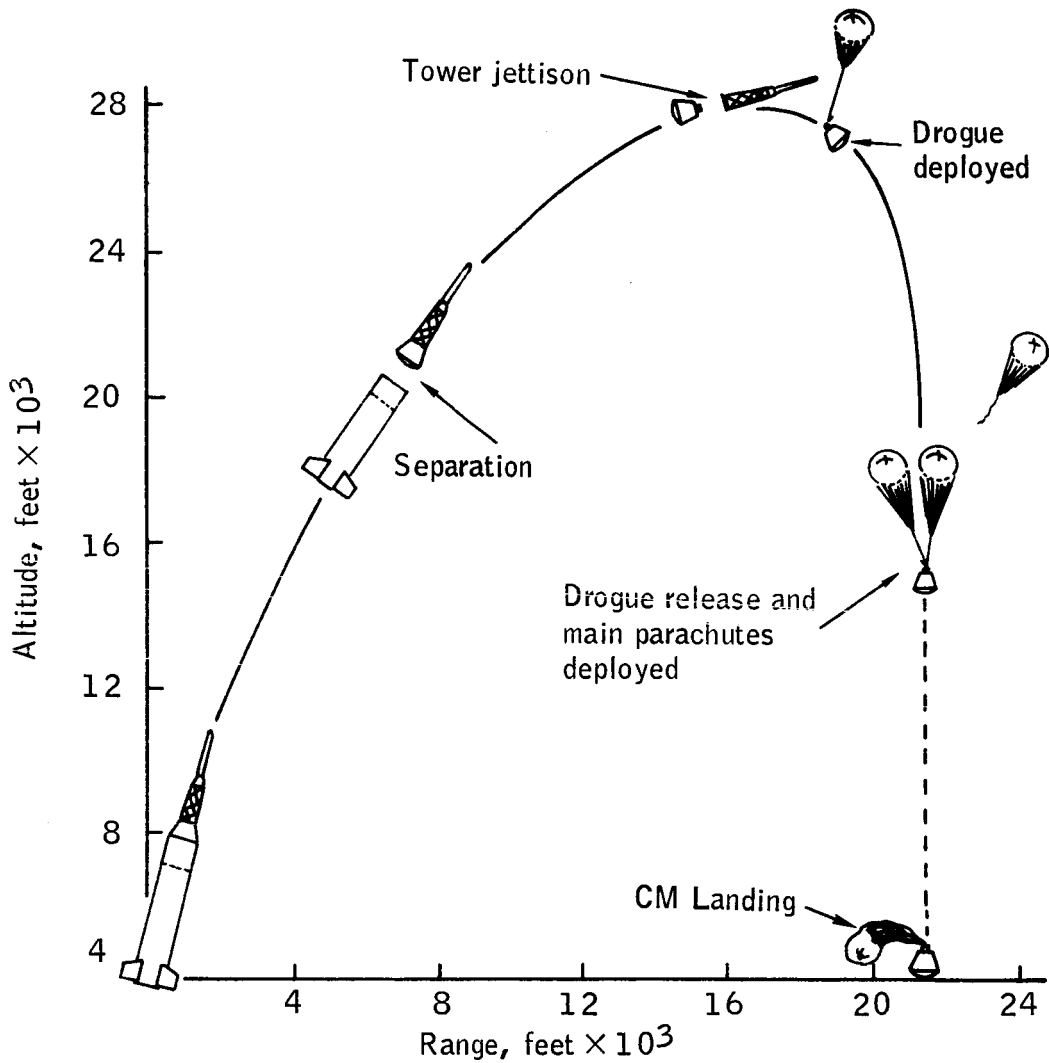
17 February 1964

3 March 1964

30 March 1964

1 - duration 24 hours

Conclusion.- The mission was successful and all test objectives were satisfied with one exception: "Demonstrate proper operation of the applicable components of the earth-landing subsystem." During the deployment of the three main parachutes, a parachute riser chafed against a simulated reaction-control-subsystem motor and drogue disconnect guide assembly. The riser subsequently broke after main parachute line stretch.



Test point conditions

Mach number: 0.935
 Dynamic pressure: 634 psf
 Altitude: 19,444 ft, msl
 Time: 28.435 sec

Launch vehicle impact

Time: 124.5 sec
 Range: 11,592 ft

Launch escape subsystem impact

Time: 110.9 sec
 Range: 27,953 ft

Commanding module landing

Time: 350.3 sec
 Range: 22,400 ft

Mission A-001 (BP 12) flight profile

APOLLO MISSION A-101 (BP 13)

Test objectives.- The test objectives for this spacecraft flight were to demonstrate the compatibility of the spacecraft with the launch vehicle in the launch and exit trajectory and environment for Apollo earth orbital flights.

28 May 1964, 12:07 PM - EST, KSC - Launch Complex 37B

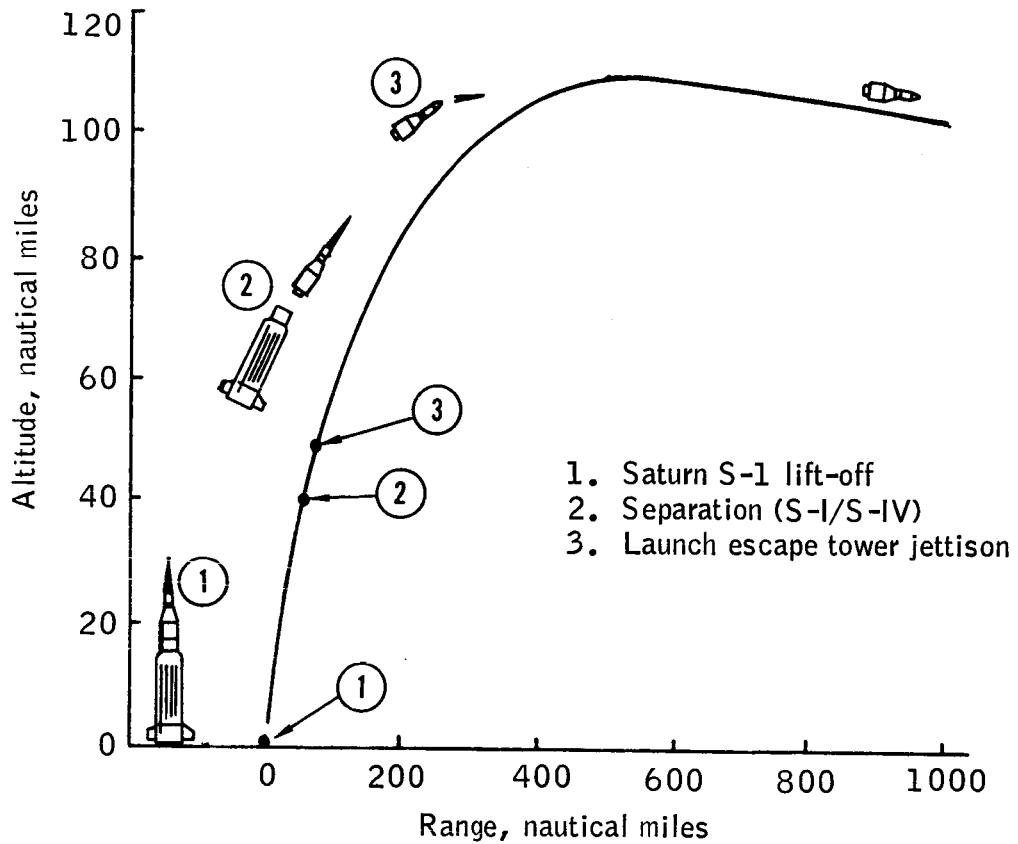
Vehicle number	Configuration	Weight at launch	Measurements
BP 13	Boilerplate	9,000 lbs	62
	Boilerplate	5,000 lbs	34
	Boilerplate	3,000 lbs	6
Predicted thrust	Operational	6,500 lbs	10
140,000 lbs	Live	Total 23,500 lbs	Total 112
None	Inert		
None	Inert		Satisfactory 107

R and D telemetry and radar
 3-PAM/FM/FM, 32 cont channels, 1-90 X 1 $\frac{1}{4}$ mult, and 1-90 X 10 mult
 2 each C-Band transponders
 Batteries: 2 main, 2 logic, and 2 pyro
 Provisional equipment cooling system
 None
 Mockup
 None
 4 each quad mockups not instrumented
 R and D LES sequencer
 None
 None
 None
 None

Saturn I, SA-6
 1,000,000 lbs
 S-1: 8 each H-1 engines; S-IV: 6 each RL10A-3
 S-1: RP-1 and LOX; S-IV: LH₂ and LOX
 S-1: 1,500,000 lbs; S-IV: 90,000 lbs

22 February 1964
 19 February 1964
 2 April 1964
 7 - duration 18 hours and 32 minutes

Conclusion.- The mission was successful and all test objectives were satisfied.



S-I/S-IV separation
 T + 149.2 sec

Number of orbits
 54

Launch escape tower jettison
 T + 161.2 sec

Re-entry area
 Near Canton Island

Orbital parameter
 Perigee: 98.4 nm
 Apogee: 122.5 nm
 Period: 88.62 min
 Inclination angle: 31.78°

Mission A-101 (BP 13) flight profile

APOLLO MISSION A-102 (BP 15)

Test objectives.- The test objectives for the spacecraft on this flight were to determine the launch and exit environmental parameters, to verify design criteria, and to demonstrate the alternate mode of spacecraft escape-tower jettison utilizing the launch-escape and pitch-control motors.

18 September 1964, 11:22 AM -EST, KCS - Launch Complex 37B

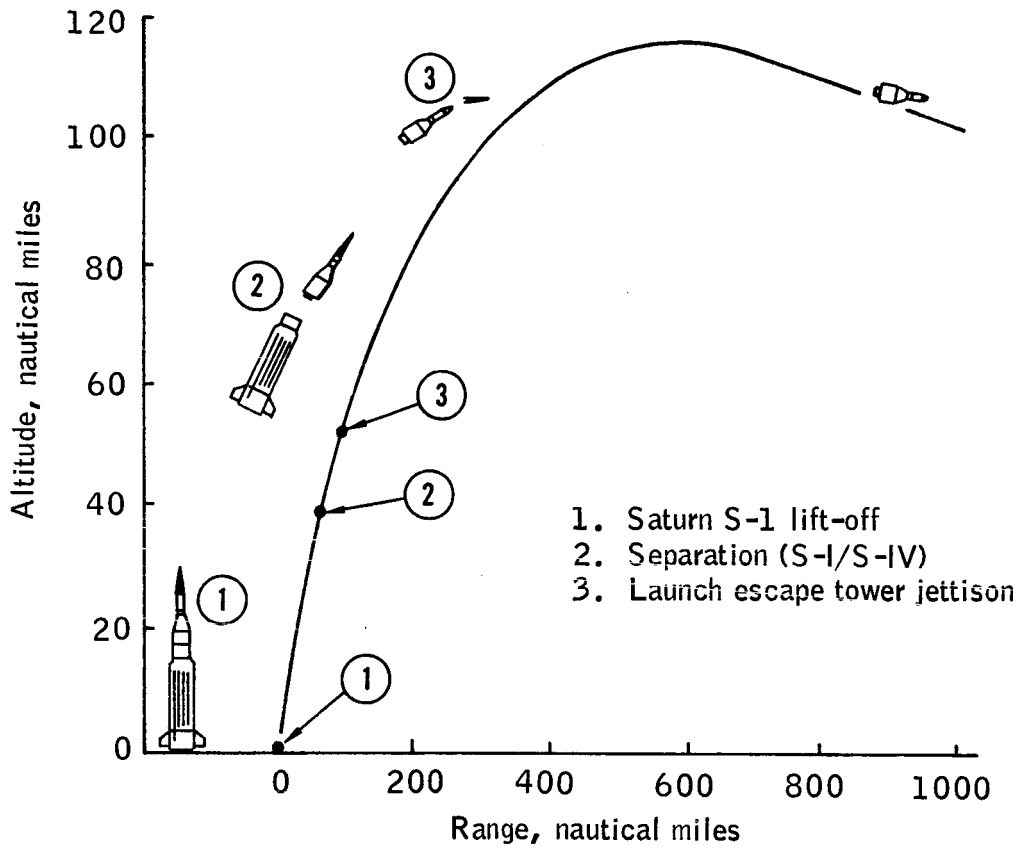
Vehicle number	Configuration	Weight at launch	Measurements
BP 15	Boilerplate	9,000 lbs	53
	Boilerplate	4,000 lbs	53
	Boilerplate	3,500 lbs	10
Predicted thrust	Operational	6,500 lbs	17
140,000	Live	Total 23,000 lbs	Total 133
None	Live		
2,000 lbs	Live		
			Satisfactory 131

R and D telemetry and radar
 3-PAM/FM/FM, 32 cont channels, 1-90 X 1 $\frac{1}{4}$ mult, and 1- 90 X 10 mult
 2 each C-Band transponders
 Batteries: 2 main, 2 pyro, and 2 logic
 Provisional equipment cooling system
 None
 Mockup
 None
 4 each R and D quads one instrumented, no fuel, and no motor
 R and D LES sequencer
 None
 None
 None
 None

Saturn I, SA-7
 1,000,000 lbs
 S-1: 8 each H-1 engines; S-IV: 6 each RL10A-3
 S-1: RP-1 and LOX; S-IV: LH₂ and LOX
 S-1: 1,500,000 lbs; S-IV: 90,000 lbs

12 July 1964
 15 July 1964
 16 August 1964
 4 - duration 2 hours and 30 minutes

Conclusion.- The mission was successful and all test objectives were satisfied.



S-I/S-IV separation
T + 148.2 sec

Number of orbits
59

Launch escape tower jettison
T + 160.2 sec

Re-entry area
Indian Ocean

Orbital parameter
Perigee: 99.8 nm
Apogee: 122.37 nm
Period: 88.64 min
Inclination angle: 31.75°

Mission A-102 (BP 15) flight profile

APOLLO MISSION A-002 (BP 23)

Test objectives.- The object of this test was to determine the aerodynamic and operational characteristics of the launch-escape vehicle during a high αQ abort.

8 December 1964, 08:00 AM - MST, WSMR - Launch Complex 36

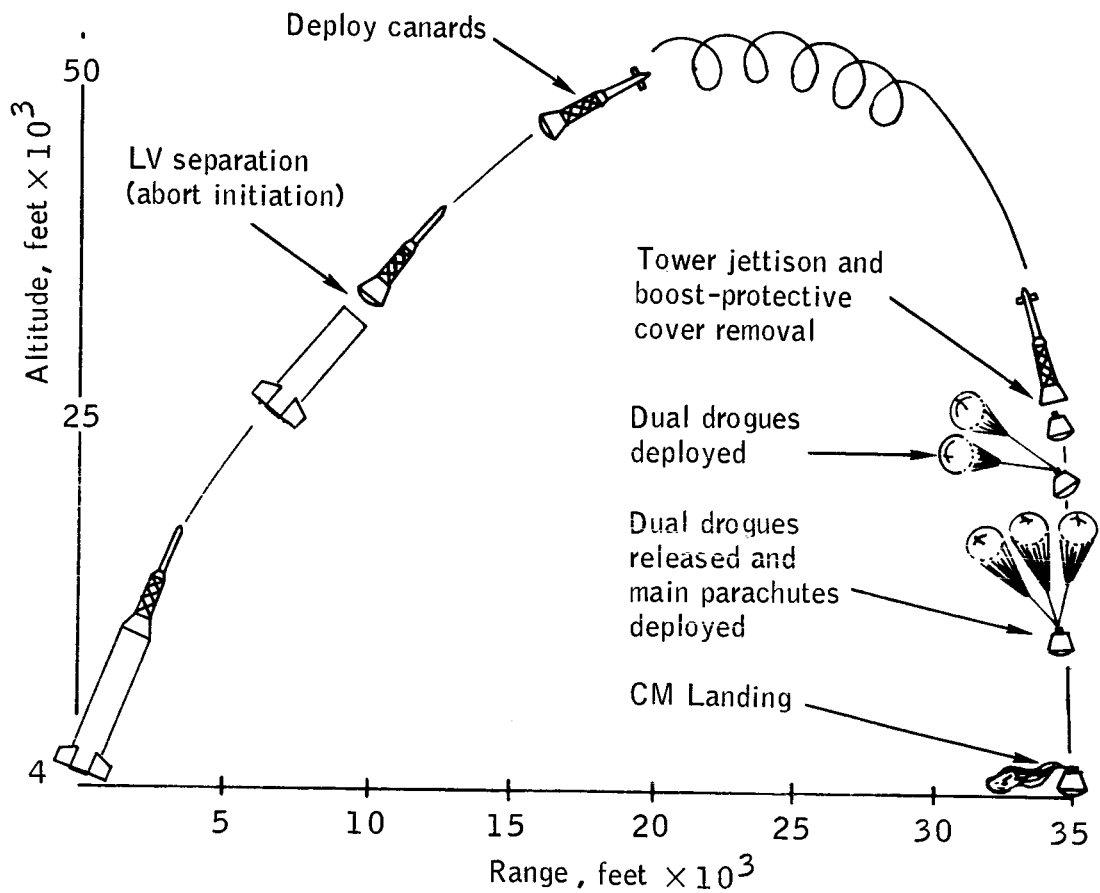
Vehicle number	Configuration	Weight at launch	Measurements
BP 23	Boilerplate	10,000 lbs	109
	Boilerplate	9,500 lbs	9
	Part of LV	-	-
Predicted thrust	Operational	8,000 lbs	14
140,000 lbs	Live	Total 27,500 lbs	Total 132
31,000 lbs	Live		
2,000	Live		
			Satisfactory 128

R and D telemetry, radar, and 3 each 16mm O/B cameras
 1-PAM/FM/FM, 15 cont channels, 1-90 X 10 mult, and 1-O/B tape recorder
 2 each C-Band transponders
 Batteries: 1 main, 2 pyro, 2 logic, and 3 camera
 None
 None
 None
 None
 None
 R and D mission sequencer
 None
 None
 None
 R and D parachutes: 2 drogues, 13.7 ft dia; 3 pilot, 7.2 ft dia; 1 main, 88.1 ft

Little Joe II, model 12-51-1 (Elevons and reaction control attitude control)			
66,000 lbs			
2 each Algols and 4 Recruits			
Solid propellant			
340,000 lbs			
	Measurements		
	Total	Telemetered	Satisfactory
	58	58	56

18 September 1964
 9 September 1964
 23 November 1964
 None

Conclusion.- The mission was successful and all test objectives were satisfied. The structural performance of the boost protective cover indicated marginal operation for the severe flight conditions that it experienced.



Test point conditions

Mach number: 1.56
 Dynamic pressure: 990 psf
 Altitude: 31,950 ft, msl
 Time: 35.7 sec

Launch vehicle impact

Exact time and location
 of impact undetermined.
 LV/SM disintegrated at
 95.7 sec

Launch escape subsystem impact

Time: 160.0 sec
 Range: 32,400 ft

Command module landing

Time: 443.4 sec
 Range: 32,800 ft

Mission A-002 (BP 23) flight profile

APPENDIX A

LIST OF REFERENCES

1. "Launch Vehicle Flight Report, GDC-63-193A, Little Joe II Qualification Test Vehicle 12-50-1", dated October 28, 1963.
2. "Postlaunch Memorandum Report for Apollo Pad Abort I (BP-6)", dated November 13, 1963.
3. "Postlaunch Report for Apollo Mission A-001 (BP-12)", MSC-R-A-64-1, dated May 28, 1964.
4. "Postlaunch Report for Apollo Mission A-101 (BP-13)", MSC-R-A-64-2, dated June 18, 1964.
5. "Postlaunch Report for Apollo Mission A-102 (BP-15)", MSC-R-A-64-3, dated October 10, 1964.
6. "Postlaunch Report for Apollo Mission A-002 (BP-23)", MSC-R-A-65-1, dated January 22, 1965.

APPENDIX B

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