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April 19, 1968

POSTFLIGHT SIMULATION OF THE APOLLO 5 TRAJECTORY FROM THE SECOND DPS BURN TO TOUCHDOWN

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Lunar Landing Branch

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MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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PROJECT APOLLO

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POSTFLIGHT SIMULATION OF THE APOLLO 5 TRAJECTORY FROM THE SECOND DPS BURN TO TOUCHDOWN

By Veit Hanssen

SUMMARY AND INTRODUCTION

This document presents pertinent postflight trajectory data for the Apollo 5 (AS-204/LM-1) Mission from the initialization of the second descent propulsion system (DPS) burn to touchdown. The trajectory was reconstructed based on tracking vectors obtained during real time and best estimated trajectory (BET) vectors derived during postflight analysis.

Apollo 5 was designed to man-rate the lunar module. Its primary objectives were multiple firing of the descent and ascent engines, depleting the fuel during the second ascent propulsion system (APS) burn, and verifying the abort staging function. These objectives were met.

Another objective, not mandatory for mission success, was verifying the onboard guidance. However, a premature shutdown of the first DPS burn resulted from the thrust buildup not satisfying the required delta velocity time criteria monitored by the guidance system, and the LM guidance computer terminated the burn. Due to this premature shutdown of the first DPS burn and communications problems between flight control and the spacecraft, it was decided not to retarget the second DPS burn, but to use alternate mission sequences for the remainder of the flight. Since gimbal lock occurred during the second APS burn and neither valid attitude nor state vector data were available for the remaining burn time until fuel depletion, the simulated point of touchdown, based on a ballistic reentry could not be verified by any real-time data.

SUMMARY OF INPUT DATA

For an equivalent six-degree-of-freedom, orbital-integration, spacecraft-attitude-control simulation, the coupling data unit (CDU) angles obtained from downlink telemetry information were used for program reader assembly (PRA) sequences III and V until gimbal lock. Constant attitude rates were assumed during the remainder of the burn.

A BET state vector was used to initialize the PRA III burn sequence and as trajectory updates past PRA III and prior to the PRA V sequence.

The engine performance and spacecraft weight data used was based on Apollo 5 postflight determination (ref. 1).

MISSION DESCRIPTION

Mission Prior to PRA Sequence III

Apollo 5 launch occurred from launch complex 37B of the Kennedy Space Center, at $22^h48^m8^s$ G.m.t. on January 22, 1968. The S-IB launch vehicle configuration and illustration of LM-1 are presented in figures 1 and 2. The major events following lift-off are presented in table I, and the ground tracks are shown in figure 3.

LM/S-IVB separation was initiated at $53^m55.9^s$ g.e.t. within the tracking range of Carnarvon. The resulting perigee and apogee altitudes were 90 and 120 n. mi., respectively. The first descent engine ignition took place at $3^h59^m41.7^s$ over Carnarvon. Since the ΔV monitor did not sense the expected acceleration, the LM guidance computer commanded early cutoff. This resulted in a 4.17-second first-DPS burn and an orbit with 92- by 120-n. mi. perigee and apogee altitude, respectively. This orbit made an alternate mission necessary. Flight control had the option of retargeting the second DPS maneuver or choose a PRA sequence which provides only rate damping control. Since a retargeted second DPS burn would have had only one burn of about 58.5-seconds duration and was more complicated to initiate, a decision in favor of alternate Mission C (PRA sequence III) was made, which consisted of two DPS burns and two APS burns and included abort staging.

After the first APS burn, flight control terminated the onboard PRA III tape which also could have provided a coast phase and a second APS burn to depletion. The possibility of using the LGC for a retargeted second APS burn was considered; however, a decision was made in favor of the PRA V sequence.

PRA III

PRA III sequence was initiated at $6^h10^m0^s$ as a result of DPS-1 failure.

This alternate mission sequence consisted of two DPS, an abort staging and one APS burn. Figure 4 presents trajectory parameter time histories

for the PRA III sequence. Tables II through VIII present simulated trajectory data from PRA III to touchdown.

The signal for PRA III sequence command initiation was followed by a 10.1-second RCS burn and a 4.9-second coast phase preceding the ullage for the second DPS ignition. The descent engine ignited after an 8.3-second ullage, and the RCS thrusters cut off at 4.6 seconds after DPS engine-on. The descent engine burned for 26 seconds at 10 percent thrust and fired for the remaining 7 seconds at full thrust in a fixed throttle position.

At sequence III burn initiation, the LM was pitched down 6.7° and yawed north 96.8° with respect to the inertial velocity vector. The second DPS burn resulted in a 106-fps ΔV using about 310 lb of propellant.

The second DPS burn was followed by a 23.7-second coast phase which terminated at an 8.3-second ullage preceding the third DPS burn. As on DPS-2, the RCS thrusters cut off at 4.6 seconds after DPS ignition.

This burn resulted in a ΔV of 48 fps. At the end of this burn, the descent stage was aborted and inserted into an orbit of 94- by 209-n. mi. perigee and apogee altitudes, respectively, which gave the descent stage an approximate lifetime of 21 days.

PRA V

The PRA V sequence was initiated over Hawaii at $7^h43^m55^s$. The trajectory parameter time histories are shown in figure 5.

At PRA V initiation, the LM was in an attitude of 28° pitchup and 129° yaw south.

RCS ignition prior to the second APS burn took place 5.3 seconds after PRA V initiate, and main engine-on occurred at 12.5 seconds of RCS burn time. The ullage terminated at 4.5 seconds after APS-2 ignition. The second APS burn to fuel depletion had a duration of 340 seconds and its estimated termination occurred at $7^h50^m13.8^s$.

Gimbal lock occurred at $7^h47^m30^s$. The uncertainty of attitudes after gimbal lock and the lack of position data at burnout caused uncertainties in the determination of the oscillating elements during the remaining 160 seconds of the burn.

Simulations indicated a total ΔV of approximately 6000 fps and a resulting orbit of -350 by 120 n. mi. perigee and apogee altitudes, respectively.

A BET vector established at $7^h40^m39.91^s$ g.e.t. was used to initialize the APS-2 simulated burn reconstruction.

The ascent stage ignited 0.3 seconds after separation at an attitude of 1.3° pitch down and 103° yawed north with respect to the inertial velocity vector. The first APS burn had a duration of 60 seconds and resulted in 670-fps ΔV. The ascent stage at burnout was in an orbit of 92- by 519-n. mi. predicted perigee and apogee altitude, respectively.

Shortly after completing the first ascent engine burn, control was returned to the guidance computer to regain spacecraft attitude control and avoid gimbal lock in the inertial platform. Excessive thruster firings were immediately experienced. Because the guidance computer was in an idling mode during sequence III control, the thruster commands were based on prestaging inertias. Propellant valves in the reaction control "A" system were shut off by ground command to conserve propellants and the "B" system propellants were depleted within 5 minutes after the "A" system was shut off. The "A" system propellant valves were subsequently reopened and connected to the "B" system thrusters by the crossfeed valves; therefore, attitude control was maintained. Prior to the second burn, the interconnect valves were opened to provide propellants to the thrusters directly from the ascent engine propellant tanks. The control thrusters immediately performed with full authority.

The conditions presented in table IX for the tracking vector comparison at abort staging (fire-in-the-hole - FITH) were obtained by integrating a free-flight NORAD tracking vector for the LM descent stage back to the time of FITH. The tracking vector presented for APS-1 cutoff were determined by integrating a post-APS-1 free-flight vector back to the respective time. As evidenced by the conditions presented in the table for these tracking vector comparisons and the pulsating integrating pendulous accelerometer (PIPA) reconstructed vectors, the simulation results agree very closely.

Coast to Impact

At the second APS burnout, the ascent stage was in an earth intersecting ellipse, coasting toward perigee. For reentry simulation a ballistic trajectory (free flight) was applied and it was assumed that the entire APS stage survived the atmospheric entry (400 000) which based on simulations occurred at -122° longitude and 22° latitude. The corresponding longitude and latitude of impact was -113° and 18°, respectively.

A study was made on different deorbit conditions, where several ellipses resulting from different attitude rates were investigated. The point of impact for all cases deviated from the one presented by less than 2° in longitude.

The rate of tumbling in the above case is based on the last attitudes prior to gimbal lock, and it can be assumed that the rates increased during the remaining 153 seconds of the burn which would place the point of touchdown closer to 110° west longitude. Since PRA V called for closing of the RCS interconnect at $7^h46^m42^s$ for system A and $7^h46^m53.63^s$ for system B, all rate damping terminated approximately 30 seconds prior to gimbal lock. It is therefore highly improbable that the ascent engine burned at constant attitude in any direction, which could cause a considerable deviation from the deorbit ellipse of about -350 by 120 n. mi. perigee and apogee altitude, respectively. Figure 5(c) indicates the fluctuation of the predicted apogee altitude and shows that perigee never varies by more than 50 n. mi. which makes the deviation of the point of touchdown less than 2°. The altitude versus longitude curve is presented in figure 6.

Table VIII presents a summary of MSFN coverage from PRA III to impact based on 0° elevation angle and 32 000 n. mi. slant range.

Table IX presents a comparison of the simulated tumble and ballastic free-flight state vectors for APS-2 thrust decay, reentry and impact. No tracking comparisons are presented for these events as a result of radar contact being lost after gimbal lock.

The state vectors in table IX were reconstructed from (1) guidance and navigation (G&N) PIPA accelerometer data, (2) external tracking data and (3) a quasi six-degree-of-freedom trajectory simulation program. It is to be noted that the G&N PIPA reconstruction, which is considered to be the most reliable source for best estimating the ascent and descent propulsion system burns (APS and DPS) were considered to be the finalized set of IMU performance errors.

Considering the comparison between PIPA reconstructed and simulated state vectors at gimbal lock and the close agreement between the same at APS-1 cutoff, it was concluded that a valid ascent stage trajectory could be propagated forward using the operational trajectory simulation program.

COORDINATE SYSTEMS

Earth-Centered Inertial (ECI) Coordinate System (X, Y, Z)

In the ECI coordinate system, the X-axis lies in the equatorial plane and is fixed along the Greenwich meridian on the midnight before launch. The Z-axis is directed through the mean rotational axis of the earth, positive north, and the Y-axis completes the right-handed system (fig. 7).

LM Spacecraft-Fixed Coordinate System (X_B, Y_B, Z_B)

The LM coordinate system is an orthogonal, right-handed system coincident with the spacecraft axes. The X_B-axis (yaw) extends through the upper docking tunnel. The Z_B-axis (roll) extends along the crew line of sight, and the Y_B-axis (pitch) completes the system (fig. 2).

Launch Site Inertial (LSI) Reference System (X_I, Y_I, Z_I)

This inertial, orthogonal, right-handed system coincides with the launch site ate the time of launch (fig. 8). The X_I-axis (roll) extends down range in the direction of the intended flight azimuth (72°) in the local horizontal plane. The Z_I-axis (yaw) extends upward along the local vertical, and the Y_I-axis (pitch) completes the system. The spacecraft inertial attitude angles are the ordered yaw, pitch, and roll angles required to rotate from this coordinate system to the current spacecraft-fixed attitude orientation.

Earth Relative Attitude Reference System (X_R, Y_R, Z_R)

This right-handed orthogonal coordinate system is referenced to a rotating earth. Pitch (Y_R-axis) is referenced to the plane of the local horizontal. Yaw (Z_R-axis) is measured from north. Roll (X_R-axis) is referenced to the local vertical (fig. 10).

Inertial Measurement Unit (IMU) Reference System (X_{SM}, Y_{SM}, Z_{SM})

The LM IMU is an inertial, orthogonal, right-handed reference system which becomes fixed at lift-off. This system is oriented so that, at lift-off, the Z (middle gimbal) axis is located 32° east of north in the local horizontal plane. The Y (inner gimbal) axis lies 122° east of north 30° above the local horizontal plane. The X (outer gimbal) axis completes the right-handed system, 30° off the local vertical (fig. 9). This orientation is such that the LM spacecraft gimbal angle readings at lift-off are 122°, 0°, and 30° for the outer, inner, and middle gimbal angles, respectively. A schematic diagram of the LM spacecraft IMU has also been included in figure 5 to show the stable member unit vectors and the axes of rotation about which the three gimbal angles are measured.

The definition of the trajectory parameters and the orbital geometry is illustrated in figures 10 and 11.

SPACECRAFT ATTITUDE PARAMETERS (TABLE IV)

LM Inertial Pitch, Yaw, and Roll

LM inertial pitch, roll, and yaw are the LM roll, pitch, and yaw angles, executed respectively, required to rotate from the launch site inertial reference coordinate system to the current spacecraft-fixed attitude.

LM Relative Pitch, Roll, and Yaw

LM relative pitch, roll, and yaw are the LM roll, pitch, and yaw angles, executed respectively, required to rotate from the relative attitude reference coordinate system to the current spacecraft-fixed attitude.

LM Gimbal Angles

IMU gimbal angles, - inner, middle, outer are the LM pitch, roll, and yaw angles, executed respectively, required to rotate from the spacecraft stable member axes (IMU reference system) to the current spacecraft-fixed attitude.

TABLE I.- TIME HISTORY OF APOLLO 5 MISSION EVENTS

Event	Mission elapsed time, hr:min:sec
Launch phase	
Guidance reference release (GRR)	-00:00:05
Range zero - 22:48:08 G.m.t.	00:00:00
Lift-off	00:00:00.36
Maximum dynamic pressure	00:01:17
S-IB inboard engines cutoff	00:02:19
S-IB outboard engines outoff	00:02:22
S-IB/S-IVB separation	00:02:23
S-IVB start command	00:02:25
LM ECS PR1, water valve actuate	00:03:15
S-IVB cutoff signal	00:09:53
Orbital phase	
Insertion	00:10:03
Aerodynamic shroud jettison start	00:10:38
SLA panel deployment	00:19:44.
Initiate RCS +X translation	00:53:53
LM/S-IVB separation command	00:53:58
Initiate maneuver to DPS burn attitude	03:55:04
Ullage on	03:59:32.5
First DPS burn start (10 percent)	03:59:40
DPS engine cutoff	03:59:44.

TABLE I.- TIME HISTORY OF APOLLO 5 MISSION EVENTS - Continued

Event	Mission elapsed time, hr:min:sec
PRA III	
Sequence initiate	6:10:00
RCS +X ullage start	06:10:07.4
RCS +X ullage off	06:10:17.5
RCS +X ullage on	06:10:22.4
RCS +X ullage off	06:10:27.2
RCS +X ullage on	06:10:33.4
DPS on (second burn)	06:10:41.7
RCS +X ullage off	06:10:46.3
DPS fixed throttle position	06:11:07.8
DPS engine off	06:11:14.7
RCS +X ullage start	06:11:38.4
DPS engine on (third burn)	06:11:46.7
RCS +X ullage off	06:11:51.3
DPS fixed throttle position	06:12:12.8
Abort stage	06:12:14.3
DPS engine off	06:12:14.7
APS engine on (FITH)	06:12:14.7
APS engine off	06:13:14.3

TABLE I.- TIME HISTORY OF APOLLO 5 MISSION EVENTS - Concluded

Event	Mission elapsed time, hr:min:sec
PRA V	
Sequence initiate	
RCS +X ullage on	07:44:0.3
APS engine on	07:44:12.8
Ullage off	07:44:17.3
APS fuel depletion - coast to entry	07:50:13.8
Entry (400 000 ft)	07:50:41.0
Impact	08:02:8.4

TABLE II
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
-POSITION VECTOR-

TIME FROM LIFTOFF HR MIN SEC	SECONDS	GEODETIC LATITUDE DEG	DEG MIN SEC	LONGITUDE DEG	DEG MIN SEC	ALTITUDE FEET	N MI	EARTH CENTERED INERTIAL CARTESIAN X (FEET)	Y (FEET)	Z (FEET)
6. 9. 51.900	22192.	29.00	29. 0. .0	-119.51	-119. 30. 36.0	568957.8	93.64	13574530.	-13026991.	10360868.
6. 10. .000	22200.	28.87	28. 52. 4.5	-118.93	-118. 55. 46.5	569258.3	93.69	13731000.	-12897241.	10317828.
INITIATE PRA III SEQUENCE										
6. 10. .000	22200.	28.87	28. 52. 4.5	-118.93	-118. 55. 46.5	569258.3	93.69	13731000.	-12897241.	10317828.
6. 10. 7.400	22207.	28.74	28. 44. 41.3	-118.40	-118. 24. 2.6	569537.5	93.73	13872826.	-12777655.	10277665.
RCS +X ULLAGE ON										
6. 10. 7.400	22207.	28.74	28. 44. 41.3	-118.40	-118. 24. 2.6	569537.5	93.73	13872826.	-12777655.	10277665.
6. 10. 17.500	22217.	28.57	28. 34. 23.0	-117.68	-117. 40. 51.6	569923.5	93.80	14064674.	-12612819.	10221550.
RCS +X ULLAGE OFF										
6. 10. 17.500	22217.	28.57	28. 34. 23.0	-117.68	-117. 40. 51.6	569923.5	93.80	14064674.	-12612819.	10221550.
6. 10. 22.400	22222.	28.49	28. 29. 17.5	-117.33	-117. 19. 57.8	570114.3	93.83	14157022.	-12532184.	10193789.
RCS +X ULLAGE ON										
6. 10. 22.400	22222.	28.49	28. 29. 17.5	-117.33	-117. 19. 57.8	570114.3	93.83	14157022.	-12532184.	10193789.
6. 10. 27.199	22227.	28.40	28. 24. 14.7	-116.99	-116. 59. 31.6	570303.0	93.86	14247021.	-12452776.	10166256.
RCS +X ULLAGE OFF										
6. 10. 27.199	22227.	28.40	28. 24. 14.7	-116.99	-116. 59. 31.6	570303.0	93.86	14247021.	-12452778.	10166256.

TABLE II
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
POSITION VECTOR - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	GEODETIC LATITUDE DEG	DEG MIN SEC	LONGITUDE DEG	DEG MIN SEC	ALTITUDE FEET	N MI	EARTH CENTERED INERTIAL CARTESIAN X (FEET)	Y (FEET)	Z (FEET)
6. 10. 33.399	22233.	28.29	28. 17. 38.6	-116.55	-116. 33. 10.7	570549.0	93.90	14362585.	-12349602.	10130198.
				RCS +X ULLAGE ON						
6. 10. 33.399	22233.	28.29	28. 17. 38.6	-116.55	-116. 33. 10.7	570549.0	93.90	14362585.	-12349602.	10130198.
6. 10. 42.999	22243.	28.12	28. 7. 14.0	-115.87	-115. 52. 29.7	570939.0	93.96	14539987.	-12188508.	10073272.
				DPS TMD IGNITION						
6. 10. 42.999	22243.	28.12	28. 7. 14.0	-115.87	-115. 52. 29.7	570939.0	93.96	14539987.	-12188508.	10073272.
6. 10. 46.299	22246.	28.06	28. 3. 36.2	-115.64	-115. 38. 32.4	571076.3	93.99	14600540.	-12132754.	10053397.
				RCS +X ULLAGE OFF						
6. 10. 46.299	22246.	28.06	28. 3. 36.2	-115.64	-115. 38. 32.4	571076.3	93.99	14600540.	-12132754.	10053397.
6. 11. 7.799	22268.	27.66	27. 39. 18.2	-114.13	-114. 7. 59.5	572042.8	94.15	14989687.	-11764797.	9920090.
				DPS FIXED THROTTLE POSITION						
6. 11. 7.799	22268.	27.66	27. 39. 18.2	-114.13	-114. 7. 59.5	572042.8	94.15	14989687.	-11764797.	9920090.
6. 11. 15.599	22276.	27.50	27. 30. 12.3	-113.59	-113. 35. 15.2	572437.3	94.21	15128718.	-11629116.	9870071.
				DPS ENGINE CUTOFF						
6. 11. 15.599	22276.	27.50	27. 30. 12.3	-113.59	-113. 35. 15.2	572437.3	94.21	15128718.	-11629116.	9870071.
6. 11. 38.399	22298.	27.05	27. 2. 46.5	-112.00	-111. 59. 58.6	573735.5	94.42	15528133.	-11226248.	9718875.
				RCS +X ULLAGE ON						
6. 11. 38.399	22298.	27.05	27. 2. 46.5	-112.00	-111. 59. 58.6	573735.5	94.42	15528133.	-11226248.	9718875.

TABLE II
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
POSITION VECTOR - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	GEODETIC LATITUDE DEG	DEG MIN SEC	LONGITUDE DEG	DEG MIN SEC	ALTITUDE FEET	N MI	EARTH CENTERED INERTIAL CARTESIAN X (FEET)	Y (FEET)	Z (FEET)
6. 11. 46.999	22307.	26.87	26. 52. 7.0	-111.40	-111. 24. 15.3	574269.8	94.51	15675839.	-11072110.	9659968.
				DPS THREE IGNITION						
6. 11. 46.999	22307.	26.87	26. 52. 7.0	-111.40	-111. 24. 15.3	574269.8	94.51	15675839.	-11072110.	9659968.
6. 11. 51.298	22311.	26.78	26. 46. 43.4	-111.11	-111. 6. 26.2	574547.5	94.56	15749088.	-10994594.	9630129.
				RCS +X ULLAGE OFF						
6. 11. 51.298	22311.	26.78	26. 46. 43.4	-111.11	-111. 6. 26.2	574547.5	94.56	15749088.	-10994594.	9630129.
6. 12. 12.798	22333.	26.32	26. 19. 7.5	-109.63	-109. 37. 45.0	576049.0	94.81	16109300.	-10602508.	9477097.
				DPS FIXED THROTTLE POSITION						
6. 12. 12.798	22333.	26.32	26. 19. 7.5	-109.63	-109. 37. 45.0	576049.0	94.81	16109300.	-10602508.	9477097.
6. 12. 14.398	22334.	26.28	26. 17. 1.7	-109.52	-109. 31. 10.5	576169.3	94.83	16135706.	-10573025.	9465452.
				ABORT STAGE						
6. 12. 14.398	22334.	26.28	26. 17. 1.7	-109.52	-109. 31. 10.5	576169.3	94.83	16135706.	-10573025.	9465452.
6. 12. 14.698	22335.	26.28	26. 16. 38.1	-109.50	-109. 29. 56.6	576191.3	94.83	16140653.	-10567490.	9463264.
				DPS ENGINE CUTOFF						
6. 12. 14.698	22335.	26.28	26. 16. 38.1	-109.50	-109. 29. 56.6	576191.3	94.83	16140653.	-10567490.	9463264.
6. 12. 14.998	22335.	26.27	26. 16. 14.5	-109.48	-109. 28. 42.6	576214.8	94.83	16145597.	-10561955.	9461075.
				APS ONE IGNITION						
6. 12. 14.998	22335.	26.27	26. 16. 14.5	-109.48	-109. 28. 42.6	576214.8	94.83	16145597.	-10561955.	9461075.
6. 12. 24.998	22345.	26.05	26. 2. 58.9	-108.79	-108. 47. 37.0	576979.8	94.96	16309539.	-10376243.	9387318.

TABLE II
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
POSITION VECTOR - Continued.

TIME FROM LIFTOFF HR MIN SEC	SECONDS	GEODETIC LATITUDE DEG	DEG MIN SEC	LONGITUDE DEG	DEG MIN SEC	ALTITUDE FEET	N MI	EARTH CENTERED INERTIAL CARTESIAN X (FEET)	Y (FEET)	Z (FEET)
6. 12. 34.998	22355.	25.82	25. 49. 28.8	-108.11	-108. 6. 29.9	577644.5	95.07	16471672.	-10188101.	9312015.
6. 12. 44.998	22365.	25.60	25. 35. 44.9	-107.42	-107. 25. 21.9	577997.3	95.13	16639733.	-9999456.	9235199.
6. 12. 54.998	22375.	25.36	25. 21. 47.7	-106.74	-106. 44. 14.0	577835.3	95.10	16789942.	-9804306.	9156652.
6. 13. 4.998	22385.	25.13	25. 7. 37.2	-106.05	-106. 3. 7.8	576974.7	94.96	16946523.	-9608720.	9076468.
6. 13. 14.770	22395.	24.89	24. 53. 32.9	-105.38	-105. 23. 1.4	575319.3	94.69	17093289.	-9415372.	8996393.
TERMINATE PRA III COAST TO PRA V										
6. 13. 13.900	22394.	24.91	24. 54. 36.0	-105.44	-105. 26. 24.0	575789.5	94.76	17081398.	-9432113.	9002526.
7. 40. 39.910	27640.	31.61	31. 36. 24.6	-166.30	-166. 17. 56.5	879497.3	143.92	7007033.	-17211149.	11361830.
BET VECTOR PRIOR TO BRA V										
7. 40. 39.910	27640.	31.61	31. 36. 21.6	-166.84	-166. 50. 34.8	876239.3	144.21	6843942.	-17278473.	11362496.
7. 43. 55.000	27835.	30.41	30. 24. 47.2	-152.07	-152. 4. 20.5	713844.0	117.35	11290399.	-14877748.	10892359.
INITIATE PRA V SEQUENCE										
7. 43. 55.000	27835.	30.41	30. 24. 47.2	-152.07	-152. 4. 20.5	713044.0	117.35	11290399.	-14877748.	10892359.
7. 44. .300	27840.	30.35	30. 21. 15.7	-151.67	-151. 40. 29.6	709338.0	116.74	11403926.	-14800986.	10871418.
RCS +X ULLAGE ON										
7. 44. .300	27840.	30.35	30. 21. 15.7	-151.67	-151. 40. 29.6	709338.0	116.74	11403926.	-14800986.	10871418.
7. 44. 12.800	27853.	30.21	30. 12. 36.7	-150.74	-150. 44. 20.8	700699.5	115.32	11669847.	-14617675.	10820255.
APS TWO BURN TO FUEL DEPLETION										
7. 44. 12.800	27853.	30.21	30. 12. 36.7	-150.74	-150. 44. 20.8	700699.5	115.32	11669847.	-14617675.	10820255.

TABLE II
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
POSITION VECTOR - Concluded

TIME FROM LIFTOFF HR MIN SEC	SECONDS	GEODETIC LATITUDE DEG	DEG MIN SEC	LONGITUDE DEG	DEG MIN SEC	ALTITUDE FEET	N MI	EARTH CENTERED INERTIAL CARTESIAN X (FEET)	Y (FEET)	Z (FEET)
7. 44. 17.300	27857.	30.15	30. 9. 15.9	-150.41	-150. 24. 23.5	696000.3	114.55	11763348.	-14550870.	10799770.
				RCS +X ULLAGE OFF						
7. 44. 17.300	27857.	30.15	30. 9. 15.9	-150.41	-150. 24. 23.5	696000.3	114.55	11763348.	-14550870.	10799770.
7. 47. 29.900	28050.	27.16	27. 9. 46.3	-136.86	-136. 51. 18.2	587263.5	96.65	15358568.	-11444865.	9763828.
				GIMBAL LOCK						
7. 47. 29.900	28050.	27.16	27. 9. 46.3	-136.86	-136. 51. 18.2	587263.5	96.65	15358568.	-11444865.	9763828.
7. 50. 13.776	28214.	23.76	23. 45. 39.4	-126.10	-126. 5. 44.5	432373.5	71.16	17689985.	-8341852.	8553760.
				APS TWO BURNOUT -COAST TO REENTRY						
7. 50. 13.776	28214.	23.76	23. 45. 39.4	-126.10	-126. 5. 44.5	432373.5	71.16	17689985.	-8341852.	8553760.
7. 50. 42.984	28243.	23.05	23. 3. 12.0	-124.23	-124. 13. 51.6	400000.3	65.83	18036887.	-7752972.	8300232.
				COAST TO IMPACT						
7. 50. 42.984	28243.	23.05	23. 3. 12.0	-124.23	-124. 13. 51.6	400000.3	65.83	18036887.	-7752972.	8300232.
8. 2. 11.091	28931.	18.06	18. 3. 36.3	-112.92	-112. 55. 10.0	2500.0	.41	19654495.	-3138797.	6446705.

TABLE III
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
-VELOCITY VECTOR-

TIME FROM LIFTOFF HR MIN SEC	SECONDS	INERTIAL VELOCITY FT/SEC	INERTIAL PATH ANGLE DEGREES	INERTIAL AZIMUTH DEGREES	EARTH FIXED VELOCITY FT/SEC	EARTH FIXED PATH ANGLE DEGREES	EARTH FIXED AZIMUTH DEGREES	EARTH CENTERED INERTIAL CARTESIAN DX FT/SEC	DY FT/SEC	DZ FT/SEC
6. 9. 51.900	22192.	25651.278	.0823	103.59	24319.884	.087	108.35	19396.	15999.	-5254.
6. 10. .000	22200.	25650.834	.0836	103.89	24319.514	.088	109.66	19238.	16093.	-5373.
INITIATE PRA III SEQUENCE										
6. 10. .000	22200.	25650.834	.0836	103.89	24319.514	.088	108.66	19238.	16093.	-5373.
6. 10. 7.400	22207.	25650.419	.0847	104.16	24319.169	.089	109.95	19093.	16228.	-5482.
RCS +X ULLAGE ON										
6. 10. 7.400	22207.	25650.419	.0847	104.16	24319.169	.089	109.95	19093.	16228.	-5482.
6. 10. 17.500	22217.	25653.651	.0863	104.52	24322.496	.091	105.33	18896.	16412.	-5630.
RCS +X ULLAGE OFF										
6. 10. 17.500	22217.	25653.651	.0863	104.52	24322.496	.091	105.33	18896.	16412.	-5630.
6. 10. 22.400	22222.	25653.370	.0871	104.70	24322.262	.092	105.52	18797.	16500.	-5701.
RCS +X ULLAGE ON										
6. 10. 22.400	22222.	25653.370	.0871	104.70	24322.262	.092	105.52	18797.	16500.	-5701.
6. 10. 27.199	22227.	25655.046	.0882	104.87	24323.983	.093	105.70	18702.	16586.	-5771.
RCS +X ULLAGE OFF										
6. 10. 27.199	22227.	25655.046	.0882	104.87	24323.983	.093	105.70	18702.	16586.	-5771.

TABLE III
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
VELOCITY VECTOR - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	INERTIAL VELOCITY FT/SEC	INERTIAL PATH ANGLE DEGREES	INERTIAL AZIMUTH DEGREES	EARTH FIXED VELOCITY FT/SEC	EARTH FIXED PATH ANGLE DEGREES	EARTH FIXED AZIMUTH DEGREES	EARTH CENTERED INERTIAL CARTESIAN DX FT/SEC	DY FT/SEC	DZ FT/SEC
6. 10. 33.399	22233.	25654.681	.0894	105.09	24323.680	.094	105.93	18576.	16696.	-5861.
				RCS +X ULLAGE ON						
6. 10. 33.399	22233.	25654.681	.0894	105.09	24323.680	.094	105.93	18576.	16696.	-5861.
6. 10. 42.999	22243.	25657.983	.0921	105.42	24327.071	.097	106.29	18382.	16865.	-5999.
				DPS TWO IGNITION						
6. 10. 42.999	22243.	25657.983	.0921	105.42	24327.071	.097	106.29	18382.	16865.	-5999.
6. 10. 46.299	22246.	25662.121	.0942	105.54	24331.232	.099	106.41	18317.	16925.	-6046.
				RCS +X ULLAGE OFF						
6. 10. 46.299	22246.	25662.121	.0942	105.54	24331.232	.099	106.41	18317.	16925.	-6046.
6. 11. 7.799	22268.	25679.424	.1054	106.28	24348.713	.111	107.19	17880.	17302.	-6353.
				DPS FIXED THROTTLE POSITION						
6. 11. 7.799	22268.	25679.424	.1054	106.28	24348.713	.111	107.19	17880.	17302.	-6353.
6. 11. 15.599	22276.	25752.007	.1186	106.52	24421.220	.125	107.45	17765.	17484.	-6472.
				DPS ENGINE CUTOFF						
6. 11. 15.599	22276.	25752.007	.1186	106.52	24421.220	.125	107.45	17765.	17484.	-6472.
6. 11. 38.399	22298.	25750.180	.1349	107.29	24419.623	.142	108.27	17269.	17854.	-6790.
				RCS +X ULLAGE ON						
6. 11. 38.399	22298.	25750.180	.1349	107.29	24419.623	.142	108.27	17269.	17854.	-6790.

TABLE III
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
VELOCITY VECTOR - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	INERTIAL VELOCITY FT/SEC	INERTIAL PATH ANGLE DEGREES	INERTIAL AZIMUTH DEGREES	EARTH FIXED VELOCITY FT/SEC	EARTH FIXED PATH ANGLE DEGREES	EARTH FIXED AZIMUTH DEGREES	EARTH CENTERED INERTIAL CARTESIAN DX FT/SEC	DY FT/SEC	DZ FT/SEC
6. 11. 46.999	22307.	25749.436	.1411	107.58	24918.967	.149	108.57	17079.	17990.	-6909.
				DPS THREE IGNITION						
6. 11. 46.999	22307.	25749.436	.1411	107.58	24918.967	.149	108.57	17079.	17990.	-6909.
6. 11. 51.298	22311.	25751.945	.1446	107.72	24921.516	.153	108.72	16985.	18059.	-6968.
				RCS +X ULLAGE OFF						
6. 11. 51.298	22311.	25751.945	.1446	107.72	24921.516	.153	108.72	16985.	18059.	-6968.
6. 12. 12.798	22333.	25772.289	.1637	108.41	24942.036	.173	109.46	16514.	18405.	-7265.
				DPS FIXED THROTTLE POSITION						
6. 12. 12.798	22333.	25772.289	.1637	108.41	24942.036	.173	109.46	16514.	18405.	-7265.
6. 12. 14.398	22334.	25789.464	.1651	108.46	24959.194	.174	109.51	16488.	18442.	-7290.
				ABORT STAGE						
6. 12. 14.398	22334.	25789.464	.1651	108.46	24959.194	.174	109.51	16488.	18442.	-7290.
6. 12. 14.698	22335.	25793.718	.1655	108.47	24963.443	.174	109.51	16484.	18450.	-7295.
				DPS ENGINE CUTOFF						
6. 12. 14.698	22335.	25793.718	.1655	108.47	24963.443	.174	109.51	16484.	18450.	-7295.
6. 12. 14.998	22335.	25793.687	.1658	108.48	24963.415	.175	109.52	16477.	18454.	-7299.
				APS ONE IGNITION						
6. 12. 14.998	22335.	25793.687	.1658	108.48	24963.415	.175	109.52	16477.	18454.	-7299.

TABLE III
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
VELOCITY VECTOR - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	INERTIAL VELOCITY FT/SEC	INERTIAL PATH ANGLE DEGREES	INERTIAL AZIMUTH DEGREES	EARTH FIXED VELOCITY FT/SEC	EARTH FIXED PATH ANGLE DEGREES	EARTH FIXED AZIMUTH DEGREES	EARTH CENTERED INERTIAL CARTESIAN DX FT/SEC	DY FT/SEC	DZ FT/SEC
6. 13. 13.900	22394.	26294.222	-.4513	110.06	24962.571	-.475	111.18	15102.	19874.	-8268.
TERMINATE PRA III; COAST TO PRA V										
6. 13. 13.900	22394.	26307.068	-.4275	110.08	24975.491	-.450	111.20	15117.	19876.	-8274.
7. 40. 39.910	27640.	25967.211	-2.0810	91.31	24613.442	-2.195	91.38	23843.	10239.	-998.
BET VECTOR PRIOR TO PRA V										
7. 40. 39.910	27640.	25969.879	-2.1218	91.02	24615.881	-2.239	91.08	23912.	10091.	-899.
7. 43. 55.000	27835.	26156.287	-1.5404	99.07	24812.833	-1.624	99.57	21463.	14429.	-3911.
INITIATE PRA V SEQUENCE										
7. 43. 55.000	27835.	26156.287	-1.5404	99.07	24812.833	-1.624	99.57	21463.	14429.	-3911.
7. 44. .300	27840.	26160.517	-1.5233	99.28	24817.324	-1.606	99.79	21379.	14539.	-3992.
RCS +X ULLAGE ON										
7. 44. .300	27840.	26160.517	-1.5233	99.28	24817.324	-1.606	99.79	21379.	14539.	-3992.
7. 44. 12.800	27853.	26160.992	-1.5037	99.81	24818.530	-1.585	100.34	21167.	14790.	-4194.
APS TWO BURN TO FUEL DEPLETION										
7. 44. 12.800	27853.	26160.992	-1.5037	99.81	24818.530	-1.585	100.34	21167.	14790.	-4194.
7. 44. 17.300	27857.	26146.349	-1.5418	100.04	24804.446	-1.625	100.59	21071.	14874.	-4292.
RCS +X ULLAGE OFF										
7. 44. 17.300	27857.	26146.349	-1.5418	100.04	24804.446	-1.625	100.59	21071.	14874.	-4292.

TABLE III
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
VELOCITY VECTOR - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	INERTIAL VELOCITY FT/SEC	INERTIAL PATH ANGLE DEGREES	INERTIAL AZIMUTH DEGREES	EARTH FIXED VELOCITY FT/SEC	EARTH FIXED PATH ANGLE DEGREES	EARTH FIXED AZIMUTH DEGREES	EARTH CENTERED INERTIAL CARTESIAN DX FT/SEC	DY FT/SEC	DZ FT/SEC
7. 45. 3.300	27903.	25693.524	-1.5190	102.40	24357.019	-1.602	103.10	19924.	15388.	-5136.
7. 45. 5.300	27905.	25670.438	-1.4992	102.49	24334.069	-1.582	103.19	19875.	15405.	-5160.
7. 45. 7.300	27907.	25647.378	-1.4781	102.57	24311.132	-1.559	103.27	19826.	15422.	-5182.
7. 45. 9.300	27909.	25624.377	-1.4559	102.65	24288.239	-1.536	103.35	19778.	15439.	-5204.
7. 45. 11.300	27911.	25601.483	-1.4324	102.72	24264.442	-1.511	103.44	19729.	15457.	-5224.
7. 45. 13.300	27913.	25578.715	-1.4080	102.80	24242.757	-1.486	103.51	19681.	15474.	-5243.
7. 45. 15.300	27915.	25556.089	-1.3827	102.87	24220.204	-1.459	103.59	19633.	15491.	-5262.
7. 45. 17.300	27917.	25533.642	-1.3565	102.94	24197.819	-1.431	103.67	19585.	15508.	-5279.
7. 45. 19.300	27919.	25511.412	-1.3292	103.01	24175.640	-1.403	103.74	19538.	15526.	-5296.
7. 45. 21.300	27921.	25489.394	-1.3012	103.07	24153.663	-1.373	103.81	19491.	15543.	-5311.
7. 45. 23.300	27923.	25467.519	-1.2727	103.14	24131.819	-1.343	103.88	19444.	15561.	-5327.
7. 45. 25.300	27925.	25445.801	-1.2438	103.20	24110.121	-1.313	103.95	19397.	15579.	-5341.
7. 45. 27.300	27927.	25424.209	-1.2149	103.26	24088.538	-1.282	104.01	19350.	15597.	-5355.
7. 45. 29.300	27929.	25402.710	-1.1864	103.32	24067.030	-1.252	104.08	19303.	15616.	-5368.
7. 45. 31.300	27931.	25381.465	-1.1580	103.38	24045.760	-1.222	104.14	19256.	15636.	-5379.
7. 45. 33.300	27933.	25360.557	-1.1295	103.43	24024.812	-1.192	104.19	19209.	15656.	-5390.
7. 45. 35.300	27935.	25340.082	-1.1009	103.48	24004.281	-1.162	104.25	19163.	15676.	-5400.
7. 45. 37.300	27937.	25320.082	-1.0721	103.53	23984.207	-1.132	104.30	19116.	15698.	-5409.
7. 45. 39.300	27939.	25300.600	-1.0434	103.58	23964.635	-1.102	104.35	19070.	15720.	-5417.
7. 45. 41.300	27941.	25281.660	-1.0148	103.62	23945.587	-1.071	104.39	19024.	15743.	-5425.
7. 45. 43.300	27943.	25263.324	-.9865	103.66	23927.128	-1.042	104.44	18978.	15767.	-5431.
7. 45. 45.300	27945.	25245.622	-.9584	103.70	23909.286	-1.012	104.48	18932.	15791.	-5437.
7. 45. 47.300	27947.	25228.557	-.9307	103.73	23892.066	-.983	104.51	18886.	15817.	-5442.
7. 45. 49.300	27949.	25212.110	-.9035	103.76	23875.448	-.954	104.55	18841.	15843.	-5446.
7. 45. 51.300	27951.	25196.183	-.8768	103.79	23859.339	-.926	104.58	18796.	15870.	-5450.
7. 45. 53.300	27953.	25180.935	-.8508	103.82	23843.893	-.899	104.61	18751.	15898.	-5453.
7. 45. 55.300	27955.	25166.705	-.8259	103.85	23829.446	-.872	104.64	18706.	15928.	-5456.
7. 45. 57.300	27957.	25153.326	-.8022	103.87	23815.835	-.847	104.67	18661.	15958.	-5458.
7. 45. 59.300	27959.	25140.634	-.7798	103.89	23802.898	-.824	104.69	18616.	15990.	-5460.
7. 46. 1.300	27961.	25128.437	-.7593	103.91	23790.443	-.802	104.71	18571.	16023.	-5461.
7. 46. 3.300	27963.	25116.646	-.7409	103.93	23778.383	-.783	104.73	18525.	16057.	-5462.
7. 46. 5.300	27965.	25105.013	-.7253	103.94	23766.471	-.766	104.74	18479.	16092.	-5464.
7. 46. 7.300	27967.	25093.504	-.7127	103.95	23754.674	-.753	104.76	18431.	16128.	-5465.
7. 46. 9.300	27969.	25082.099	-.7030	103.97	23742.975	-.743	104.77	18383.	16165.	-5467.
7. 46. 11.300	27971.	25070.795	-.6964	103.98	23731.369	-.736	104.78	18333.	16203.	-5469.
7. 46. 13.300	27973.	25059.604	-.6929	103.99	23719.870	-.732	104.80	18283.	16241.	-5471.
7. 46. 15.300	27975.	25048.497	-.6927	104.00	23708.452	-.732	104.81	18232.	16281.	-5473.
7. 46. 17.300	27977.	25037.513	-.6956	104.01	23697.154	-.735	104.82	18180.	16321.	-5476.
7. 46. 19.300	27979.	25026.635	-.7019	104.01	23685.960	-.742	104.83	18126.	16363.	-5479.
7. 46. 21.300	27981.	25015.851	-.7115	104.02	23674.860	-.752	104.83	18072.	16405.	-5483.
7. 46. 23.300	27983.	25005.139	-.7245	104.03	23663.833	-.766	104.84	18017.	16448.	-5488.
7. 46. 25.300	27985.	24994.556	-.7409	104.04	23652.936	-.783	104.85	17961.	16491.	-5493.

TABLE III
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
VELOCITY VECTOR - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	INERTIAL VELOCITY FT/SEC	INERTIAL PATH ANGLE DEGREES	INERTIAL AZIMUTH DEGREES	EARTH FIXED VELOCITY FT/SEC	EARTH FIXED PATH ANGLE DEGREES	EARTH FIXED AZIMUTH DEGREES	EARTH CENTERED INERTIAL CARTESIAN DX FT/SEC	DY FT/SEC	DZ FT/SEC
7. 46. 27.300	27987.	24978.948	-.7717	104.05	23637.099	-.816	104.87	17898.	16532.	-5504.
7. 46. 29.300	27989.	24968.567	-.7950	104.06	23626.414	-.840	104.88	17840.	16577.	-5510.
7. 46. 31.300	27991.	24958.269	-.8215	104.07	23615.818	-.868	104.89	17781.	16623.	-5518.
7. 46. 33.300	27993.	24948.128	-.8514	104.08	23606.385	-.900	104.90	17721.	16669.	-5527.
7. 46. 35.300	27995.	24938.096	-.8847	104.09	23595.072	-.935	104.91	17660.	16715.	-5536.
7. 46. 37.300	27997.	24928.154	-.9212	104.10	23584.859	-.974	104.92	17598.	16762.	-5547.
7. 46. 39.300	27999.	24918.306	-.9609	104.11	23574.752	-1.016	104.93	17535.	16809.	-5559.
7. 46. 41.300	28001.	24908.541	-1.0038	104.12	23564.742	-1.061	104.95	17471.	16857.	-5572.
7. 46. 43.300	28003.	24898.813	-1.0500	104.14	23554.783	-1.110	104.96	17407.	16904.	-5586.
7. 46. 45.300	28005.	24889.225	-1.0993	104.16	23544.981	-1.162	104.98	17341.	16952.	-5601.
7. 46. 47.300	28007.	24879.677	-1.1522	104.18	23535.243	-1.218	105.00	17275.	17000.	-5618.
7. 46. 49.300	28009.	24870.053	-1.2114	104.20	23525.477	-1.281	105.03	17207.	17048.	-5639.
7. 46. 51.300	28011.	24861.059	-1.2754	104.23	23516.378	-1.348	105.07	17139.	17096.	-5663.
7. 46. 53.300	28013.	24851.951	-1.3386	104.26	23507.161	-1.415	105.10	17070.	17144.	-5686.
7. 46. 55.300	28015.	24842.934	-1.4046	104.29	23498.064	-1.485	105.13	17000.	17192.	-5710.
7. 46. 57.300	28017.	24833.987	-1.4738	104.33	23489.077	-1.558	105.17	16930.	17239.	-5737.
7. 46. 59.300	28019.	24825.675	-1.5473	104.38	23480.793	-1.636	105.22	16860.	17285.	-5769.
7. 47. 1.300	28021.	24819.678	-1.6254	104.44	23474.943	-1.719	105.29	16791.	17330.	-5808.
7. 47. 3.300	28023.	24818.707	-1.7002	104.54	23474.311	-1.798	105.39	16729.	17372.	-5859.
7. 47. 5.300	28025.	24825.674	-1.7550	104.66	23481.782	-1.855	105.52	16681.	17409.	-5917.
7. 47. 7.300	28027.	24840.485	-1.7643	104.79	23497.136	-1.865	105.66	16652.	17438.	-5972.
7. 47. 9.300	28029.	24856.947	-1.7173	104.88	23513.861	-1.815	105.75	16639.	17464.	-6003.
7. 47. 11.300	28031.	24855.875	-1.6671	104.91	23512.647	-1.762	105.79	16610.	17489.	-6007.
7. 47. 13.300	28033.	24838.952	-1.6997	104.93	23495.555	-1.797	105.81	16543.	17524.	-6018.
7. 47. 15.300	28035.	24837.362	-1.7643	105.03	23494.329	-1.865	105.91	16483.	17561.	-6067.
7. 47. 17.300	28037.	24852.081	-1.7316	105.13	23509.352	-1.831	106.01	16464.	17588.	-6102.
7. 47. 19.300	28039.	24831.823	-1.7428	105.15	23488.960	-1.842	106.04	16402.	17614.	-6110.
7. 47. 21.300	28041.	24828.076	-1.7848	105.26	23485.655	-1.887	106.16	16349.	17641.	-6159.
7. 47. 23.300	28043.	24848.005	-1.7566	105.31	23505.580	-1.857	106.21	16328.	17682.	-6179.
7. 47. 25.300	28045.	24828.376	-1.7978	105.39	23486.155	-1.901	106.29	16261.	17705.	-6211.
7. 47. 27.300	28047.	24803.632	-1.8405	105.47	23461.728	-1.946	106.38	16191.	17721.	-6247.
7. 47. 29.300	28049.	24777.535	-1.8280	105.55	23435.842	-1.933	106.47	16137.	17726.	-6268.
7. 47. 29.900	28050.	24774.016	-1.8163	105.59	23432.457	-1.920	106.51	16127.	17727.	-6279.

GIMBAL LOCK

7. 47. 29.900	28050.	24774.016	-1.8163	105.59	23432.457	-1.920	106.51	16127.	17727.	-6279.

TABLE III
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
VELOCITY VECTOR - Concluded

TIME FROM LIFTOFF HR MIN SEC	SECONDS	INERTIAL VELOCITY FT/SEC	INERTIAL PATH ANGLE DEGREES	INERTIAL AZIMUTH DEGREES	EARTH FIXED VELOCITY FT/SEC	EARTH FIXED PATH ANGLE DEGREES	EARTH FIXED AZIMUTH DEGREES	EARTH CENTERED INERTIAL CARTESIAN DX FT/SEC	DY FT/SEC	DZ FT/SEC
7. 50. 13.776	28214.	24937.335	-2.5045	110.72	23610.178	-2.645	111.94	12250.	19987.	-8505.
				ABS TWO BURNOUT -COAST TO REENTRY						
7. 50. 13.776	28214.	24937.335	-2.5045	110.72	23610.178	-2.645	111.94	12250.	19987.	-8505.
7. 50. 40.994	28241.	24974.109	-2.6154	111.45	23649.350	-2.762	112.72	11545.	20305.	-8839.
				COAST TO IMPACT						
7. 50. 40.994	28241.	24974.109	-2.6154	111.45	23649.350	-2.762	112.72	11545.	20305.	-8839.
7. 51. 5.994	28266.	25008.452	-2.7149	112.10	23685.969	-2.867	113.41	10883.	20579.	-9138.
7. 51. 30.994	28291.	25040.296	-2.8121	112.73	23720.158	-2.969	114.08	10207.	20831.	-9429.
7. 51. 55.994	28316.	25052.965	-2.9082	113.34	23736.233	-3.070	114.72	9510.	21049.	-9703.
7. 52. 20.994	28341.	24935.361	-3.0108	113.92	23620.067	-3.179	115.38	8755.	21138.	-9915.
7. 52. 45.994	28366.	24121.729	-3.1650	114.42	22808.759	-3.347	115.93	7759.	20621.	-9820.
7. 53. 10.994	28391.	21003.878	-3.5659	114.69	19692.603	-3.804	116.46	6074.	18127.	-8699.
7. 53. 35.994	28416.	14527.941	-4.7634	114.26	13216.627	-5.237	116.86	3584.	12726.	-6021.
7. 54. .994	28441.	7999.445	-7.6611	112.30	6686.773	-9.177	117.12	1426.	7195.	-3192.
7. 54. 25.994	28466.	4135.202	-12.9127	107.71	2832.996	-19.037	117.25	269.	3862.	-1454.
7. 54. 50.994	28491.	2468.049	-19.0143	100.65	1237.170	-40.538	119.30	-176.	2372.	-660.
7. 55. 15.994	28516.	1806.116	-20.9206	93.96	693.300	-68.449	117.24	-245.	1762.	-312.
7. 55. 40.994	28541.	1565.500	-17.2941	90.75	467.429	-84.641	116.82	-146.	1550.	-164.
7. 56. 5.994	28566.	1499.954	-13.3610	90.08	346.653	-89.201	114.26	-50.	1495.	-110.
7. 56. 30.994	28591.	1480.926	-10.7367	90.00	276.892	-89.876	101.58	11.	1478.	-86.
7. 56. 55.994	28616.	1472.887	-9.1289	90.00	233.683	-89.937	91.32	48.	1470.	-73.
7. 57. 20.994	28641.	1468.315	-8.0670	90.00	206.050	-89.947	90.40	71.	1465.	-64.
7. 57. 45.994	28666.	1465.321	-7.3102	90.00	186.449	-89.953	90.36	87.	1462.	-58.
7. 58. 10.994	28691.	1463.179	-6.7369	90.00	171.647	-89.957	90.34	98.	1459.	-53.
7. 58. 35.994	28716.	1461.525	-6.2740	90.00	159.720	-89.960	90.34	106.	1457.	-50.
7. 59. .994	28741.	1460.188	-5.8860	90.00	149.741	-89.962	90.27	113.	1455.	-47.
7. 59. 25.994	28766.	1459.072	-5.5520	90.00	141.164	-89.965	90.26	118.	1454.	-44.
7. 59. 50.994	28791.	1458.115	-5.2578	90.00	133.618	-89.967	90.26	123.	1452.	-42.
8. 0. 15.994	28816.	1457.282	-4.9956	90.00	124.899	-89.968	90.22	126.	1451.	-39.
8. 0. 40.994	28841.	1456.548	-4.7594	90.00	120.856	-89.970	90.12	129.	1450.	-38.
8. 1. 5.994	28866.	1455.898	-4.5471	90.00	115.422	-89.971	90.16	132.	1449.	-36.
8. 1. 30.994	28891.	1455.321	-4.3570	90.00	110.561	-89.972	98.10	133.	1449.	-34.
8. 1. 55.994	28916.	1454.820	-4.1947	90.00	106.413	-89.974	89.99	135.	1448.	-33.
8. 2. 8.449	28928.	1454.937	-4.3050	90.00	109.217	-89.975	89.83	131.	1449.	-34.

TABLE IV
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
-BODY ATTITUDES-

TIME FROM LIFTOFF HR MIN SECONDS	SPACE FIXED PITCH DEG	SPACE FIXED YAW DEG	SPACE FIXED ROLL DEG	EARTH RELATIVE PITCH DEG	EARTH RELATIVE YAW DEG	EARTH RELATIVE ROLL DEG	IMU GIMBAL ANGLES INNER DEG	IMU GIMBAL ANGLES MIDDLE DEG	IMU GIMBAL ANGLES OUTER DEG	IMU GIMBAL RATES INNER DEG/SEC	IMU GIMBAL RATES MIDDLE DEG/SEC	IMU GIMBAL RATES OUTER DEG/SEC
6. 9. 51.900	48.05	-1.22	174.46	1.46	1.69	171.69	-150.11	.83	42.90	.0000	.0000	.0000
6. 10. .000	48.58	-1.09	174.18	1.44	1.81	171.39	-150.36	.34	42.62	-.0076	9.1243	-.0080
INITIATE PRA III SEQUENCE												
6. 10. .000	48.58	-1.09	174.18	1.44	1.81	171.39	-150.36	.34	42.62	-.0076	9.1243	-.0080
6. 10. 7.400	49.01	-.79	173.92	1.39	2.07	171.11	-150.43	-.18	42.36	.0155	.0064	-.0052
RCS +X ULLAGE ON												
6. 10. 7.400	49.01	-.79	173.92	1.39	2.07	171.11	-150.43	-.18	42.36	.0155	.0064	-.0052
6. 10. 17.500	265.29	-29.31	99.95	-33.03	216.48	-97.46	32.14	46.00	-139.13	-94.9329	24.0617	95.0046
RCS +X ULLAGE OFF												
6. 10. 17.500	265.29	-29.31	99.95	-33.03	216.48	-97.46	32.14	46.00	-139.13	-94.9329	24.0617	95.0046
6. 10. 22.400	46.16	1.45	171.21	-2.37	4.46	168.30	-146.86	.47	39.62	.0647	.0016	-.0606
RCS +X ULLAGE ON												
6. 10. 22.400	46.16	1.45	171.21	-2.37	4.46	168.30	-146.86	.47	39.62	.0647	.0016	-.0606
6. 10. 27.199	45.36	2.36	169.88	-3.45	5.41	166.86	-145.64	.46	38.25	-.2054	.0244	.2933
RCS +X ULLAGE OFF												
6. 10. 27.199	45.36	2.36	169.88	-3.45	5.41	166.86	-145.64	.46	38.25	-.2054	.0244	.2933

TABLE IV
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
BODY ATTITUDES - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SPACE FIXED PITCH DEG	SPACE FIXED YAW DEG	SPACE FIXED ROLL DEG	EARTH RELATIVE PITCH DEG	EARTH RELATIVE YAW DEG	EARTH RELATIVE ROLL DEG	IMU GIMBAL ANGLES INNER DEG	IMU GIMBAL ANGLES MIDDLE DEG	IMU GIMBAL ANGLES OUTER DEG	IMU GIMBAL RATES INNER DEG/SEC	IMU GIMBAL RATES MIDDLE DEG/SEC	IMU GIMBAL RATES OUTER DEG/SEC
6. 10. 33.399	44.63	3.44	168.14	-4.64	6.53	164.96	-144.35	.30	36.47	.0797	-.0057	0.0841
RCS +X ULLAGE ON												
6. 10. 33.399	44.63	3.44	168.14	-4.64	6.53	164.96	-144.35	.30	36.47	.0797	-.0057	0.0841
6. 10. 42.999	43.12	5.41	165.48	-6.58	8.61	161.89	-141.88	.10	33.68	-.2600	.0050	.2751
DPS TWO IGNITION												
6. 10. 42.999	43.12	5.41	165.48	-6.58	8.61	161.89	-141.88	.10	33.68	-.2600	.0050	.2751
6. 10. 46.299	42.62	6.00	164.60	-7.25	9.23	160.85	-141.11	.08	32.75	.0000	.0000	.0000
RCS +X ULLAGE OFF												
6. 10. 46.299	42.62	6.00	164.60	-7.25	9.23	160.85	-141.11	.08	32.75	.0000	.0000	.0000
6. 11. 7.799	47.62	5.71	160.19	-3.75	8.65	156.78	-144.63	-3.45	28.75	.5287	-.0399	.1075
DPS FIXED THROTTLE POSITION												
6. 11. 7.799	47.62	5.71	160.19	-3.75	8.65	156.78	-144.63	-3.45	28.75	.5287	-.0399	.1075
6. 11. 15.599	49.31	3.02	159.73	-2.73	5.84	156.54	-147.77	-2.92	28.24	.2502	-.0500	.0500
DPS ENGINE CUTOFF												
6. 11. 15.599	49.31	3.02	159.73	-2.73	5.84	156.54	-147.77	-2.92	28.24	.2502	-.0500	.0500
6. 11. 38.399	51.99	-1.34	159.38	-1.84	1.34	156.32	-152.81	-2.04	27.71	.0097	-.0014	0.0003
RCS +X ULLAGE ON												
6. 11. 38.399	51.99	-1.34	159.38	-1.84	1.34	156.32	-152.81	-2.04	27.71	.0097	-.0014	0.0003

TABLE IV
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
BODY ATTITUDES - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SPACE FIXED PITCH DEG	SPACE FIXED YAW DEG	SPACE FIXED ROLL DEG	EARTH RELATIVE PITCH DEG	EARTH RELATIVE YAW DEG	EARTH RELATIVE ROLL DEG	IMU GIMBAL ANGLES INNER DEG	IMU GIMBAL ANGLES MIDDLE DEG	IMU GIMBAL ANGLES OUTER DEG	IMU GIMBAL RATES INNER DEG/SEC	IMU GIMBAL RATES MIDDLE DEG/SEC	IMU GIMBAL RATES OUTER DEG/SEC
6. 11. 46.999	50.86	.61	158.52	-3.44	3.35	155.34	-150.61	-2.49	26.94	-.2650	.1150	.1700
DPS THREE IGNITION												
6. 11. 46.999	50.86	.61	158.52	-3.44	3.35	155.34	-150.61	-2.49	26.94	-.2650	.1150	.1700
6. 11. 51.298	50.42	1.74	157.55	-4.11	4.51	154.27	-149.47	-2.91	26.02	-.0466	.1594	.2304
RCS +X ULLAGE OFF												
6. 11. 51.298	50.42	1.74	157.55	-4.11	4.51	154.27	-149.47	-2.91	26.02	-.0466	.1594	.2304
6. 12. 12.798	56.04	3.06	153.30	.12	5.51	150.09	-152.21	-7.98	21.76	.4208	.0878	.1594
DPS FIXED THROTTLE POSITION												
6. 12. 12.798	56.04	3.06	153.30	.12	5.51	150.09	-152.21	-7.98	21.76	.4208	.0878	.1594
6. 12. 14.398	55.52	2.89	153.11	-.52	5.36	149.86	-152.00	-7.48	21.56	-1.2805	-.9705	.0400
ABORT STAGE												
6. 12. 14.398	55.52	2.89	153.11	-.52	5.36	149.86	-152.00	-7.48	21.56	-1.2805	-.9705	.0400
6. 12. 14.698	55.05	2.98	153.08	-1.00	5.47	149.79	-151.61	-7.19	21.55	-1.2769	-.9668	.0399
DPS ENGINE CUTOFF												
6. 12. 14.698	55.05	2.98	153.08	-1.00	5.47	149.79	-151.61	-7.19	21.55	-1.2769	-.9668	.0399
6. 12. 14.998	54.81	3.01	152.95	-1.26	5.52	149.65	-151.43	-7.03	21.43	-.0432	.0532	.2661
APS ONE IGNITION												
6. 12. 14.998	54.81	3.01	152.95	-1.26	5.52	149.65	-151.43	-7.03	21.43	-.0432	.0532	.2661

TABLE IV
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
BODY ATTITUDES - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SPACE FIXED PITCH DEG	SPACE FIXED YAW DEG	SPACE FIXED ROLL DEG	EARTH RELATIVE PITCH DEG	EARTH RELATIVE YAW DEG	EARTH RELATIVE ROLL DEG	IMU GIMBAL ANGLES INNER DEG	IMU GIMBAL ANGLES MIDDLE DEG	IMU GIMBAL ANGLES OUTER DEG	IMU GIMBAL RATES INNER DEG/SEC	IMU GIMBAL RATES MIDDLE DEG/SEC	IMU GIMBAL RATES OUTER DEG/SEC
6. 13. 13.900	130.71	2.98	87.10	69.79	1.34	85.41	132.48	-50.86	-84.16	1.4190	-.4775	1.9401
TERMINATE PRA III; COAST TO PRA V												
6. 13. 13.900	130.71	2.98	87.10	69.81	1.35	85.40	132.48	-50.86	-84.16	1.4190	-.4775	1.9401
7. 40. 39.910	179.33	-36.65	102.85	17.82	223.78	-59.26	88.79	-3.17	-106.77	-.0000	.0000	.0000
BET VECTOR PRIOR TO PRA V												
7. 40. 39.910	179.33	-36.65	102.85	17.44	223.86	-59.59	88.79	-3.17	-106.77	-.0000	.0000	.0000
7. 43. 55.000	180.72	-36.60	105.15	26.41	227.57	-47.85	87.80	-2.65	-105.35	-.0000	.0000	.0000
INITIATE PRA V SEQUENCE.												
7. 43. 55.000	180.72	-36.60	105.15	26.41	227.57	-47.85	87.80	-2.65	-105.35	-.0000	.0000	.0000
7. 44. .300	180.76	-36.60	105.21	26.65	227.69	-47.51	87.77	-2.64	-105.31	-.0007	.0003	.0010
RCS +X ULLAGE ON												
7. 44. .300	173.30	-36.40	94.71	31.92	231.02	-51.87	92.98	-5.64	-110.99	-.0007	.0003	.0010
7. 44. 12.800	180.61	-36.51	105.11	27.39	228.03	-46.82	87.83	-2.78	-105.32	.6722	-.6746	-.9594
APS TWO BURN TO FUEL DEPRETION												
7. 44. 12.800	180.61	-36.51	105.11	27.39	228.03	-46.82	87.83	-2.78	-105.32	.6722	-.6746	-.9594
7. 44. 17.300	186.00	-36.43	110.55	23.70	225.99	-45.33	84.12	-.54	-103.19	1.1619	-.4965	-.4999
RCS +X ULLAGE OFF												
7. 44. 17.300	186.00	-36.43	110.55	23.70	225.99	-45.33	84.12	-.54	-103.19	1.1619	-.4965	-.4999

TABLE IV
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
BODY ATTITUDES - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SPACE FIXED PITCH DEG	SPACE FIXED YAW DEG	SPACE FIXED ROLL DEG	EARTH RELATIVE PITCH DEG	EARTH RELATIVE YAW DEG	EARTH RELATIVE ROLL DEG	IMU GIMBAL ANGLES INNER DEG	IMU GIMBAL ANGLES MIDDLE DEG	IMU GIMBAL ANGLES OUTER DEG	IMU GIMBAL RATES INNER DEG/SEC	IMU GIMBAL RATES MIDDLE DEG/SEC	IMU GIMBAL RATES OUTER DEG/SEC
7. 44. 19.300	189.06	-35.92	113.36	21.71	224.50	-44.86	81.79	.45	-102.19	1.1621	179.5074	-.5000
7. 44. 21.300	192.06	-35.29	116.10	19.73	223.01	-44.36	79.46	1.39	-101.16	1.1666	-.4700	-.5155
7. 44. 23.300	195.04	-34.58	118.86	17.73	221.52	-43.74	77.09	2.33	-100.02	1.1840	-.4700	-.5660
7. 44. 25.300	197.97	-33.79	121.52	15.73	220.07	-43.11	74.72	3.27	-98.89	1.1840	-.4708	-.5659
7. 44. 27.300	200.94	-33.03	124.25	13.61	218.73	-42.32	72.35	4.33	-97.65	1.1840	-.5318	-.6219
7. 44. 29.300	203.89	-32.26	126.92	11.45	217.44	-41.48	69.99	5.44	-96.37	1.1840	-.5561	-.6400
7. 44. 31.300	206.79	-31.39	129.52	9.29	216.16	-40.61	67.60	6.53	-95.06	1.1939	-.5446	-.6566
7. 44. 33.300	209.62	-30.38	132.11	7.16	214.80	-39.62	65.15	7.54	-93.61	1.2238	-.5040	-.7220
7. 44. 35.300	212.40	-29.33	134.59	5.02	213.47	-38.63	62.70	8.55	-92.17	1.2240	-.5040	-.7220
7. 44. 37.300	215.06	-28.11	137.02	2.94	212.04	-37.55	60.19	9.43	-90.63	1.2564	-.4435	-.7670
7. 44. 39.300	217.65	-26.81	139.36	.87	210.58	-36.42	57.65	10.27	-89.05	1.2721	-.4200	-.7920
7. 44. 41.300	220.17	-25.44	141.58	-1.17	209.10	-35.28	55.08	11.07	-87.46	1.2814	-.3986	-.7940
7. 44. 43.300	222.55	-23.91	143.67	-3.14	207.50	-34.11	52.46	11.72	-85.85	1.3106	-.3226	-.8056
7. 44. 45.300	224.89	-22.37	145.65	-5.11	205.91	-32.91	49.84	12.36	-84.24	1.3106	-.3227	-.8056
7. 44. 47.300	227.10	-20.73	147.49	-7.00	204.24	-31.69	47.20	12.88	-82.63	1.3225	-.2568	-.8035
7. 44. 49.300	229.24	-19.04	149.22	-8.86	202.54	-30.44	44.54	13.34	-81.03	1.3279	-.2320	-.8020
7. 44. 51.300	231.32	-17.32	150.87	-10.70	200.81	-29.15	41.88	13.77	-79.41	1.3304	-.2134	-.8117
7. 44. 53.300	233.29	-15.51	152.47	-12.46	198.99	-27.74	39.20	14.06	-77.72	1.3393	-.1477	-.8404
7. 44. 55.300	235.25	-13.71	153.98	-14.21	197.16	-26.30	36.52	14.36	-76.04	1.3393	-.1477	-.8403
7. 44. 57.300	237.13	-11.81	155.46	-15.91	195.22	-24.75	33.80	14.54	-74.31	1.3609	-.0904	-.8682
7. 44. 59.300	238.98	-9.88	156.86	-17.59	193.23	-23.13	31.06	14.67	-72.56	1.3682	-.0680	-.8740
7. 45. 1.300	240.80	-7.94	158.20	-19.23	191.21	-21.46	28.34	14.77	-70.81	1.3627	-.0481	-.8755
7. 45. 3.300	242.50	-5.96	159.51	-20.74	189.10	-19.66	25.65	14.73	-69.02	1.3459	.0220	-.8920
7. 45. 5.300	244.20	-3.99	160.75	-22.24	186.97	-17.81	22.95	14.68	-67.24	1.3461	.0220	-.8920
7. 45. 7.300	245.83	-1.97	161.98	-23.65	184.75	-15.84	20.28	14.53	-65.42	1.3348	.0767	-.9081
7. 45. 9.300	247.44	.05	163.17	-25.01	182.48	-13.79	17.62	14.33	-63.60	1.3299	.0980	-.9100
7. 45. 11.300	249.01	1.94	164.30	-26.30	180.30	-11.73	15.09	14.17	-61.82	1.2664	.0839	-.8931
7. 45. 13.300	250.37	3.44	165.42	-27.38	178.53	-9.79	13.01	14.10	-60.13	1.0420	.0340	-.8460
7. 45. 15.300	251.75	4.92	166.50	-28.45	176.74	-7.81	10.92	14.03	-58.43	1.0420	.0340	-.8460
7. 45. 17.300	253.20	6.33	167.45	-29.57	174.99	-5.92	8.85	14.04	-56.85	1.0370	-.0063	-.7939
7. 45. 19.300	254.69	7.69	168.28	-30.71	173.24	-4.08	6.78	14.09	-55.33	1.0350	-.0225	-.7576
7. 45. 21.300	255.76	9.03	169.15	-31.41	171.53	-2.22	5.03	13.84	-53.88	.8740	.1242	-.7273
7. 45. 23.300	256.69	10.37	170.09	-31.93	169.84	-.29	3.41	13.48	-52.40	.8114	.1817	-.7384
7. 45. 25.300	257.63	11.70	171.02	-32.45	168.13	1.67	1.79	13.11	-50.92	.8113	.1817	-.7383
7. 45. 27.300	257.78	13.92	171.83	-32.00	165.57	3.81	.16	11.56	-49.72	.8114	.7763	-.5999
7. 45. 29.300	258.35	16.27	172.67	-31.85	162.76	6.19	-1.84	10.15	-48.37	.9997	.7045	-.6783
7. 45. 31.300	259.16	18.49	173.57	-31.90	160.05	8.68	-3.90	8.97	-46.88	1.0297	.5878	-.7457
7. 45. 33.300	260.29	20.82	174.27	-32.13	157.10	11.21	-6.24	7.88	-45.45	1.1716	.5466	-.7104

TABLE IV
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
BODY ATTITUDES - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SPACE FIXED PITCH DEG	SPACE FIXED YAW DEG	SPACE FIXED ROLL DEG	EARTH RELATIVE PITCH DEG	EARTH RELATIVE YAW DEG	EARTH RELATIVE ROLL DEG	INU GIMBAL ANGLES INNER DEG	INU GIMBAL ANGLES MIDDLE DEG	INU GIMBAL ANGLES OUTER DEG	INU GIMBAL RATES INNER DEG/SEC	INU GIMBAL RATES MIDDLE DEG/SEC	INU GIMBAL RATES OUTER DEG/SEC
7. 45. 35.300	261.44	23.09	174.97	-32.29	154.20	13.78	-8.52	6.79	-44.03	1.1423	.5439	-.7105
7. 45. 37.300	262.66	25.43	175.64	-32.40	151.20	16.45	-10.86	5.67	-42.61	1.1781	.5639	-.7126
7. 45. 39.300	263.78	27.77	176.28	-32.32	148.24	19.06	-13.10	4.44	-41.27	1.1200	.6133	-.6700
7. 45. 41.300	264.95	30.14	176.91	-32.15	145.23	21.74	-15.36	3.16	-39.93	1.1272	.6398	-.6712
7. 45. 43.300	246.15	32.56	177.51	-31.88	142.18	24.46	-17.63	1.83	-38.59	1.1337	.6667	-.6657
7. 45. 45.300	267.34	34.94	178.08	-31.51	139.22	27.11	-19.81	.48	-37.32	1.0939	.6730	-.6357
7. 45. 47.300	268.55	37.18	178.58	-31.11	136.42	29.64	-21.90	-.79	-36.12	1.0435	.6788	-.6034
7. 45. 49.300	269.50	39.14	178.94	-30.58	134.04	31.67	-23.63	-1.99	-35.21	.8658	.6997	-.4508
7. 45. 51.300	270.36	41.03	179.25	-29.97	131.84	33.52	-25.23	-3.19	-34.42	.8000	.6997	-.3975
7. 45. 53.300	271.79	43.94	179.75	-29.03	128.46	36.50	-27.71	-5.04	-33.13	1.2409	.9253	-.6448
7. 45. 55.300	273.22	47.09	-179.63	-27.77	124.97	39.64	-30.26	-7.16	-31.76	1.2749	1.0604	-.6847
7. 45. 57.300	274.31	49.52	-179.20	-26.66	122.38	41.92	-32.18	-8.84	-30.78	.9600	.8400	-.4900
7. 45. 59.300	274.43	51.91	-178.01	-25.04	120.35	43.93	-33.52	-10.84	-29.73	.6698	.9985	-.5242
7. 46. 1.300	274.08	54.34	-176.47	-23.17	118.54	45.79	-34.65	-13.01	-28.70	.5650	1.0850	-.5150
7. 46. 3.300	272.30	56.69	-173.68	-20.77	117.36	47.40	-35.11	-15.54	-27.50	.2273	1.2631	-.6033
7. 46. 5.300	269.63	58.96	-170.07	-18.15	116.48	48.90	-35.25	-18.20	-26.19	.0687	1.3332	-.6550
7. 46. 7.300	266.35	61.05	-165.84	-15.50	115.77	50.36	-35.22	-20.86	-24.79	-.0133	1.3294	-.7000
7. 46. 9.300	262.42	62.97	-160.96	-12.82	115.19	51.77	-35.05	-23.52	-23.32	-.0822	1.3294	-.7336
7. 46. 11.300	257.86	64.76	-155.47	-10.12	114.63	53.14	-34.85	-26.21	-21.84	-.1000	1.3425	-.7400
7. 46. 13.300	252.56	66.26	-149.18	-7.43	114.21	54.64	-34.48	-28.84	-20.20	-.1851	1.3175	-.8180
7. 46. 15.300	246.59	67.51	-142.23	-4.74	113.83	55.91	-34.04	-31.47	-18.52	-.2205	1.3145	-.8397
7. 46. 17.300	240.01	68.49	-134.69	-2.06	113.46	57.24	-33.55	-34.09	-16.82	-.2471	1.3086	-.8532
7. 46. 19.300	232.77	69.07	-126.43	.66	113.22	58.63	-32.85	-36.71	-14.90	-.3521	1.3089	-.9602
7. 46. 21.300	225.07	69.17	-117.74	3.45	113.12	59.99	-31.88	-39.35	-12.81	-.4823	1.3195	-1.0407
7. 46. 23.300	217.46	68.92	-109.18	6.22	113.02	61.32	-30.83	-41.96	-10.67	-.5260	1.3089	-1.0721
7. 46. 25.300	210.16	68.36	-100.84	8.97	112.89	62.73	-29.71	-44.55	-8.37	-.5890	1.2960	-1.1517
7. 46. 27.300	203.48	67.35	-92.86	11.71	112.91	64.41	-28.27	-47.07	-5.56	-.7200	1.2601	-1.4105
7. 46. 29.300	197.65	65.97	-86.01	14.41	113.08	65.85	-26.50	-49.48	-2.73	-.8862	1.2056	-1.4103
7. 46. 31.300	192.43	64.45	-79.89	17.10	113.19	67.16	-24.63	-51.87	.11	-.9375	1.1951	178.5840
7. 46. 33.300	187.65	62.70	-73.81	19.87	113.30	68.90	-22.46	-54.30	3.63	-1.0815	1.2139	-1.7636
7. 46. 35.300	183.86	60.65	-68.73	22.57	113.69	70.70	-19.67	-56.51	7.68	-1.3955	1.1066	-2.0224
7. 46. 37.300	180.48	58.52	-64.02	25.29	114.06	72.54	-16.57	-58.68	12.08	-1.5492	1.0851	-2.2002
7. 46. 39.300	177.69	56.27	-59.90	27.95	114.56	74.49	-12.93	-60.67	17.01	-1.8232	.9933	-2.4632
7. 46. 41.300	175.35	53.68	-56.69	30.77	115.38	76.12	-8.18	-62.52	22.48	-2.3735	.9266	-2.7352
7. 46. 43.300	173.27	51.10	-53.11	33.54	116.19	78.41	-2.98	-64.20	29.05	-2.5997	.8370	-3.2874
7. 46. 45.300	171.25	48.24	-49.89	36.55	117.14	80.59	3.41	-65.78	36.52	176.8062	.7904	-3.7344
7. 46. 47.300	169.42	43.75	-49.25	40.82	119.56	81.40	14.74	-66.98	46.23	-5.6660	.6004	-4.8561
7. 46. 49.300	165.51	35.24	-57.91	49.23	124.17	73.54	38.22	-67.70	56.80	-11.7422	.3600	-5.2832
7. 46. 51.300	165.57	35.75	-45.88	48.83	123.53	85.07	36.95	-67.86	67.68	.6383	.0811	-5.4427
7. 46. 53.300	165.31	34.16	-38.39	50.17	124.78	93.34	40.96	-67.37	78.74	-2.0088	-.2459	-5.5283
7. 46. 55.300	164.50	29.89	-36.67	53.78	128.63	97.68	51.01	-65.72	89.25	-5.0244	-.8245	-5.2549
7. 46. 57.300	163.39	24.12	-36.05	58.48	135.00	103.14	62.55	-62.68	99.75	-5.7474	-1.5171	-5.2620
7. 46. 59.300	160.15	13.66	-31.12	67.01	150.75	121.24	79.83	-56.15	118.67	-8.6416	-3.2674	-9.4872

TABLE IV
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
BODY ATTITUDES - Concluded

TIME FROM LIFTOFF HR MIN SECONDS	SPACE FIXED PITCH DEG	SPACE FIXED YAW DEG	SPACE FIXED ROLL DEG	EARTH RELATIVE PITCH DEG	EARTH RELATIVE YAW DEG	EARTH RELATIVE ROLL DEG	IMU GIMBAL ANGLES INNER DEG	IMU GIMBAL ANGLES MIDDLE DEG	IMU GIMBAL ANGLES OUTER DEG	IMU GIMBAL RATES INNER DEG/SEC	IMU GIMBAL RATES MIDDLE DEG/SEC	IMU GIMBAL RATES OUTER DEG/SEC
7. 47. 1.300	153.65	-4.62	-29.00	73.86	213.28	-177.06	99.79	-41.68	135.40	-9.9805	-7.2332	-8.4170
7. 47. 3.300	141.72	-32.08	-30.83	53.14	270.99	-121.32	117.57	-16.29	146.33	-8.8877	-12.6975	-5.4619
7. 47. 5.300	111.09	-58.88	-51.03	21.75	-72.15	-107.52	134.71	12.91	149.35	-8.5693	-15.4045	-1.5137
7. 47. 7.300	20.34	-50.03	-134.05	-23.78	-52.40	-110.99	177.37	47.06	122.42	-21.3340	-17.0783	13.4658
7. 47. 9.300	339.03	-5.34	-158.24	-74.37	-6.57	-151.62	-92.27	49.24	45.96	-45.1766	-1.0898	38.2305
7. 47. 11.300	269.99	49.72	-96.13	-22.46	124.31	116.55	-29.92	-10.54	49.37	-31.1774	25.6330	-1.7044
7. 47. 13.300	172.88	19.37	-35.05	54.19	150.54	120.46	57.05	-53.09	99.61	136.5152	21.2760	-25.1198
7. 47. 15.300	87.62	-63.62	-72.96	10.27	-67.01	-106.64	142.55	22.50	145.69	-42.7510	-42.2031	-93.0410
7. 47. 17.300	308.00	17.63	-36.43	-66.53	125.07	-162.87	-48.11	30.08	134.87	-84.6682	-3.7891	5.4082
7. 47. 19.300	191.65	26.76	-38.12	35.75	149.62	123.92	31.97	-44.06	84.97	139.9611	38.8220	24.9531
7. 47. 21.300	27.41	-52.34	-142.54	-19.41	-53.27	-123.99	172.62	43.36	111.80	-70.3281	-44.0900	-13.4141
7. 47. 23.300	274.34	78.59	-93.29	-6.12	99.78	128.20	-49.84	-32.91	48.67	-68.7682	38.5031	31.5625
7. 47. 25.300	217.46	-31.84	-17.66	9.59	214.61	173.34	61.63	13.47	113.20	124.2654	156.8084	-32.2656
7. 47. 27.300	212.12	.51	-23.79	19.12	181.92	159.41	41.14	-12.22	108.81	10.2450	-20.7754	2.1953
7. 47. 29.300	284.87	-37.24	98.69	-42.88	230.37	-116.12	32.21	64.14	-151.28	4.4648	141.8203	-49.9531
7. 47. 29.900	296.56	-45.71	115.06	-43.28	246.57	-118.22	53.01	73.94	-162.21	-23.7675	-11.2039	12.5031
GIMBAL LOCK												
7. 47. 29.900	311.71	-43.28	125.72	-50.38	258.62	-126.78	53.01	85.00	-162.21	-23.7675	-11.2039	12.5031
7. 50. 13.776	.89	-56.18	-150.86	-35.45	288.27	-93.33	167.94	121.06	-51.17	-23.7675	-11.2039	12.5031
APS TWO BURNOUT -COAST TO REENTRY												
7. 50. 13.776	.89	-56.18	-150.86	-35.45	288.27	-93.33	167.94	121.06	-51.17	.0000	.0000	.0000
7. 50. 42.984	317.27	-39.98	144.47	-52.23	248.32	-95.76	142.15	88.30	-56.37	.0005	.0002	-.0003
COAST TO IMPACT												
7. 50. 42.984	317.27	-39.98	144.47	-52.23	248.32	-95.76	142.15	88.30	-56.37	.0005	.0002	-.0003
8. 2. 11.091	130.42	73.57	170.93	10.92	52.67	-140.55	116.74	57.79	-19.84	-.0010	-.0005	.0005

TABLE V
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
-DIRECTION COSINES-

TIME FROM LIFTOFF HR MIN SEC	SECONDS	LM YAW AXIS (X-BODY) L 11	L 21	L 31	LM PITCH AXIS (Y-BODY) L 12	L 22	L 32	LM ROLL AXIS (Z-BODY) L 13	L 23	L 33
6. 9. 51.900	22192.	.7346539	.6508304	-.1915813	-.2911837	.5575296	.7774141	.6127770	-.5153450	.5991026
6. 10. .000	22200.	.7281928	.6572315	-.1943759	-.2966672	.5579210	.7750566	.6178380	-.5067257	.6012530
INITIATE PRA III SEQUENCE										
6. 10. .000	22200.	.7281928	.6572315	-.1943759	-.2966672	.5579210	.7750566	.6178380	-.5067257	.6012530
6. 10. 7.400	22207.	.7220961	.6640127	-.1940731	-.3037639	.5543826	.7734118	.6215342	-.4995252	.6034498
RCS +X ULLAGE ON										
6. 10. 7.400	22207.	.7220961	.6640127	-.1940731	-.3037639	.5543826	.7734118	.6215342	-.4995252	.6034498
6. 10. 17.500	22217.	-.0493061	-.9986947	-.0133318	.8815845	-.0497903	.4893928	-.4694439	.0113908	.8828888
RCS +X ULLAGE OFF										
6. 10. 17.500	22217.	-.0493061	-.9986947	-.0133318	.8815845	-.0497903	.4893928	-.4694439	.0113908	.8828888
6. 10. 22.400	22222.	.7437123	.6546688	-.1352802	-.3558285	.5589872	.7489455	.5659311	-.5088634	.6486755
RCS +X ULLAGE ON										
6. 10. 22.400	22222.	.7437123	.6546688	-.1352802	-.3558285	.5589872	.7489455	.5659311	-.5088634	.6486755
6. 10. 27.199	22227.	.7479600	.6537966	-.1144807	-.3790243	.5623064	.7349494	.5448806	-.5063216	.6683888
RCS +X ULLAGE OFF										
6. 10. 27.199	22227.	.7479600	.6537966	-.1144807	-.3790243	.5623064	.7349494	.5448806	-.5063216	.6683888

TABLE V
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
DIRECTION COSINES - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	LM YAW AXIS (X-BODY) L 11	L 21	L 31	LM PITCH AXIS (Y-BODY) L 12	L 22	L 32	LM ROLL AXIS (Z-BODY) L 13	L 23	L 33
6. 10. 33.399	22233.	.7502441	.6547319	-.0919771	-.4074466	.5674080	.7155664	.5206927	-.4993738	.6924629
RCS +X ULLAGE ON										
6. 10. 33.399	22233.	.7502441	.6547319	-.0919771	-.4074466	.5674080	.7155664	.5206927	-.4993738	.6924629
6. 10. 42.999	22243.	.7550513	.6538402	-.0488922	-.4523338	.5734300	.6830608	.4746489	-.4936304	.7287231
DPS TWO IGNITION										
6. 10. 42.999	22243.	.7550513	.6538402	-.0488922	-.4523338	.5734300	.6830608	.4746489	-.4936304	.7287231
6. 10. 46.299	22246.	.7565922	.6529153	-.0356352	-.4657944	.5764031	.6714127	.4589159	-.4913869	.7402264
RCS +X ULLAGE OFF										
6. 10. 46.299	22246.	.7565922	.6529153	-.0356352	-.4657944	.5764031	.6714127	.4589159	-.4913869	.7402264
6. 11. 7.799	22268.	.7062044	.7027886	-.0858102	-.5136739	.5919980	.6210293	.4872518	-.3944952	.7790758
DPS FIXED THROTTLE POSITION										
6. 11. 7.799	22268.	.7062044	.7027886	-.0858102	-.5136739	.5919980	.6210293	.4872518	-.3944952	.7790758
6. 11. 15.599	22276.	.7014257	.6986612	-.1409766	-.4925358	.6181078	.6126591	.5151799	-.3602989	.7776724
DPS ENGINE CUTOFF										
6. 11. 15.599	22276.	.7014257	.6986612	-.1409766	-.4925358	.6181078	.6126591	.5151799	-.3602989	.7776724
6. 11. 38.399	22298.	.6896387	.6871402	-.2285536	-.4572733	.6579508	.5983326	.5615154	-.3081219	.7679592
RCS +X ULLAGE ON										
6. 11. 38.399	22298.	.6896387	.6871402	-.2285536	-.4572733	.6579508	.5983326	.5615154	-.3081219	.7679592

TABLE V
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
DIRECTION COSINES - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	LM YAW AXIS (X-BODY) L 11	L 21	L 31	LM PITCH AXIS (Y-BODY) L 12	L 22	L 32	LM ROLL AXIS (Z-BODY) L 13	L 23	L 33
6. 11. 46.999	22307.	.6947823	.6936081	-.1902245	-.4825109	.6456518	.5918758	.5333486	-.3194395	.7832609
DPS THREE IGNITION										
6. 11. 46.999	22307.	.6947823	.6936081	-.1902245	-.4825109	.6456518	.5918758	.5333486	-.3194395	.7832609
6. 11. 51.298	22311.	.6947751	.6989159	-.1697178	-.5021590	.6403228	.5812254	.5149019	-.3185957	.7958473
RCS +X ULLAGE OFF										
6. 11. 51.298	22311.	.6947751	.6989159	-.1697178	-.5021590	.6403228	.5812254	.5149019	-.3185957	.7958473
6. 12. 12.798	22333.	.6198269	.7589497	-.1995240	-.5793185	.6140958	.5360390	.5293435	-.2166635	.8202758
DPS FIXED THROTTLE POSITION										
6. 12. 12.798	22333.	.6198269	.7589497	-.1995240	-.5793185	.6140958	.5360390	.5293435	-.2166635	.8202758
6. 12. 14.398	22334.	.6272636	.7533047	-.1976672	-.5770835	.6200102	.5315656	.5229866	-.2193613	.8236295
ABORT STAGE										
6. 12. 14.398	22334.	.6272636	.7533047	-.1976672	-.5770835	.6200102	.5315656	.5229866	-.2193613	.8236295
6. 12. 14.698	22335.	.6327618	.7501031	-.1922441	-.5762011	.6219601	.5302432	.5173052	-.2247464	.8257629
DPS ENGINE CUTOFF										
6. 12. 14.698	22335.	.6327618	.7501031	-.1922441	-.5762011	.6219601	.5302432	.5173052	-.2247464	.8257629
6. 12. 14.998	22335.	.6356230	.7483461	-.1896353	-.5766184	.6235422	.5279264	.5133173	-.2262150	.8278479
APS ONE IGNITION										
6. 12. 14.998	22335.	.6356230	.7483461	-.1896353	-.5766184	.6235422	.5279264	.5133173	-.2262150	.8278479

TABLE V
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
DIRECTION COSINES - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	LM YAW AXIS (X-BODY) L 11	L 21	L 31	LM PITCH AXIS (Y-BODY) L 12	L 22	L 32	LM ROLL AXIS (Z-BODY) L 13	L 23	L 33
6. 13. 13.900	22394.	-.5516990	.6712794	-.4949870	-.7930299	-.6060155	.0620383	-.2583247	.4267660	.8666828
TERMINATE PRA II; COAST TO PRA V										
6. 13. 13.900	22394.	-.5516990	.6712794	-.4949870	-.7930299	-.6060155	.0620383	-.2583247	.4267660	.8666828
7. 40. 39.910	27640.	-.6237933	-.3015621	-.7210701	-.2956252	-.7629970	.5748402	-.7235244	.5717480	.3868031
BET VECTOR PRIOR TO PRA V										
7. 40. 39.910	27640.	-.6237933	-.3015621	-.7210701	-.2956252	-.7629970	.5748402	-.7235244	.5717480	.3868031
7. 43. 55.000	27835.	-.6267253	-.3181586	-.7113300	-.3022252	-.7421516	.5982231	-.7182445	.5899035	.3689697
INITIATE PRA V SEQUENCE										
7. 43. 55.000	27835.	-.6267253	-.3181586	-.7113300	-.3022252	-.7421516	.5982231	-.7182445	.5899035	.3689697
7. 44. .300	27840.	-.6268019	-.3186078	-.7110615	-.3024010	-.7415761	.5988476	-.7181037	.5903845	.3684741
RCS +X ULLAGE ON										
7. 44. .300	27840.	-.6121230	-.2261480	-.7577350	-.2890345	-.8279427	.4805932	-.7360464	.5131938	.4414382
7. 44. 12.800	27853.	-.6278922	-.3162235	-.7111638	-.3031495	-.7422107	.5976818	-.7168345	.5908688	.3701654
APS TWO BURN TO FUEL DEPLETION										
7. 44. 12.800	27853.	-.6278922	-.3162235	-.7111638	-.3031495	-.7422107	.5976818	-.7168345	.5908688	.3701654

TABLE V
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
DIRECTION COSINES - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	LM YAW AXIS (X-BODY) L 11	L 21	L 31	LM PITCH AXIS (Y-BODY) L 12	L 22	L 32	LM ROLL AXIS (Z-BODY) L 13	L 23	L 33
7. 44. 17.300	27857.	-.6334122	-.3814201	-.6732812	-.2855603	-.6934822	.6614978	-.7191969	.6112632	.3383227
RCS +X ULLAGE OFF										
7. 44. 17.300	27857.	-.6334122	-.3814201	-.6732812	-.2855603	-.6934822	.6614978	-.7191969	.6112632	.3383227
7. 44. 19.300	27859.	-.6398188	-.4157228	-.6463874	-.2705338	-.6654050	.6957362	-.7193424	.6200064	.3138663
7. 44. 21.300	27861.	-.6455368	-.4487166	-.6180102	-.2562491	-.6389103	.7283310	-.7198133	.6279189	.2959686
7. 44. 23.300	27863.	-.6501985	-.4811533	-.5879909	-.2482511	-.6039924	.7599162	-.7207782	.6353619	.2771173
7. 44. 25.300	27865.	-.6535115	-.5126642	-.5568646	-.2247482	-.5710941	.7895187	-.7227800	.6411138	.2579962
7. 44. 27.300	27867.	-.6539614	-.5447340	-.5249880	-.2100668	-.5359026	.8177288	-.7267871	.6450374	.2360237
7. 44. 29.300	27869.	-.6523339	-.5763222	-.4922531	-.1955495	-.4995034	.8439530	-.7322710	.6467990	.2131435
7. 44. 31.300	27871.	-.6495829	-.6066322	-.4583005	-.1811216	-.4619689	.8682049	-.7384016	.6469792	.1902129
7. 44. 33.300	27873.	-.6465592	-.6351860	-.4224924	-.1676579	-.4219687	.8909732	-.7442123	.6469011	.1663338
7. 44. 35.300	27875.	-.6419614	-.6624913	-.3859933	-.1542300	-.3815590	.9113867	-.7510650	.6446068	.1427701
7. 44. 37.300	27877.	-.6375448	-.6875139	-.3476511	-.1462984	-.3392509	.9300234	-.7573450	.6420541	.1191430
7. 44. 39.300	27879.	-.6322047	-.7108577	-.3082182	-.1287910	-.2958535	.9465112	-.7640223	.6380846	.0954879
7. 44. 41.300	27881.	-.6258357	-.7324663	-.2679975	-.1163307	-.2521027	.9606827	-.7712307	.6324059	.0725666
7. 44. 43.300	27883.	-.6199544	-.7513269	-.2261953	-.1036244	-.2073554	.9727619	-.7777650	.6265074	.0504952
7. 44. 45.300	27885.	-.6124137	-.7687849	-.1841632	-.0912688	-.1626429	.9824547	-.7852512	.6184771	.0294384
7. 44. 47.300	27887.	-.6050469	-.7835511	-.1413005	-.0788084	-.1176613	.9899217	-.7922799	.6100847	.0094902
7. 44. 49.300	27889.	-.5947233	-.7964307	-.0980784	-.0665556	-.0726813	.9951320	-.7996822	.6003461	-.0096363
7. 44. 51.300	27891.	-.5872843	-.8075297	-.0547076	-.0549837	-.0276310	.9981048	-.8075109	.5891794	-.0281737
7. 44. 53.300	27893.	-.5780441	-.8159342	-.0107825	-.0443334	.0182081	.9988508	-.8148003	.5778579	-.0466982
7. 44. 55.300	27895.	-.5672002	-.8229199	.0329638	-.0343436	.0636237	.9973828	-.8228635	.5645837	-.0643494
7. 44. 57.300	27897.	-.5562432	-.8273956	.0775245	-.0250669	.1099514	.9936208	-.8306414	.5507515	-.0819000
7. 44. 59.300	27899.	-.5442486	-.8299852	.1221387	-.0164724	.1561342	.9875984	-.8387622	.5354872	-.0986477
7. 45. 1.300	27901.	-.5312624	-.8307264	.1662942	-.0088343	.2017065	.9794061	-.8471612	.5188526	-.1144980
7. 45. 3.300	27903.	-.5188421	-.8286877	.2099512	-.0026050	.2471257	.9689799	-.8548661	.5022007	-.1303780

TABLE V
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
DIRECTION COSINES - Continued.

TIME FROM LIFTOFF HR MIN SEC	SECONDS	LM YAW AXIS (X-BODY) L 11	L 21	L 31	LM PITCH AXIS (Y-BODY) L 12	L 22	L 32	LM ROLL AXIS (Z-BODY) L 13	L 23	L 33
7. 45. 5.300	27905.	-.5049091	-.8252389	.2530761	.0026362	.2917174	.9565009	-.8631085	.4836132	-.1451153
7. 45. 7.300	27907.	-.4911462	-.8193567	.2956856	.0064441	.3360213	.9418323	-.8710533	.4644828	-.1597656
7. 45. 9.300	27909.	-.4765896	-.8116945	.3376601	.0091265	.3794973	.9251478	-.8790785	.4439975	-.1734565
7. 45. 11.300	27911.	-.4611654	-.8033120	.3768504	.0096921	.4201233	.9074152	-.8872612	.4221210	-.1859606
7. 45. 13.300	27913.	-.4465988	-.7961946	.4081956	.0055544	.4537440	.8911147	-.8947170	.4002381	-.1982192
7. 45. 15.300	27915.	-.4312247	-.7882604	.4389655	.0005435	.4862991	.8737922	-.9022444	.3770394	-.2092757
7. 45. 17.300	27917.	-.4140721	-.7803731	.4685746	-.0041254	.5163826	.8563480	-.9102347	.3526567	-.2170390
7. 45. 19.300	27919.	-.3957805	-.7720466	.4972944	-.0086733	.5446298	.8386317	-.9183041	.3276009	-.2222501
7. 45. 21.300	27921.	-.3835543	-.7615065	.5224882	-.0148885	.5707835	.8209655	-.9233983	.3071058	-.2302642
7. 45. 23.300	27923.	-.3734556	-.7498394	.5461427	-.0227751	.5959730	.8026814	-.9273684	.2873274	-.2396472
7. 45. 25.300	27925.	-.3628791	-.7376573	.5693685	-.0312658	.6203122	.7837316	-.9313115	.2665981	-.2481618
7. 45. 27.300	27927.	-.3670497	-.7122568	.5983015	-.0310311	.6522135	.7573999	-.9296836	.2594374	-.2614969
7. 45. 29.300	27929.	-.3647282	-.6851269	.6305350	-.0315610	.6858911	.7270194	-.9305789	.2452642	-.2717871
7. 45. 31.300	27931.	-.3579328	-.6591019	.6614142	-.0357915	.7175078	.6956303	-.9330611	.2253159	-.2804098
7. 45. 33.300	27933.	-.3461705	-.6310602	.6942110	-.0384475	.7488826	.6615864	-.9373835	.2023311	-.2835037
7. 45. 35.300	27935.	-.3340132	-.6023059	.7250261	-.0429074	.7781212	.6266469	-.9415913	.1781994	-.2857461
7. 45. 37.300	27937.	-.3208003	-.5715407	.7552671	-.0483896	.8062615	.5895768	-.9459099	.1525894	-.2863056
7. 45. 39.300	27939.	-.3090511	-.5392225	.7834069	-.0540776	.8323632	.5515859	-.9495067	.1281035	-.2864027
7. 45. 41.300	27941.	-.2969589	-.5050761	.8103786	-.0610033	.8569625	.5117556	-.9529397	.1025346	-.2852940
7. 45. 43.300	27943.	-.2845893	-.4691119	.8360280	-.0690240	.8798530	.4702068	-.9561614	.0761098	-.2827767
7. 45. 45.300	27945.	-.2727017	-.4326847	.8593123	-.0778226	.9001581	.4285546	-.9589460	.0499937	-.2791473
7. 45. 47.300	27947.	-.2606921	-.3972942	.8798845	-.0875831	.9173732	.3882724	-.9614410	.0241546	-.2739482
7. 45. 49.300	27949.	-.2519676	-.3654722	.8960705	-.0945565	.9308126	.3530536	-.9631050	.0042288	-.2690924
7. 45. 51.300	27951.	-.2446472	-.3344029	.9101222	-.1009241	.9423294	.3191075	-.9643454	-.0137845	-.2642875
7. 45. 53.300	27953.	-.2327629	-.2855572	.9296658	-.1135054	.9573653	.2656468	-.9658871	-.0436894	-.2552514
7. 45. 55.300	27955.	-.2225171	-.2315189	.9470402	-.1286545	.9698722	.2068718	-.9664027	-.0758085	-.2455991
7. 45. 57.300	27957.	-.2155026	-.1891972	.9579995	-.1404314	.9768578	.1613314	-.9663527	-.0997659	-.2370847
7. 45. 59.300	27959.	-.2193643	-.1480884	.9643387	-.1528766	.9814212	.1159359	-.9635912	-.1219926	-.2379281
7. 46. 1.300	27961.	-.2276880	-.1065616	.9678857	-.1645901	.9839029	.0696065	-.9597230	-.1434558	-.2415619
7. 46. 3.300	27963.	-.2483132	-.0668748	.9663686	-.1764763	.9840419	.0227514	-.9524687	-.1648916	-.2561525
7. 46. 5.300	27965.	-.2740427	-.0283675	.9612990	-.1876914	.9819217	-.0245301	-.9432245	-.1871499	-.2744128
7. 46. 7.300	27967.	-.3012111	.0084597	.9535199	-.1984641	.9775064	-.0713661	-.9326756	-.2107357	-.2927568
7. 46. 9.300	27969.	-.3293914	.0439409	.9431704	-.2081696	.9709565	-.1179362	-.9209596	-.2351865	-.3106776
7. 46. 11.300	27971.	-.3574529	.0794232	.9305478	-.2160107	.9623291	-.1651123	-.9086070	-.2600281	-.3268311
7. 46. 13.300	27973.	-.3861484	.1125718	.9155419	-.2238662	.9514161	-.2114029	-.8948594	-.2865918	-.3421868
7. 46. 15.300	27975.	-.4145565	.1449557	.8984045	-.2299998	.9384914	-.2575539	-.8804788	-.3134035	-.3557179
7. 46. 17.300	27977.	-.4422940	.1766474	.8793018	-.2342181	.9236395	-.3033677	-.8657470	-.3401261	-.3671462
7. 46. 19.300	27979.	-.4710056	.2065279	.8576129	-.2380294	.9063886	-.3490009	-.8494090	-.3685184	-.3777544
7. 46. 21.300	27981.	-.5010307	.2346407	.8330138	-.2396477	.8872874	-.3940686	-.8315871	-.3970703	-.3883271
7. 46. 23.300	27983.	-.5298926	.2618742	.8066199	-.2390434	.8664434	-.4383310	-.8136781	-.4250855	-.3965226
7. 46. 25.300	27985.	-.5572714	.2885585	.7785772	-.2376515	.8430157	-.4825414	-.7955943	-.4539366	-.4012122
7. 46. 27.300	27987.	-.5850095	.3123341	.7484726	-.2384345	.8158534	-.5268132	-.7751857	-.4866524	-.4028108
7. 46. 29.300	27989.	-.6126000	.3330454	.7167998	-.2341992	.7896786	-.5670611	-.7548986	-.5152556	-.4057582

TABLE V
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
DIRECTION COSINES - Continued

TIME FROM LIFTOFF HR MIN SEC	SECONDS	LM YAW AXIS (X-BODY) L 11	L 21	L 31	LM PITCH AXIS (Y-BODY) L 12	L 22	L 32	LM ROLL AXIS (Z-BODY) L 13	L 23	L 33
7. 46. 31.300	27991.	-.6382644	.3535936	.6838056	-.2263775	.7627841	-.6057340	-.7357797	-.5419167	-.4068123
7. 46. 33.300	27993.	-.6633480	.3738948	.6482068	-.2210860	.7296337	-.6471133	-.7149059	-.5725707	-.4013381
7. 46. 35.300	27995.	-.6890087	.3892918	.6113255	-.2146999	.6959981	-.6851938	-.6922217	-.6033560	-.3959678
7. 46. 37.300	27997.	-.7129357	.4043246	.5729260	-.2062673	.6599665	-.7224250	-.6702062	-.6332186	-.3871147
7. 46. 39.300	27999.	-.7360849	.4165095	.5335717	-.1985595	.6227774	-.7573062	-.6477216	-.6623203	-.3768481
7. 46. 41.300	28001.	-.7609257	.4253527	.4899665	-.1781767	.5891292	-.7881496	-.6238951	-.6870239	-.3724956
7. 46. 43.300	28003.	-.7831252	.4335200	.4458423	-.1647916	.5466419	-.8209911	-.5996321	-.7164098	-.3564486
7. 46. 45.300	28005.	-.8051414	.4410838	.3964749	-.1433311	.5039714	-.8517447	-.5755028	-.7426021	-.3425472
7. 46. 47.300	28007.	-.8381982	.4404303	.3216284	-.0808734	.4828461	-.8719428	-.5393359	-.7568888	-.3691017
7. 46. 49.300	28009.	-.8792387	.4450743	.1698470	.1293909	.5662501	-.8140140	-.4584726	-.6937360	-.5554676
7. 46. 51.300	28011.	-.8766791	.4468643	.1781690	.0247305	.4117284	-.9109710	-.4804395	-.7942230	-.3720049
7. 46. 53.300	28013.	-.8841337	.4419614	.1515841	-.0186841	.2961725	-.9560057	-.4669707	-.8467301	-.2849243
7. 46. 55.300	28015.	-.8997395	.4292349	.0789059	.0334004	.2479929	-.9681859	-.4351473	-.8684796	-.2374686
7. 46. 57.300	28017.	-.9118802	.4099375	-.0206346	.1184651	.2079535	-.9712997	-.3938811	-.8880915	-.2369622
7. 46. 59.300	28019.	-.8992674	.3845294	-.2084590	.2552105	.0742238	-.9640323	-.3552262	-.9201239	-.1648830
7. 47. 1.300	28021.	-.7881904	.3273174	-.5211710	.5293372	-.0714267	-.8453995	-.3139395	-.9422110	-.1169634
7. 47. 3.300	28023.	-.4482931	.1825790	-.8750418	.8430506	-.2390603	-.4817840	-.2971514	-.9536850	-.0967593
7. 47. 5.300	28025.	.0878756	-.0043927	-.9961217	.9386171	-.3345073	.0842778	-.3335802	-.9423829	-.0252720
7. 47. 7.300	28027.	.7942542	-.1694959	-.5834649	.5543996	-.1907401	.8100982	-.2485985	-.9668967	-.0578277
7. 47. 9.300	28029.	.8761622	-.3368222	.3448050	-.3214684	.1246977	.9386738	-.3591626	-.9332745	.0009777
7. 47. 11.300	28031.	-.2630327	-.1883086	.9462313	-.9642323	.0845601	-.2512083	-.0327087	-.9784628	-.2038153
7. 47. 13.300	28033.	-.9688644	.2453961	-.0329012	.0495541	.1422280	-.9873871	-.2376215	-.9589327	-.1548679
7. 47. 15.300	28035.	.2899425	-.0530417	-.9555731	.9056644	-.3075446	.2918702	-.3093626	-.9500541	-.0911323
7. 47. 17.300	28037.	.4028268	-.4931164	.7710816	-.1817620	-.8687777	-.4606385	.8970469	.0454042	-.4395967
7. 47. 19.300	28039.	-.9732860	.0461438	.2249110	-.2188662	.1094942	-.9695919	-.0493670	-.9929158	-.0964699
7. 47. 21.300	28041.	.7495539	-.1326999	-.6485057	.6575949	.0371663	.7524543	-.0757480	-.9904592	.1151209
7. 47. 23.300	28043.	-.2499130	.3099949	.9173040	-.9670278	-.0319494	-.2526561	-.0489964	-.9502004	.3077632
7. 47. 25.300	28045.	-.5789092	-.7229413	-.3771206	.4692356	.0828706	-.8791760	.6668449	-.6859215	.2912552
7. 47. 27.300	28047.	-.8788667	-.4760253	.0315133	.0514631	-.1602705	-.9857306	.4742834	-.8647041	.1653542
7. 47. 29.300	28049.	.2562234	-.9630846	-.0825682	.9314526	.2231693	.2873872	-.2583515	-.1505436	.9542490
7. 47. 29.900	28050.	.4042080	-.8890468	-.2149688	.8527819	.2813240	.4400225	-.3307248	-.3611821	.8718765
GIMBAL LOCK										
7. 47. 29.900	28050.	.5718372	-.7999905	-.1817070	.7627974	.4369907	.4766331	-.3018977	-.4111622	.8601182
7. 50. 13.776	28214.	.7410721	-.3890737	-.5472054	.5304605	-.1603491	.8324060	-.4116112	-.9071437	.0875580
APS TWO BURNOUT -COAST TO REENTRY										
7. 50. 13.776	28214.	.7410721	-.3890737	-.5472054	.5304605	-.1603491	.8324060	-.4116112	-.9071437	.0875580

TABLE V
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY

DIRECTION COSINES - Concluded

TIME FROM LIFTOFF HR MIN SEC	SECONDS	LM YAW AXIS (X-BODY) L 11	L 21	L 31	LM PITCH AXIS (Y-BODY) L 12	L 22	L 32	LM ROLL AXIS (Z-BODY) L 13	L 23	L 33
7. 50. 42.984	28243.	.6394500	-.7567782	-.1356117	.6037753	.3850953	.6979663	-.4759822	-.5281935	.7031731
COAST TO IMPACT										
7. 50. 42.984	28243.	.6394500	-.7567782	-.1356117	.6037753	.3850953	.6979663	-.4759822	-.5281935	.7031731
8. 2. 11.091	28931.	-.3876648	.6547888	.6488202	.3111527	-.5695991	.7607501	.8676980	.4967983	.0170742

TABLE VI
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
-PERFORMANCE AND WEIGHT-

TIME FROM LIFTOFF HR MIN SECONDS	SECONDS	TOTAL WEIGHT POUNDS	THRUST RCS POUNDS	THRUST DPS/APS POUNDS	PROP FLOW RATE RCS POUNDS/SEC	PROP FLOW RATE DPS/APS POUNDS/SEC	PROP REMAINING RCS POUNDS	PROP REMAINING DPS/APS POUNDS	DELTA V FT/SEC	INERTIAL VELOCITY FT/SEC
6. 9. 51.900	22192.	31447.00	.0	.00	.00	.00	585.00	17785.00	.00	25651.28
6. 10. .000	22200.	31447.00	.0	.00	.00	.00	585.00	17785.00	.00	25650.83
INITIATE PRA III SEQUENCE										
6. 10. .000	22200.	31447.00	.0	.00	.00	.00	585.00	17785.00	.00	25650.83
6. 10. 7.400	22207.	31447.00	.0	.00	.00	.00	585.00	17785.00	.00	25650.42
RCS +X ULLAGE ON										
6. 10. 7.400	22207.	31447.00	400.0	.00	4.47	.00	585.00	17785.00	.00	25650.42
6. 10. 17.500	22217.	31432.17	400.0	.00	4.47	.00	570.17	17785.00	4.13	25653.65
RCS +X ULLAGE OFF										
6. 10. 17.500	22217.	31432.17	.0	.00	.00	.00	570.17	17785.00	.00	25653.65
6. 10. 22.400	22222.	31432.17	.0	.00	.00	.00	570.17	17785.00	.00	25653.37
RCS +X ULLAGE ON										
6. 10. 22.400	22222.	31432.17	400.0	.00	4.47	.00	570.17	17785.00	.00	25653.37
6. 10. 27.199	22227.	31425.13	400.0	.00	4.47	.00	563.13	17785.00	1.96	25655.05
RCS +X ULLAGE OFF										
6. 10. 27.199	22227.	31425.13	.0	.00	.00	.00	563.13	17785.00	.00	25655.05

TABLE VI
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
PERFORMANCE AND WEIGHT - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SECONDS	TOTAL WEIGHT POUNDS	THRUST RCS POUNDS	THRUST DPS/APS POUNDS	PROP FLOW RATE RCS POUNDS/SEC	PROP FLOW RATE DPS/APS POUNDS/SEC	PROP REMAINING RCS POUNDS	PROP REMAINING DPS/APS POUNDS	DELTA V FT/SEC	INERTIAL VELOCITY FT/SEC
6. 10. 33.399	22233.	31425.13	.0	.00	.00	.00	563.13	17785.00	.00	25654.68
RCS +X ULLAGE ON										
6. 10. 33.399	22233.	31425.13	400.0	.00	1.47	.00	563.13	17785.00	.00	25654.68
6. 10. 42.999	22243.	31411.03	400.0	.00	1.47	.00	549.03	17785.00	3.93	25657.99
DPS TWO IGNITION										
6. 10. 42.999	22243.	31411.03	400.0	.00	1.47	.00	549.03	17785.00	3.93	25657.99
6. 10. 46.299	22246.	31394.90	400.0	1020.00	1.47	3.42	544.19	17773.71	8.73	25662.12
RCS +X ULLAGE OFF										
6. 10. 46.299	22246.	31394.90	.0	1020.00	.00	3.42	544.19	17773.71	8.73	25662.12
6. 11. 7.799	22268.	31277.70	.0	9899.85	.00	32.53	544.19	17656.52	44.95	25679.43
DPS FIXED THROTTLE POSITION										
6. 11. 7.799	22268.	31277.70	.0	9899.85	.00	32.53	544.19	17656.52	44.95	25679.43
6. 11. 15.599	22276.	31037.32	.0	8.33	.00	.03	499.00	17461.32	106.30	25752.01
DPS ENGINE CUTOFF										
6. 11. 15.599	22276.	31037.32	.0	.00	.00	.00	499.00	17461.32	.00	25752.01
6. 11. 38.399	22298.	31037.32	.0	.00	.00	.00	499.00	17461.32	.00	25750.18
RCS +X ULLAGE ON										
6. 11. 38.399	22298.	31037.32	400.0	.00	1.47	.00	499.00	17461.32	.00	25750.18

TABLE VI
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
PERFORMANCE AND WEIGHT - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SECONDS	TOTAL WEIGHT POUNDS	THRUST RCS POUNDS	THRUST DPS/APS POUNDS	PROP FLOW RATE RCS POUNDS/SEC	PROP FLOW RATE DPS/APS POUNDS/SEC	PROP REMAINING RCS POUNDS	PROP REMAINING DPS/APS POUNDS	DELTA V FT/SEC	INERTIAL VELOCITY FT/SEC
6. 11. 46.999	22307.	31024.70	400.0	.00	1.47	.00	486.38	17461.32	3.57	25753.00
DPS THREE IGNITION										
6. 11. 46.999	22307.	31024.70	400.0	.00	1.47	.00	486.38	17461.32	3.57	25753.00
6. 11. 51.298	22311.	31003.69	400.0	1020.00	1.47	3.42	480.06	17446.62	9.90	25757.29
RCS +X ULLAGE OFF										
6. 11. 51.298	22311.	31003.69	.0	1020.00	.00	3.42	480.06	17446.62	9.90	25757.29
6. 12. 12.798	22333.	30886.49	.0	9899.86	.00	32.53	480.06	17329.43	46.57	25777.67
DPS FIXED THROTTLE POSITION										
6. 12. 12.798	22333.	30886.49	.0	9899.86	.00	32.53	480.06	17329.43	46.57	25777.67
6. 12. 14.398	22334.	30865.85	.0	9046.34	.00	29.73	480.06	17308.79	53.12	25794.87
ABORT STAGE										
6. 12. 14.398	22334.	10214.00	.0	9046.34	.00	29.73	484.00	5150.00	53.12	25794.87
6. 12. 14.698	22335.	10214.00	.0	9046.34	.00	29.73	484.00	5150.00	53.12	25794.89
DPS ENGINE CUTOFF										
6. 12. 14.698	22335.	10214.00	.0	.00	.00	.00	484.00	5150.00	.00	25794.89
6. 12. 14.998	22335.	10214.00	.0	.00	.00	.00	484.00	5150.00	.00	25794.81
APS ONE IGNITION										
6. 12. 14.998	22335.	10211.00	.0	.00	.00	.00	481.00	5150.00	.00	25794.81

TABLE VI
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
PERFORMANCE AND WEIGHT - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SECONDS	TOTAL WEIGHT POUNDS	THRUST RCS POUNDS	THRUST DPS/APS POUNDS	PROP FLOW RATE RCS POUNDS/SEC	PROP FLOW RATE DPS/APS POUNDS/SEC	PROP REMAINING RCS POUNDS	PROP REMAINING DPS/APS POUNDS	DELTA V FT/SEC	INERTIAL VELOCITY FT/SEC
6. 12. 24.998	22345.	10096.07	.0	3480.40	.00	11.49	481.00	5035.07	110.35	25900.70
6. 12. 34.998	22355.	9981.13	.0	3480.40	.00	11.49	481.00	4920.13	221.96	26004.41
6. 12. 44.998	22365.	9866.20	.0	3480.40	.00	11.49	481.00	4805.20	334.86	26099.59
6. 12. 54.998	22375.	9751.27	.0	3480.40	.00	11.49	481.00	4690.27	449.09	26182.33
6. 13. 4.998	22385.	9636.33	.0	3480.40	.00	11.49	481.00	4575.33	564.67	26249.63
6. 13. 14.770	22395.	9532.89	.0	.00	.00	.00	481.00	4471.89	669.88	26298.91
TERMINATE PRA III COAST TO PRA V										
6. 13. 13.900	22394.	9532.89	.0	.00	.00	.00	481.00	4471.89	.00	26307.07
7. 40. 39.910	27640.	9532.89	.0	.00	.00	.00	481.00	4471.89	.00	25967.21
BET VECTOR PRIOR TO PRA V										
7. 40. 39.910	27640.	14122.39	.0	.00	.00	.00	122.50	4471.89	.00	25969.88
7. 43. 55.000	27835.	14122.39	.0	.00	.00	.00	122.50	4471.89	.00	26156.29
INITIATE PRA V SEQUENCE										
7. 43. 55.000	27835.	14103.89	.0	.00	.00	.00	104.00	4471.89	.00	26156.29
7. 44. .300	27840.	14103.89	.0	.00	.00	.00	104.00	4471.89	.00	26160.52
RCS +X ULLAGE ON										
7. 44. .300	27840.	9147.89	400.0	.00	1.47	.00	104.00	4471.89	.00	26160.52
7. 44. 12.800	27853.	9129.54	400.0	.00	1.47	.00	85.65	4471.89	17.61	26161.00
APS TWO BURN TO FUEL DEPLETION										
7. 44. 12.800	27853.	9129.54	400.0	.00	1.47	.00	85.65	4471.89	17.61	26161.00

TABLE VI
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY

PERFORMANCE AND WEIGHT - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SECONDS	TOTAL WEIGHT POUNDS	THRUST RCS POUNDS	THRUST DPS/APS POUNDS	PROP FLOW RATE RCS POUNDS/SEC	PROP FLOW RATE DPS/APS POUNDS/SEC	PROP REMAINING RCS POUNDS	PROP REMAINING DPS/APS POUNDS	DELTA V FT/SEC	INERTIAL VELOCITY FT/SEC
7. 44. 17.300	27857.	9055.20	400.0	3471.62	1.47	12.30	77.72	4405.48	65.94	26141.86
RCS +X ULLAGE OFF										
7. 44. 17.300	27857.	9055.20	.0	3471.62	.00	12.30	77.72	4405.48	65.94	26141.86
7. 44. 19.300	27859.	9030.60	.0	3474.12	.00	12.30	77.72	4380.88	90.60	26129.98
7. 44. 21.300	27861.	9006.00	.0	3476.62	.00	12.30	77.72	4356.28	115.53	26113.23
7. 44. 23.300	27863.	8981.40	.0	3479.12	.00	12.30	77.72	4331.68	140.46	26097.87
7. 44. 25.300	27865.	8956.80	.0	3479.61	.00	12.30	77.72	4307.08	165.46	26081.82
7. 44. 27.300	27867.	8932.20	.0	3479.01	.00	12.30	77.72	4282.48	190.52	26064.14
7. 44. 29.300	27869.	8907.60	.0	3478.41	.00	12.30	77.72	4257.88	215.68	26047.87
7. 44. 31.300	27871.	8883.00	.0	3477.81	.00	12.30	77.72	4233.28	240.86	26030.02
7. 44. 33.300	27873.	8858.40	.0	3477.21	.00	12.30	77.72	4208.68	266.10	26011.63
7. 44. 35.300	27875.	8833.80	.0	3476.09	.00	12.30	77.72	4184.08	291.49	25999.71
7. 44. 37.300	27877.	8809.20	.0	3474.69	.00	12.30	77.72	4159.48	316.80	25973.30
7. 44. 39.300	27879.	8784.60	.0	3473.29	.00	12.30	77.72	4134.88	342.28	25953.41
7. 44. 41.300	27881.	8760.00	.0	3471.89	.00	12.30	77.72	4110.28	367.76	25933.07
7. 44. 43.300	27883.	8735.40	.0	3470.49	.00	12.30	77.72	4085.68	393.39	25919.32
7. 44. 45.300	27885.	8710.80	.0	3469.74	.00	12.30	77.72	4061.08	418.98	25891.17
7. 44. 47.300	27887.	8686.20	.0	3469.34	.00	12.30	77.72	4036.48	444.68	25869.66
7. 44. 49.300	27889.	8661.60	.0	3468.94	.00	12.30	77.72	4011.88	470.49	25847.82
7. 44. 51.300	27891.	8637.00	.0	3468.54	.00	12.30	77.72	3987.28	496.26	25825.69
7. 44. 53.300	27893.	8612.40	.0	3468.14	.00	12.30	77.72	3962.68	522.18	25803.29
7. 44. 55.300	27895.	8587.80	.0	3467.35	.00	12.30	77.72	3938.08	548.16	25780.68
7. 44. 57.300	27897.	8563.20	.0	3466.36	.00	12.30	77.72	3913.48	574.21	25757.89
7. 44. 59.300	27899.	8538.60	.0	3465.36	.00	12.30	77.72	3888.88	600.39	25734.97
7. 45. 1.300	27901.	8514.00	.0	3464.36	.00	12.30	77.72	3864.28	626.51	25711.94
7. 45. 3.300	27903.	8489.40	.0	3463.35	.00	12.30	77.72	3839.68	652.74	25688.86
7. 45. 5.300	27905.	8464.80	.0	3462.66	.00	12.30	77.72	3815.08	679.08	25665.76
7. 45. 7.300	27907.	8440.20	.0	3462.14	.00	12.30	77.72	3790.48	705.48	25649.69
7. 45. 9.300	27909.	8415.60	.0	3461.62	.00	12.30	77.72	3765.88	731.98	25610.67
7. 45. 11.300	27911.	8391.00	.0	3461.10	.00	12.30	77.72	3741.28	758.49	25596.76
7. 45. 13.300	27913.	8366.40	.0	3460.58	.00	12.30	77.72	3716.68	785.11	25573.98

TABLE VI
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
PERFORMANCE AND WEIGHT - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SECONDS	TOTAL WEIGHT POUNDS	THRUST RCS POUNDS	THRUST DPS/APS POUNDS	PROP FLOW RATE RCS POUNDS/SEC	PROP FLOW RATE DPS/APS POUNDS/SEC	PROP REMAINING RCS POUNDS	PROP REMAINING DPS/APS POUNDS	DELTA V FT/SEC	INERTIAL VELOCITY FT/SEC
7. 45. 15.300	27915.	8341.80	.0	3460.06	.00	12.30	77.72	3492.08	811.80	25551.34
7. 45. 17.300	27917.	8317.20	.0	3459.54	.00	12.30	77.72	3467.48	838.56	25528.88
7. 45. 19.300	27919.	8292.60	.0	3459.02	.00	12.30	77.72	3442.88	865.40	25504.63
7. 45. 21.300	27921.	8268.00	.0	3458.50	.00	12.30	77.72	3418.28	892.39	25484.60
7. 45. 23.300	27923.	8243.40	.0	3457.98	.00	12.30	77.72	3393.68	919.39	25469.71
7. 45. 25.300	27925.	8218.80	.0	3457.46	.00	12.30	77.72	3369.08	946.30	25440.98
7. 45. 27.300	27927.	8194.20	.0	3456.94	.00	12.30	77.72	3344.48	973.53	25419.37
7. 45. 29.300	27929.	8169.60	.0	3456.42	.00	12.30	77.72	3319.88	1000.76	25397.86
7. 45. 31.300	27931.	8145.00	.0	3455.90	.00	12.30	77.72	3295.28	1028.06	25376.60
7. 45. 33.300	27933.	8120.40	.0	3455.38	.00	12.30	77.72	3270.68	1055.44	25358.68
7. 45. 35.300	27935.	8095.80	.0	3454.86	.00	12.30	77.72	3246.08	1082.90	25335.19
7. 45. 37.300	27937.	8071.20	.0	3454.34	.00	12.30	77.72	3221.48	1110.48	25315.17
7. 45. 39.300	27939.	8046.60	.0	3453.82	.00	12.30	77.72	3196.88	1138.07	25295.67
7. 45. 41.300	27941.	8022.00	.0	3453.30	.00	12.30	77.72	3172.28	1165.77	25276.72
7. 45. 43.300	27943.	7997.40	.0	3452.78	.00	12.30	77.72	3147.68	1193.56	25258.37
7. 45. 45.300	27945.	7972.80	.0	3452.26	.00	12.30	77.72	3123.08	1221.41	25240.66
7. 45. 47.300	27947.	7948.20	.0	3451.74	.00	12.30	77.72	3298.48	1249.36	25223.58
7. 45. 49.300	27949.	7923.60	.0	3451.22	.00	12.30	77.72	3273.88	1277.39	25207.12
7. 45. 51.300	27951.	7899.00	.0	3450.70	.00	12.30	77.72	3249.28	1305.50	25191.18
7. 45. 53.300	27953.	7874.40	.0	3450.18	.00	12.30	77.72	3224.68	1333.69	25175.92
7. 45. 55.300	27955.	7849.80	.0	3449.74	.00	12.30	77.72	3200.08	1361.97	25161.68
7. 45. 57.300	27957.	7825.20	.0	3449.34	.00	12.30	77.72	3175.48	1390.34	25148.29
7. 45. 59.300	27959.	7800.60	.0	3448.94	.00	12.30	77.72	3150.88	1418.79	25135.59
7. 46. 1.300	27961.	7776.00	.0	3448.54	.00	12.30	77.72	3126.28	1447.32	25123.38
7. 46. 3.300	27963.	7751.40	.0	3448.14	.00	12.30	77.72	3101.68	1475.95	25111.59
7. 46. 5.300	27965.	7726.80	.0	3447.74	.00	12.30	77.72	3077.08	1504.66	25099.94
7. 46. 7.300	27967.	7702.20	.0	3447.34	.00	12.30	77.72	3052.48	1533.46	25088.43
7. 46. 9.300	27969.	7677.60	.0	3446.94	.00	12.30	77.72	3027.88	1562.35	25077.02
7. 46. 11.300	27971.	7653.00	.0	3446.54	.00	12.30	77.72	3003.28	1591.33	25065.70
7. 46. 13.300	27973.	7628.40	.0	3446.14	.00	12.30	77.72	2978.68	1620.40	25054.51
7. 46. 15.300	27975.	7603.80	.0	3445.74	.00	12.30	77.72	2954.08	1649.56	25043.39
7. 46. 17.300	27977.	7579.20	.0	3445.34	.00	12.30	77.72	2929.48	1678.82	25032.40
7. 46. 19.300	27979.	7554.60	.0	3444.94	.00	12.30	77.72	2904.88	1708.16	25021.52
7. 46. 21.300	27981.	7530.00	.0	3444.54	.00	12.30	77.72	2880.28	1737.59	25010.73
7. 46. 23.300	27983.	7505.40	.0	3444.14	.00	12.30	77.72	2855.68	1767.12	25000.01
7. 46. 25.300	27985.	7480.80	.0	3443.74	.00	12.30	77.72	2831.08	1796.75	24980.42

TABLE VI
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
PERFORMANCE AND WEIGHT - Continued

TIME FROM LIFTOFF HR MIN SECONDS	SECONDS	TOTAL WEIGHT POUNDS	THRUST RCS POUNDS	THRUST DPS/APS POUNDS	PROP FLOW RATE RCS POUNDS/SEC	PROP FLOW RATE DPS/APS POUNDS/SEC	PROP REMAINING RCS POUNDS	PROP REMAINING DPS/APS POUNDS	DELTA V FT/SEC	INERTIAL VELOCITY FT/SEC
7. 46. 27.300	27987.	7456.20	.0	3443.34	.00	12.30	77.72	8806.48	1826.94	24978.95
7. 46. 29.300	27989.	7431.60	.0	3442.94	.00	12.30	77.72	2781.88	1864.27	24968.57
7. 46. 31.300	27991.	7407.00	.0	3442.54	.00	12.30	77.72	2757.28	1886.18	24958.27
7. 46. 33.300	27993.	7382.40	.0	3442.14	.00	12.30	77.72	2732.68	1916.10	24948.13
7. 46. 35.300	27995.	7357.80	.0	3441.74	.00	12.30	77.72	2708.08	1946.29	24938.10
7. 46. 37.300	27997.	7333.20	.0	3441.34	.00	12.30	77.72	2683.48	1976.48	24928.15
7. 46. 39.300	27999.	7308.60	.0	3440.94	.00	12.30	77.72	2658.88	2006.78	24918.31
7. 46. 41.300	28001.	7284.00	.0	3440.54	.00	12.30	77.72	2634.28	2037.17	24908.54
7. 46. 43.300	28003.	7260.20	.0	3440.14	.00	11.90	77.72	2610.48	2067.64	24898.81
7. 46. 45.300	28005.	7236.40	.0	3439.87	.00	11.90	77.72	2586.68	2098.25	24889.22
7. 46. 47.300	28007.	7212.60	.0	3439.67	.00	11.90	77.72	2562.88	2128.94	24879.68
7. 46. 49.300	28009.	7188.80	.0	3439.47	.00	11.90	77.72	2539.08	2159.73	24870.05
7. 46. 51.300	28011.	7165.00	.0	3439.27	.00	11.90	77.72	2515.28	2190.62	24861.06
7. 46. 53.300	28013.	7141.20	.0	3439.07	.00	11.90	77.72	2491.48	2221.61	24851.95
7. 46. 55.300	28015.	7118.20	.0	3438.87	.00	11.50	77.72	2468.48	2252.69	24849.93
7. 46. 57.300	28017.	7095.20	.0	3438.67	.00	11.50	77.72	2445.48	2283.88	24833.99
7. 46. 59.300	28019.	7072.20	.0	3438.47	.00	11.50	77.72	2422.48	2315.17	24826.68
7. 47. 1.300	28021.	7049.20	.0	3438.27	.00	11.50	77.72	2399.48	2346.56	24819.68
7. 47. 3.300	28023.	7026.20	.0	3438.07	.00	11.50	77.72	2376.48	2378.04	24818.71
7. 47. 5.300	28025.	7003.20	.0	3437.87	.00	11.50	77.72	2353.48	2409.63	24825.67
7. 47. 7.300	28027.	6980.20	.0	3437.67	.00	11.50	77.72	2330.48	2441.32	24840.49
7. 47. 9.300	28029.	6957.20	.0	3437.47	.00	11.50	77.72	2307.48	2473.11	24854.95
7. 47. 11.300	28031.	6934.20	.0	3437.27	.00	11.50	77.72	2284.48	2505.01	24856.80
7. 47. 13.300	28033.	6911.20	.0	3437.07	.00	11.50	77.72	2261.48	2537.01	24838.95
7. 47. 15.300	28035.	6888.20	.0	3436.87	.00	11.50	77.72	2238.48	2569.12	24837.36
7. 47. 17.300	28037.	6865.20	.0	3436.67	.00	11.50	77.72	2215.48	2601.33	24859.08
7. 47. 19.300	28039.	6842.20	.0	3436.47	.00	11.50	77.72	2192.48	2633.65	24831.82
7. 47. 21.300	28041.	6819.20	.0	3436.27	.00	11.50	77.72	2169.48	2666.07	24828.08
7. 47. 23.300	28043.	6796.20	.0	3436.07	.00	11.50	77.72	2146.48	2698.61	24848.01
7. 47. 25.300	28045.	6773.20	.0	3435.87	.00	11.50	77.72	2123.48	2731.25	24828.38
7. 47. 27.300	28047.	6750.20	.0	3435.67	.00	11.50	77.72	2100.48	2764.00	24803.63
7. 47. 29.300	28049.	6727.20	.0	3435.47	.00	11.50	77.72	2077.48	2796.86	24777.53
7. 47. 29.900	28050.	6720.30	.0	3435.41	.00	11.50	77.72	2070.58	2806.81	24774.02

GIMBAL LOCK

7. 47. 29.900	28050.	6693.58	.0	3435.41	.00	11.50	51.00	2070.58	2806.81	24774.02

TABLE VI
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
PERFORMANCE AND WEIGHT - Concluded

TIME FROM LIFTOFF HR MIN SECONDS	SECONDS	TOTAL WEIGHT POUNDS	THRUST RCS POUNDS	THRUST DPS/APS POUNDS	PROP FLOW RATE RCS POUNDS/SEC	PROP FLOW RATE DPS/APS POUNDS/SEC	PROP REMAINING RCS POUNDS	PROP REMAINING DPS/APS POUNDS	DELTA V FT/SEC	INERTIAL VELOCITY FT/SEC
7. 50. 13.776	28214.	4809.00	.0	3440.98	.00	11.50	51.00	186.00	5992.79	24037.33
APS TWO BURNOUT -COAST TO REENTRY										
7. 50. 13.776	28214.	4809.00	.0	.00	.00	.00	51.00	186.00	.00	24937.33
7. 50. 40.994	28241.	4809.00	.0	.00	.00	.00	51.00	186.00	.00	24974.11
COAST TO IMPACT										
7. 50. 40.994	28241.	4809.00	.0	.00	.00	.00	51.00	186.00	.00	24974.11
8. 2. 8.449	28928.	4809.00	.0	.00	.00	.00	51.00	186.00	.00	1454.94

TABLE VII
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
-ELLIPTIC AND ORBITAL PARAMETERS-

TIME FROM LIFTOFF HR	MIN	SECONDS	DECL DEG	RT ASC DEG	RADIUS FEET	SEMI MAJOR AXIS FEET	ECCEN	INCL DEG	INER LONG OF ASC NODE DEGREES	ALT OF PERIGEE N MI	ALT OF APOGEE N MI	TRUE ANOMALY DEGREES	ORBIT PERIOD MIN	REV NUM
6.	9.	51.900	28.84	-.76	21478313.	21564000.	.004989	31.632	-160.44	92.28	124.14	27.83	88.4	5.89
6.	10.	.000	28.71	-.75	21478751.	21564126.	.004992	31.682	-160.44	92.29	124.17	28.30	88.4	5.89
					INITIATE PRA III SEQUENCE.									
6.	10.	.000	28.71	-.75	21478751.	21564126.	.004992	31.682	-160.44	92.29	124.17	28.30	88.4	5.89
6.	10.	7.400	28.59	-.74	21479156.	21564241.	.004994	31.633	-160.44	92.30	124.20	28.73	88.4	5.89
					RCS +X ULLAGE ON									
6.	10.	7.400	28.59	-.74	21479156.	21564241.	.004994	31.683	-160.44	92.30	124.20	28.73	88.4	5.89
6.	10.	17.500	28.42	-.73	21479718.	21570858.	.004760	31.633	-160.44	92.45	126.25	27.56	88.4	5.90
					RCS +X ULLAGE OFF									
6.	10.	17.500	28.42	-.73	21479718.	21570858.	.004760	31.633	-160.44	92.45	126.25	27.56	88.4	5.90
6.	10.	22.400	28.33	-.72	21479996.	21570938.	.004762	31.633	-160.44	92.46	126.27	27.84	88.4	5.90
					RCS +X ULLAGE ON									
6.	10.	22.400	28.33	-.72	21479996.	21570938.	.004762	31.683	-160.44	92.46	126.27	27.84	88.4	5.90
6.	10.	27.199	28.25	-.72	21480270.	21574335.	.004902	31.633	-160.44	92.52	127.33	27.32	88.4	5.90
					RCS +X ULLAGE OFF									
6.	10.	27.199	28.25	-.72	21480270.	21574335.	.004902	31.683	-160.44	92.52	127.33	27.32	88.4	5.90

TABLE VII
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
ELLIPTIC AND ORBITAL PARAMETERS - Continued

TIME FROM LIFTOFF HR MIN SECONDS	DECL DEG	RT ASC DEG	RADIUS FEET	SEMI MAJOR AXIS FEET	ECCEN	INCL DEG	INER LONG OF ASC NODE DEGREES	ALT OF PERIGEE N MI	ALT OF APOGEE N MI	TRUE ANOMALY DEGREES	ORBIT PERIOD MIN	REV NUM
6. 10. 33.399	28.14	-.71	21480629.	21574440.	.004904	31.633	-160.44	92.53	127.36	27.68	88.4	5.90
RCS +X ULLAGE ON												
6. 10. 33.399	28.14	-.71	21480629.	21574440.	.004904	31.633	-160.44	92.53	127.36	27.68	88.4	5.90
6. 10. 42.999	27.97	-.70	21481195.	21581187.	.005186	31.633	-160.44	92.64	129.48	26.82	88.5	5.90
DPS TWO IGNITION												
6. 10. 42.999	27.97	-.70	21481195.	21581187.	.005186	31.633	-160.44	92.64	129.48	26.82	88.5	5.90
6. 10. 46.299	27.90	-.69	21481393.	21588617.	.005503	31.633	-160.44	92.73	131.83	25.65	88.5	5.90
RCS +X ULLAGE OFF												
6. 10. 46.299	27.90	-.69	21481393.	21588617.	.005503	31.633	-160.44	92.73	131.83	25.65	88.5	5.90
6. 11. 7.799	27.50	-.67	21482768.	21620855.	.006892	31.631	-160.43	93.03	142.08	22.23	88.7	5.91
DPS FIXED THROTTLE POSITION												
6. 11. 7.799	27.50	-.67	21482768.	21620855.	.006892	31.631	-160.43	93.03	142.08	22.23	88.7	5.91
6. 11. 15.599	27.35	-.66	21483313.	21746656.	.012436	31.621	-160.40	93.56	182.57	13.32	89.5	5.91
DPS ENGINE CUTOFF												
6. 11. 15.599	27.35	-.66	21483313.	21746656.	.012436	31.621	-160.40	93.56	182.57	13.32	89.5	5.91
6. 11. 38.399	26.89	-.63	21485066.	21747085.	.012451	31.622	-160.40	93.57	182.69	14.79	89.5	5.91
RCS +X ULLAGE ON												
6. 11. 38.399	26.89	-.63	21485066.	21747085.	.012451	31.622	-160.40	93.57	182.69	14.79	89.5	5.91

TABLE VII
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
ELLIPTIC AND ORBITAL PARAMETERS - Continued

TIME FROM LIFTOFF HR MIN SECONDS	DECL DEG	RT ASC DEG	RADIUS FEET	SEMI MAJOR AXIS FEET	ECCEN	INCL DEG	INER LONG OF ASC NODE DEGREES	ALT OF PERIGEE N MI	ALT OF APOGEE N MI	TRUE ANOMALY DEGREES	ORBIT PERIOD MIN	REV NUM
6. 11. 46.999	26.72	-.61	21485774.	21747251.	.012467	31.623	-160.40	93.57	182.74	15.34	89.5	5.91
DPS THREE IGNITION												
6. 11. 46.999	26.72	-.61	21485774.	21747251.	.012467	31.623	-160.40	93.57	182.74	15.34	89.5	5.91
6. 11. 51.298	26.63	-.61	21486139.	21752340.	.012681	31.622	-160.40	93.59	184.39	15.38	89.5	5.92
RCS +X ULLAGE OFF												
6. 11. 51.298	26.63	-.61	21486139.	21752340.	.012681	31.622	-160.40	93.59	184.39	15.38	89.5	5.92
6. 12. 12.798	26.17	-.58	21488078.	21791621.	.014906	31.621	-160.40	93.73	197.06	14.99	89.8	5.92
DPS FIXED THROTTLE POSITION												
6. 12. 12.798	26.17	-.58	21488078.	21791621.	.014906	31.621	-160.40	93.73	197.06	14.99	89.8	5.92
6. 12. 14.398	26.14	-.58	21488230.	21821848.	.015730	31.619	-160.39	93.84	206.82	13.82	90.0	5.92
ABORT STAGE												
6. 12. 14.398	26.14	-.58	21488230.	21821848.	.015730	31.619	-160.39	93.84	206.82	13.82	90.0	5.92
6. 12. 14.698	26.13	-.58	21488258.	21829333.	.016059	31.619	-160.39	93.86	209.24	13.56	90.0	5.92
DPS ENGINE CUTOFF.												
6. 12. 14.698	26.13	-.58	21488258.	21829333.	.016059	31.619	-160.39	93.86	209.24	13.56	90.0	5.92
6. 12. 14.998	26.12	-.58	21488287.	21829338.	.016059	31.619	-160.39	93.86	209.24	13.58	90.0	5.92
APS ONE IGNITION												
6. 12. 14.998	26.12	-.58	21488287.	21829338.	.016060	31.619	-160.39	93.86	209.24	13.58	90.0	5.92

TABLE VII
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
ELLIPTIC AND ORBITAL PARAMETERS - Continued

TIME FROM LIFTOFF HR MIN SECONDS	DECL DEG	RT ASC DEG	RADIUS FEET	SEMI MAJOR AXIS FEET	ECCEN	INCL DEG	INER LONG OF ASC NODE DEGREES	ALT OF PERIGEE N MI	ALT OF APOGEE N MI	TRUE ANOMALY DEGREES	ORBIT PERIOD MIN	REV NUM
6. 13. 13.900	24.77	-.50	21488819.	22750302.	.055891	31.473	-159.99	92.64	511.17	352.38	95.8	5.93
TERMINATE PRA III; COAST TO PRA V												
6. 13. 13.900	24.77	-.50	21489168.	22775961.	.056882	31.480	-160.01	92.94	519.38	352.95	95.9	5.93
7. 40. 39.910	31.44	-1.18	21781032.	22768203.	.056491	31.467	-160.36	93.18	516.54	318.01	95.9	6.76
BET VECTOR PRIOR TO PRA V												
7. 40. 39.910	31.44	-1.19	21782825.	22777230.	.057187	31.457	-160.37	91.97	520.72	317.60	95.9	6.76
7. 43. 55.000	30.25	-.92	21620915.	22778638.	.057273	31.459	-160.40	91.86	521.28	331.00	96.0	6.80
INITIATE PRA V SEQUENCE												
7. 43. 55.000	30.25	-.92	21620915.	22778638.	.057273	31.459	-160.40	91.86	521.28	331.00	96.0	6.80
7. 44. .300	30.19	-.91	21617272.	22778705.	.057277	31.459	-160.40	91.86	521.31	331.36	96.0	6.80
RCS +X ULLAGE ON												
7. 44. .300	30.19	-.91	21617272.	22778705.	.057277	31.459	-160.40	91.86	521.31	331.36	96.0	6.80
7. 44. 12.800	30.05	-.90	21608786.	22760784.	.056778	31.466	-160.45	90.91	516.28	331.54	95.8	6.81
APS TWO BURN TO FUEL DEPLETION												
7. 44. 12.800	30.05	-.90	21608786.	22760784.	.056778	31.466	-160.45	90.91	516.28	331.54	95.8	6.81

TABLE VII
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
ELLIPTIC AND ORBITAL PARAMETERS - Continued

TIME FROM LIFTOFF HR MIN SECONDS	DECL DEG	RT ASC DEG	RADIUS FEET	SEMI MAJOR AXIS FEET	ECCEN	INCL DEG	INER LONG OF ASC NODE DEGREES	ALT OF PERIGEE N MI	ALT OF APOGEE N MI	TRUE ANOMALY DEGREES	ORBIT PERIOD MIN	REV NUM
7. 44. 17.300	29.99	-.89	21604137.	22713737.	.056588	31.483	-160.57	87.95	503.50	320.94	95.5	5.81
RCS +X ULLAGE OFF												
7. 44. 17.300	29.99	-.89	21604137.	22713737.	.056588	31.483	-160.57	87.95	503.54	320.94	95.5	5.81
7. 44. 19.300	29.97	-.89	21602742.	22683949.	.054690	31.493	-160.63	86.61	494.96	329.06	95.4	5.81
7. 44. 21.300	29.94	-.89	21601332.	22652872.	.053744	31.504	-160.70	85.24	485.98	328.15	95.2	5.81
7. 44. 23.300	29.92	-.88	21599910.	22620542.	.052751	31.514	-160.76	83.84	476.61	327.19	95.0	5.81
7. 44. 25.300	29.89	-.88	21598476.	22587018.	.051713	31.524	-160.82	82.41	466.88	326.20	94.7	5.81
7. 44. 27.300	29.87	-.88	21597034.	22552393.	.050634	31.535	-160.89	80.95	456.82	325.16	94.5	5.81
7. 44. 29.300	29.84	-.87	21595582.	22516754.	.049516	31.545	-160.95	79.45	446.45	324.08	94.3	5.81
7. 44. 31.300	29.82	-.87	21594125.	22480176.	.048363	31.555	-161.01	77.93	435.79	322.95	94.1	5.81
7. 44. 33.300	29.79	-.87	21592663.	22442701.	.047176	31.565	-161.06	76.37	424.87	321.76	93.8	5.81
7. 44. 35.300	29.76	-.87	21591198.	22404395.	.045959	31.575	-161.12	74.78	413.71	320.52	93.6	5.81
7. 44. 37.300	29.74	-.86	21589731.	22365332.	.044716	31.584	-161.18	73.15	402.34	319.21	93.4	5.81
7. 44. 39.300	29.71	-.86	21588264.	22325552.	.043450	31.594	-161.23	71.48	390.77	317.82	93.1	5.81
7. 44. 41.300	29.68	-.86	21586798.	22285134.	.042165	31.603	-161.28	69.78	379.04	316.36	92.9	5.81
7. 44. 43.300	29.66	-.86	21585336.	22244127.	.040865	31.612	-161.33	67.97	367.17	314.81	92.6	5.81
7. 44. 45.300	29.63	-.85	21583879.	22202600.	.039556	31.620	-161.37	66.12	355.20	313.16	92.3	5.81
7. 44. 47.300	29.60	-.85	21582428.	22160622.	.038242	31.628	-161.42	64.20	343.15	311.40	92.1	5.81
7. 44. 49.300	29.57	-.85	21580985.	22118252.	.036930	31.636	-161.46	62.19	331.06	309.51	91.8	5.81
7. 44. 51.300	29.55	-.84	21579552.	22075574.	.035627	31.643	-161.50	60.09	318.97	307.50	91.5	5.81
7. 44. 53.300	29.52	-.84	21578129.	22032656.	.034338	31.650	-161.53	57.88	306.91	305.34	91.3	5.81
7. 44. 55.300	29.49	-.84	21576718.	21989574.	.033072	31.656	-161.56	55.55	294.93	303.01	91.0	5.81
7. 44. 57.300	29.46	-.84	21575321.	21946414.	.031837	31.662	-161.59	53.09	283.07	300.52	90.7	5.81
7. 44. 59.300	29.43	-.83	21573939.	21903239.	.030641	31.666	-161.62	50.47	271.38	297.84	90.5	5.81
7. 45. 1.300	29.40	-.83	21572573.	21860140.	.029494	31.671	-161.64	47.69	259.91	294.97	90.2	5.81

TABLE VII
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY

ELLIPTIC AND ORBITAL PARAMETERS - Continued

TIME FROM LIFTOFF HR	MIN	SECONDS	DECL DEG	RT ASC DEG	RADIUS FEET	SEMI MAJOR AXIS FEET	ECCEN	INCL DEG	INER LONG OF ASC NODE DEGREES	ALT OF PERIGEE N MI	ALT OF APOGEE N MI	TRUE ANOMALY DEGREES	ORBIT PERIOD MIN	REV NUM
7.	45.	3.300	29.37	-.83	21571224.	21817178.	.028405	31.474	-161.65	44.72	248.71	291.88	89.9	5.82
7.	45.	5.300	29.34	-.83	21569894.	21774429.	.027386	31.677	-161.67	41.54	237.82	288.58	89.7	5.82
7.	45.	7.300	29.31	-.82	21568584.	21731964.	.026445	31.679	-161.68	38.14	227.31	285.06	89.4	5.82
7.	45.	9.300	29.28	-.82	21567294.	21689843.	.025595	31.680	-161.68	34.49	217.22	281.32	89.2	5.82
7.	45.	11.300	29.25	-.82	21566025.	21648148.	.024843	31.681	-161.69	30.57	207.60	277.37	88.9	5.82
7.	45.	13.300	29.22	-.82	21564780.	21606903.	.024202	31.681	-161.69	26.36	198.49	273.24	88.6	5.82
7.	45.	15.300	29.19	-.81	21563558.	21566138.	.023680	31.680	-161.68	21.83	189.92	268.93	88.4	5.82
7.	45.	17.300	29.16	-.81	21562360.	21525906.	.023281	31.679	-161.68	16.98	181.93	264.50	88.2	5.82
7.	45.	19.300	29.13	-.81	21561188.	21486270.	.023007	31.677	-161.67	11.79	174.51	259.98	87.9	5.82
7.	45.	21.300	29.10	-.80	21560040.	21447217.	.022863	31.674	-161.65	6.27	167.67	255.43	87.7	5.82
7.	45.	23.300	29.07	-.80	21558920.	21408625.	.022855	31.671	-161.64	.34	161.40	250.87	87.4	5.82
7.	45.	25.300	29.04	-.80	21557825.	21370514.	.022981	31.667	-161.62	-5.97	155.68	246.37	87.2	5.82
7.	45.	27.300	29.01	-.80	21556757.	21332830.	.023242	31.663	-161.60	-12.70	150.50	241.97	87.0	5.82
7.	45.	29.300	28.98	-.79	21555717.	21295511.	.023640	31.657	-161.58	-19.86	145.85	237.73	86.7	5.82
7.	45.	31.300	28.95	-.79	21554701.	21258814.	.024153	31.651	-161.55	-27.34	141.67	233.69	86.5	5.82
7.	45.	33.300	28.92	-.79	21553712.	21222872.	.024763	31.643	-161.51	-35.06	137.92	229.89	86.3	5.82
7.	45.	35.300	28.89	-.79	21552750.	21187831.	.025451	31.635	-161.48	-42.93	134.57	226.35	86.1	5.82
7.	45.	37.300	28.85	-.78	21551813.	21153745.	.026204	31.625	-161.43	-50.89	131.56	223.06	85.9	5.82
7.	45.	39.300	28.82	-.78	21550903.	21120676.	.027007	31.615	-161.39	-58.88	128.87	220.03	85.7	5.82
7.	45.	41.300	28.79	-.78	21550018.	21088649.	.027849	31.603	-161.33	-66.85	126.46	217.25	85.5	5.82
7.	45.	43.300	28.76	-.78	21549160.	21057752.	.028717	31.591	-161.28	-74.74	124.30	214.70	85.3	5.82
7.	45.	45.300	28.73	-.77	21548327.	21028022.	.029599	31.577	-161.22	-82.50	122.37	212.37	85.1	5.82
7.	45.	47.300	28.70	-.77	21547519.	20999452.	.030489	31.563	-161.15	-90.11	120.63	210.24	84.9	5.82
7.	45.	49.300	28.66	-.77	21546736.	20971997.	.031379	31.547	-161.09	-97.54	119.07	208.28	84.8	5.82
7.	45.	51.300	28.63	-.77	21545977.	20945494.	.032272	31.531	-161.02	-104.83	117.66	206.49	84.6	5.82
7.	45.	53.300	28.60	-.76	21545243.	20920181.	.033151	31.514	-160.94	-111.89	116.39	204.86	84.5	5.83
7.	45.	55.300	28.57	-.76	21544530.	20896578.	.033992	31.495	-160.86	-118.54	115.27	203.40	84.3	5.83
7.	45.	57.300	28.54	-.76	21543840.	20874406.	.034801	31.476	-160.78	-124.85	114.26	202.09	84.2	5.83
7.	45.	59.300	28.50	-.76	21543170.	20853401.	.035585	31.456	-160.69	-130.89	113.37	200.90	84.1	5.83
7.	46.	1.300	28.47	-.75	21542519.	20833249.	.036359	31.435	-160.60	-136.75	112.58	199.83	83.9	5.83
7.	46.	3.300	28.44	-.75	21541885.	20813807.	.037128	31.413	-160.50	-142.48	111.88	198.88	83.8	5.83
7.	46.	5.300	28.41	-.75	21541267.	20794682.	.037910	31.391	-160.41	-148.20	111.28	198.04	83.7	5.83
7.	46.	7.300	28.37	-.74	21540661.	20775814.	.038706	31.368	-160.31	-153.92	110.77	197.31	83.6	5.83
7.	46.	9.300	28.34	-.74	21540066.	20757169.	.039515	31.344	-160.21	-159.65	110.33	196.69	83.5	5.83
7.	46.	11.300	28.31	-.74	21539478.	20738734.	.040336	31.320	-160.10	-165.38	109.96	196.16	83.4	5.83
7.	46.	13.300	28.28	-.74	21538894.	20720518.	.041167	31.296	-160.00	-171.10	109.67	195.73	83.2	5.83
7.	46.	15.300	28.25	-.73	21538313.	20702476.	.042008	31.271	-159.89	-176.83	109.43	195.38	83.1	5.83
7.	46.	17.300	28.21	-.73	21537730.	20684658.	.042858	31.246	-159.79	-182.54	109.26	195.13	83.0	5.83
7.	46.	19.300	28.18	-.73	21537144.	20667032.	.043715	31.220	-159.68	-188.24	109.14	194.95	82.9	5.83
7.	46.	21.300	28.15	-.73	21536550.	20649575.	.044581	31.195	-159.57	-193.93	109.08	194.86	82.8	5.83
7.	46.	23.300	28.12	-.72	21535947.	20632246.	.045458	31.170	-159.46	-199.64	109.07	194.84	82.7	5.83
7.	46.	25.300	28.08	-.72	21535332.	20615123.	.046341	31.144	-159.35	-205.33	109.12	194.89	82.6	5.83

TABLE VII
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
ELLIPTIC AND ORBITAL PARAMETERS - Continued

TIME FROM LIFTOFF HR MIN SECONDS	DECL DEG	RT ASC DEG	RADIUS FEET	SEMI MAJOR AXIS FEET	ECCEN	INCL DEG	INER LONG OF ASC NODE DEGREES	ALT OF PERIGEE N MI	ALT OF APOGEE N MI	TRUE ANOMALY DEGREES	ORBIT PERIOD MIN	REV NUM
7. 46. 27.300	28.05	-.72	21534701.	20598177.	.047233	31.119	-159.24	-211.02	109.22	195.00	82.5	5.83
7. 46. 29.300	28.02	-.72	21534051.	20581373.	.048134	31.093	-159.14	-216.71	109.38	194.18	82.4	5.83
7. 46. 31.300	27.99	-.71	21533380.	20564688.	.049047	31.068	-159.03	-222.41	109.58	193.41	82.3	5.83
7. 46. 33.300	27.96	-.71	21532685.	20548227.	.049966	31.044	-158.93	-228.10	109.85	192.70	82.2	5.83
7. 46. 35.300	27.92	-.71	21531961.	20531911.	.050896	31.019	-158.82	-233.79	110.17	192.04	82.1	5.83
7. 46. 37.300	27.89	-.71	21531209.	20515709.	.051839	30.995	-158.72	-239.50	110.56	191.42	82.0	5.83
7. 46. 39.300	27.86	-.70	21530423.	20499617.	.052796	30.972	-158.62	-245.24	111.00	190.85	81.9	5.83
7. 46. 41.300	27.83	-.70	21529602.	20483617.	.053769	30.949	-158.53	-251.02	111.51	190.31	81.8	5.83
7. 46. 43.300	27.79	-.70	21528742.	20467629.	.054763	30.927	-158.44	-256.85	112.09	189.81	81.7	5.83
7. 46. 45.300	27.76	-.70	21527842.	20451806.	.055771	30.906	-158.35	-262.70	112.74	189.34	81.6	5.84
7. 46. 47.300	27.73	-.69	21526897.	20435993.	.056805	30.886	-158.26	-268.63	113.47	188.91	81.5	5.84
7. 46. 49.300	27.70	-.69	21525904.	20420011.	.057890	30.868	-158.19	-274.76	114.34	190.55	81.4	5.84
7. 46. 51.300	27.66	-.69	21524858.	20404889.	.058971	30.853	-158.12	-280.73	115.34	200.25	81.4	5.84
7. 46. 53.300	27.63	-.69	21523757.	20389530.	.060067	30.837	-158.06	-286.79	116.35	200.90	81.3	5.84
7. 46. 55.300	27.60	-.68	21522600.	20374233.	.061187	30.822	-158.00	-292.91	117.43	201.57	81.2	5.84
7. 46. 57.300	27.57	-.68	21521386.	20358960.	.062336	30.810	-157.95	-299.11	118.62	202.26	81.1	5.84
7. 46. 59.300	27.53	-.68	21520110.	20344533.	.063484	30.801	-157.91	-305.18	119.94	203.00	81.0	5.84
7. 47. 1.300	27.50	-.68	21518769.	20333388.	.064522	30.800	-157.91	-310.37	121.47	203.83	80.9	5.84
7. 47. 3.300	27.47	-.67	21517362.	20329458.	.065210	30.812	-157.96	-313.27	123.08	204.74	80.9	5.84
7. 47. 5.300	27.43	-.67	21515895.	20337000.	.065225	30.836	-158.05	-312.16	124.46	205.62	80.9	5.84
7. 47. 7.300	27.40	-.67	21514401.	20355959.	.064359	30.864	-158.16	-306.33	124.89	206.16	81.1	5.84
7. 47. 9.300	27.37	-.67	21512922.	20377417.	.062928	30.876	-158.21	-298.23	123.85	206.05	81.2	5.84
7. 47. 11.300	27.33	-.66	21511491.	20373277.	.062655	30.861	-158.15	-297.96	122.21	205.33	81.2	5.84
7. 47. 13.300	27.30	-.66	21510071.	20345969.	.064112	30.841	-158.07	-307.05	122.31	205.21	81.0	5.84
7. 47. 15.300	27.26	-.66	21508601.	20341016.	.064790	30.854	-158.12	-310.08	123.71	205.96	81.0	5.84
7. 47. 17.300	27.23	-.66	21507113.	20359872.	.063592	30.868	-158.18	-303.16	123.00	205.97	81.1	5.84
7. 47. 19.300	27.20	-.65	21505650.	20327660.	.065103	30.851	-158.11	-313.19	122.41	205.46	80.9	5.84
7. 47. 21.300	27.16	-.65	21504151.	20319522.	.065748	30.870	-158.19	-316.59	123.15	205.84	80.8	5.84
7. 47. 23.300	27.13	-.65	21502653.	20345917.	.064239	30.864	-158.16	-307.48	122.73	206.08	81.0	5.84
7. 47. 25.300	27.09	-.65	21501148.	20314596.	.065946	30.867	-158.17	-318.01	122.95	205.96	80.8	5.84
7. 47. 27.300	27.06	-.64	21499608.	20275917.	.068010	30.878	-158.21	-330.84	123.05	205.71	80.6	5.84
7. 47. 29.300	27.02	-.64	21498051.	20235438.	.069730	30.884	-158.24	-342.78	121.66	204.78	80.3	5.84
7. 47. 29.900	27.01	-.64	21497589.	20229550.	.069895	30.891	-158.26	-344.24	121.17	204.54	80.3	5.84

GIMBAL LOCK

7. 47. 29.900	27.01	-.64	21497589.	20229550.	.069895	30.891	-158.26	-344.24	121.17	204.54	80.3	5.84

TABLE VII
APOLLO MISSION AS-204/LM-1
POSTFLIGHT TRAJECTORY
ELLIPTIC AND ORBITAL PARAMETERS - Concluded

TIME FROM LIFTOFF HR MIN SECONDS	DECL DEG	RT ASC DEG	RADIUS FEET	SEMI MAJOR AXIS FEET	ECCEN	INCL DEG	INER LONG OF ASC NODE DEGREES	ALT OF PERIGEE N MI	ALT OF APOGEE N MI	TRUE ANOMALY DEGREES	ORBIT PERIOD MIN	REV NUM
7. 50. 13.776	23.62	-.44	21344774.	20193069.	.071291	31.023	-158.61	-354.45	119.40	214.48	80.1	5.87
APS TWO BURNOUT -COAST TO REENTRY												
7. 50. 13.776	23.62	-.44	21344774.	20193069.	.071291	31.023	-158.61	-354.45	119.40	214.48	80.1	5.87
7. 50. 40.994	22.96	-.41	21315018.	20192901.	.071314	31.025	-158.61	-354.55	119.45	214.32	80.1	5.88
COAST TO IMPACT												
7. 50. 40.994	22.96	-.41	21315018.	20192901.	.071314	31.025	-158.61	-354.55	119.45	214.32	80.1	5.88
7. 51. 5.994	22.34	-.38	21286508.	20191380.	.071392	31.026	-158.61	-355.04	119.44	217.97	80.1	5.88
7. 51. 30.994	21.70	-.35	21256891.	20184173.	.071690	31.027	-158.61	-357.13	119.16	210.47	80.0	5.89
7. 51. 55.994	21.04	-.32	21226193.	20147172.	.073123	31.027	-158.62	-367.55	117.37	220.13	79.8	5.89
7. 52. 20.994	20.36	-.29	21194468.	19922926.	.082036	31.022	-158.61	-431.07	106.90	214.06	78.5	5.90
7. 52. 45.994	19.68	-.26	21161930.	18806165.	.136374	30.985	-158.54	-768.56	75.61	200.37	72.0	5.90
7. 53. 10.994	19.04	-.24	21129306.	15794054.	.342699	30.809	-158.26	-1733.77	47.83	186.79	55.4	5.90
7. 53. 35.994	18.53	-.22	21098129.	12531122.	.686287	30.186	-157.25	-2795.63	35.07	182.16	39.2	5.91
7. 54. .994	18.23	-.20	21069910.	11064866.	.905988	28.520	-154.40	-3271.43	28.12	180.80	32.5	5.91
7. 54. 25.994	18.09	-.20	21045174.	10658835.	.975721	25.127	-147.17	-3399.67	23.04	180.33	30.7	5.91
7. 54. 50.994	18.04	-.19	21023619.	10559844.	.991870	20.879	-132.48	-3427.05	18.91	180.16	30.3	5.91
7. 55. 15.994	18.03	-.19	21005379.	10528314.	.995754	18.450	-113.73	-3432.33	15.30	180.09	30.2	5.91
7. 55. 40.994	18.02	-.19	20991582.	10515006.	.996669	18.038	-103.42	-3433.06	12.51	180.06	30.1	5.91
7. 56. 5.994	18.02	-.19	20981567.	10508403.	.996826	18.021	-101.10	-3433.14	10.61	180.04	30.1	5.91
7. 56. 30.994	18.02	-.19	20973859.	10504092.	.996846	18.020	-100.74	-3433.15	9.23	180.03	30.0	5.91
7. 56. 55.994	18.02	-.18	20967530.	10500731.	.996850	18.020	-100.61	-3433.15	8.13	180.03	30.0	5.91
7. 57. 20.994	18.02	-.18	20962057.	10497880.	.996853	18.020	-100.50	-3433.15	7.20	180.03	30.0	5.91
7. 57. 45.994	18.02	-.18	20957163.	10495357.	.996855	18.020	-100.39	-3433.15	6.37	180.02	30.0	5.91
7. 58. 10.994	18.02	-.18	20952695.	10493066.	.996857	18.020	-100.28	-3433.15	5.62	180.02	30.0	5.91
7. 58. 35.994	18.02	-.18	20948558.	10490954.	.996859	18.020	-100.18	-3433.15	4.93	180.02	30.0	5.91
7. 59. .994	18.02	-.18	20944693.	10488984.	.996861	18.020	-100.07	-3433.15	4.29	180.02	30.0	5.91
7. 59. 25.994	18.02	-.17	20941059.	10487136.	.996863	18.020	-99.96	-3433.15	3.68	180.02	30.0	5.91
7. 59. 50.994	18.02	-.17	20937627.	10485393.	.996864	18.020	-99.86	-3433.16	3.11	180.02	30.0	5.91
8. 0. 15.994	18.02	-.17	20934372.	10483741.	.996866	18.020	-99.75	-3433.16	2.57	180.02	30.0	5.91
8. 0. 40.994	18.02	-.17	20931277.	10482172.	.996867	18.020	-99.64	-3433.16	2.06	180.01	30.0	5.91
8. 1. 5.994	18.02	-.17	20928325.	10480677.	.996868	18.020	-99.54	-3433.16	1.57	180.01	29.9	5.91
8. 1. 30.994	18.02	-.16	20925502.	10479248.	.996870	18.020	-99.43	-3433.16	1.10	180.01	29.9	5.91
8. 1. 55.994	18.02	-.16	20922796.	10477879.	.996871	18.020	-99.33	-3433.16	.65	180.01	29.9	5.91
8. 2. 8.449	18.02	-.16	20921496.	10477229.	.996872	18.020	-99.28	-3433.16	.44	180.01	29.9	5.91

TABLE VIII

RADAR ACQUISITION DATA

MINIMUM ELEVATION, 0 DEGREES
MAXIMUM SLANT RANGE, 32000 NAUTICAL MILES

STATION NAME	REV NO.	ACQUISITION D	H	M	S	LOSS D	H	M	S	ELAPSED TIME M	S	MAX ELEV DEGREES	LOSS RANGE N. MI.	MIN RANGE N. MI.
RKV C TVC	5	0	6	9	55	0	6	12	11	2	15	17.2	817.	282.
CAL C R V	5	0	6	9	54	0	6	12	27	2	33	12.4	820.	356.
GDS S RTVC	5	0	6	9	53	0	6	12	58	3	4	9.6	822.	417.
WHS C R	5	0	6	9	52	0	6	15	15	5	23	9.9	812.	414.
GYM S RTVC	5	0	6	9	53	0	6	15	9	5	15	51.0	809.	121.
TEX S RTVC	5	0	6	11	33	0	6	17	43	6	9	13.2	826.	339.
MLA C R	5	0	6	16	59	0	6	19	1	2	2	.4	849.	795.
PAT C R	5	0	6	16	54	0	6	19	9	2	15	.6	849.	787.
MIL S RTVC	5	0	6	17	1	0	6	18	58	1	56	.3	849.	798.
GBI C RTVC	6	0	6	17	17	0	6	20	9	2	51	1.0	867.	773.
ANT C RTVC	6	0	6	21	28	0	6	25	44	4	16	2.3	1020.	808.
ASC C R V	6	0	6	33	48	0	6	43	56	10	8	9.3	1669.	1020.
PRE C R	6	0	6	43	27	0	7	0	12	16	44	49.3	1944.	584.
TAN C R V	6	0	6	48	49	0	7	5	47	16	57	33.1	1939.	808.
CSQ S TVC	6	0	7	0	52	0	7	15	48	14	55	17.4	1807.	1149.
CRO C RTVC	6	0	7	7	58	0	7	17	36	9	37	4.9	1773.	1585.
GWM S RTVC	6	0	7	20	24	0	7	32	56	12	31	28.4	1270.	567.
HAW C RTVC	6	0	7	38	31	0	7	45	14	6	42	8.5	865.	569.
WTN C,S R	6	0	7	43	10	0	7	50	6	6	56	33.2	730.	179.
CAL C R V	6	0	7	48	55	0	7	50	35	1	40	.3	723.	720.
RKV C TVC	6	0	7	46	51	0	7	51	56	5	5	6.4	648.	454.
GYM S RTVC	6	0	7	51	48	0	7	52	28	0	40	.2	594.	588.

TABLE IX.- MISSION PROGRAMMER SEQUENCES III AND V STATE VECTOR COMPARISON

Vector description and source	Time, hr:min:sec	Velocity, fps	Flight-path angle, deg	Heading, angle, deg	Latitude, deg	Longitude, deg	Altitude, n. mi.
First ascent engine firing on (abort stage)	06:12:14.7						
Accelerometer reconstructed		25 800	0.218	108.48	26.28	-109.49	94.6
Skin tracking (NORAD)		25 795	0.326	108.81	26.06	-109.32	93.9
Simulated		25 794	0.212	108.47	26.28	-109.50	94.8
First ascent engine firing off	06:13:14.7						
Accelerometer reconstructed		26 311	-0.366	110.08	24.90	-105.41	94.8
Best estimate trajectory (phase 3)		26 319	-0.359	110.09	24.91	-105.41	94.0
Simulated		26 321	-0.452	110.08	24.89	-105.37	94.6
Gimbal lock	07:47:29.9						
Accelerometer reconstructed		24 803	-1.77	105.55	27.16	-136.87	96.1
Simulated		24 774	-1.77	105.59	27.16	-136.86	96.5
Thrust decay	07:50:13.8						
Accelerometer reconstructed							
Simulated		24 937	-2.46	110.72	23.76	-126.10	70.8
Entry (400K)							
Accelerometer reconstructed	07:50:41.3	25 027	-2.54	111.22	23.10	-124.3	65.8
Simulated	07:50:41.0	24 974	-2.57	111.46	23.10	-124.4	65.8
Impact							
Accelerometer					17.9	-112.5	
Simulated					18.1	-113.1	

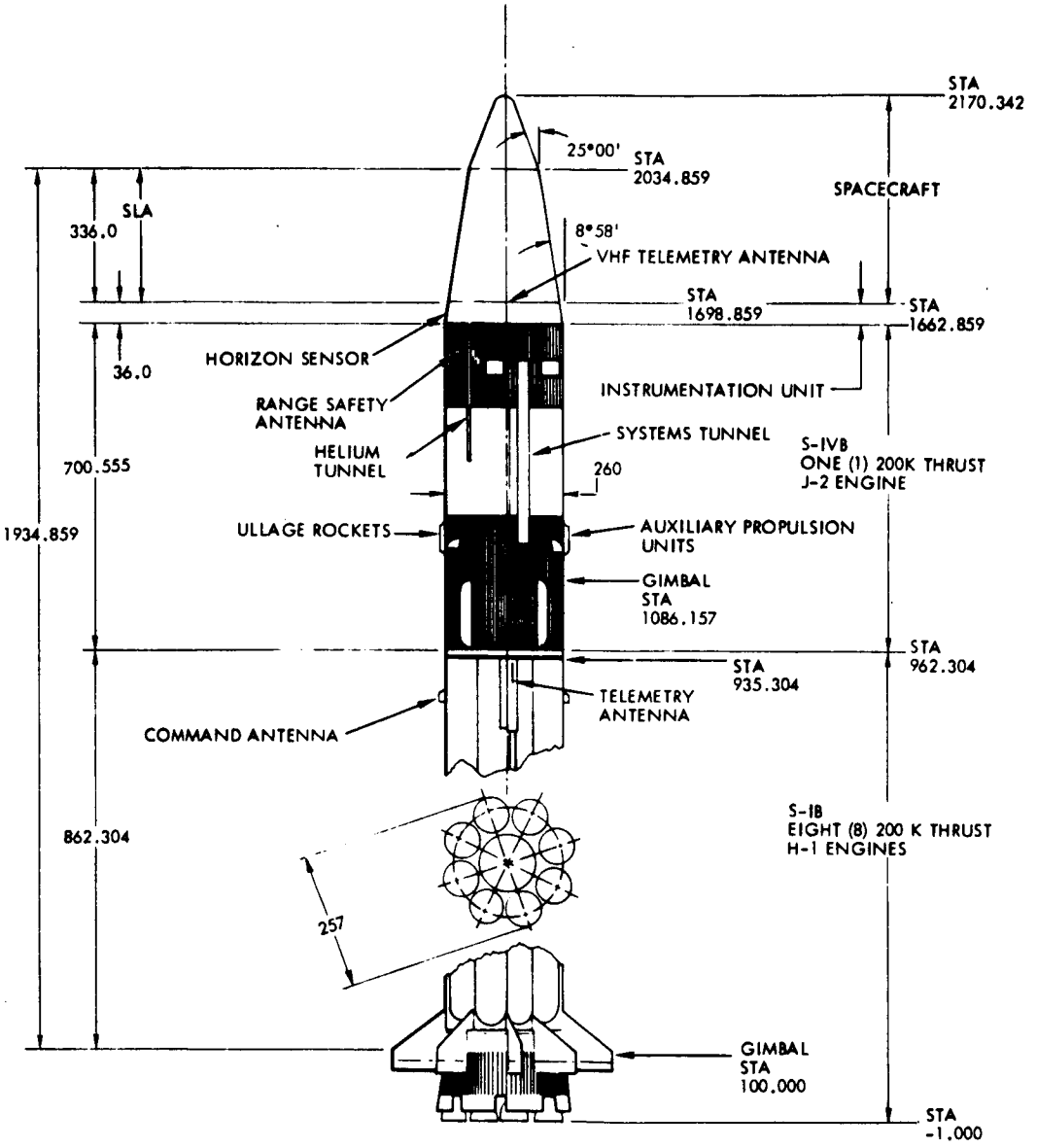


Figure 1.- S-IB launch vehicle.

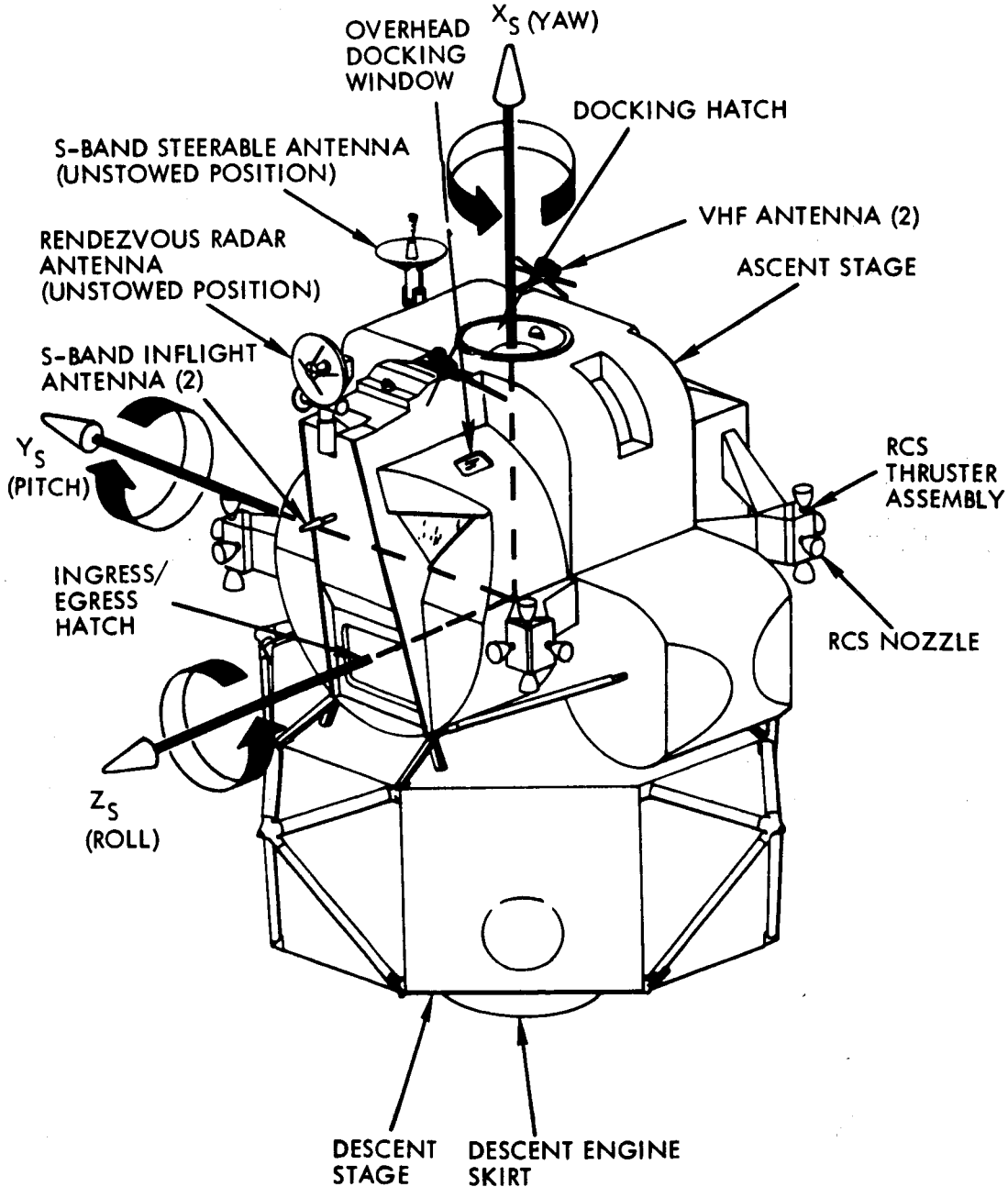


Figure 2 LM-1 flight configuration and body axis system

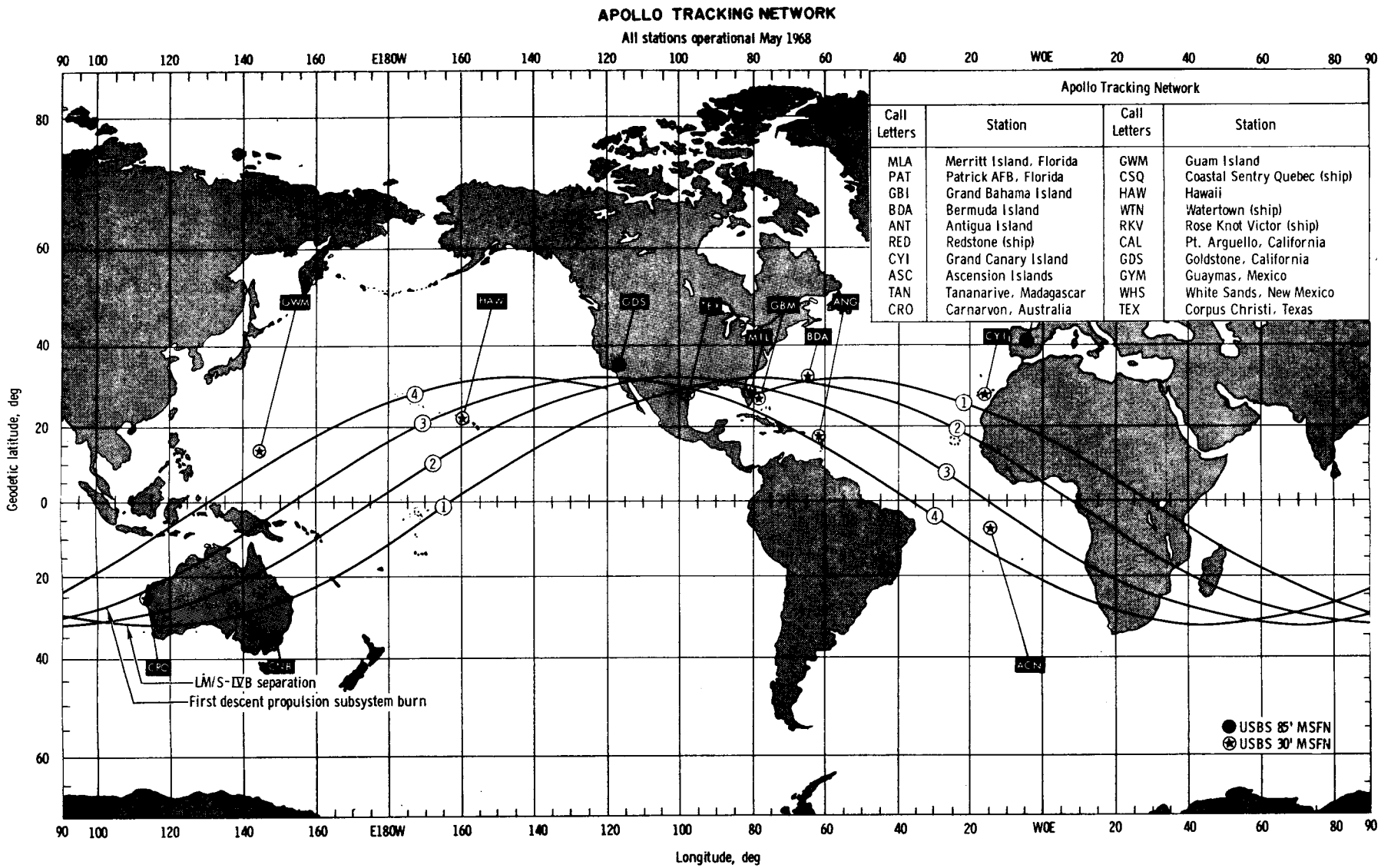


Figure 3.- Groundtracks and major mission events.

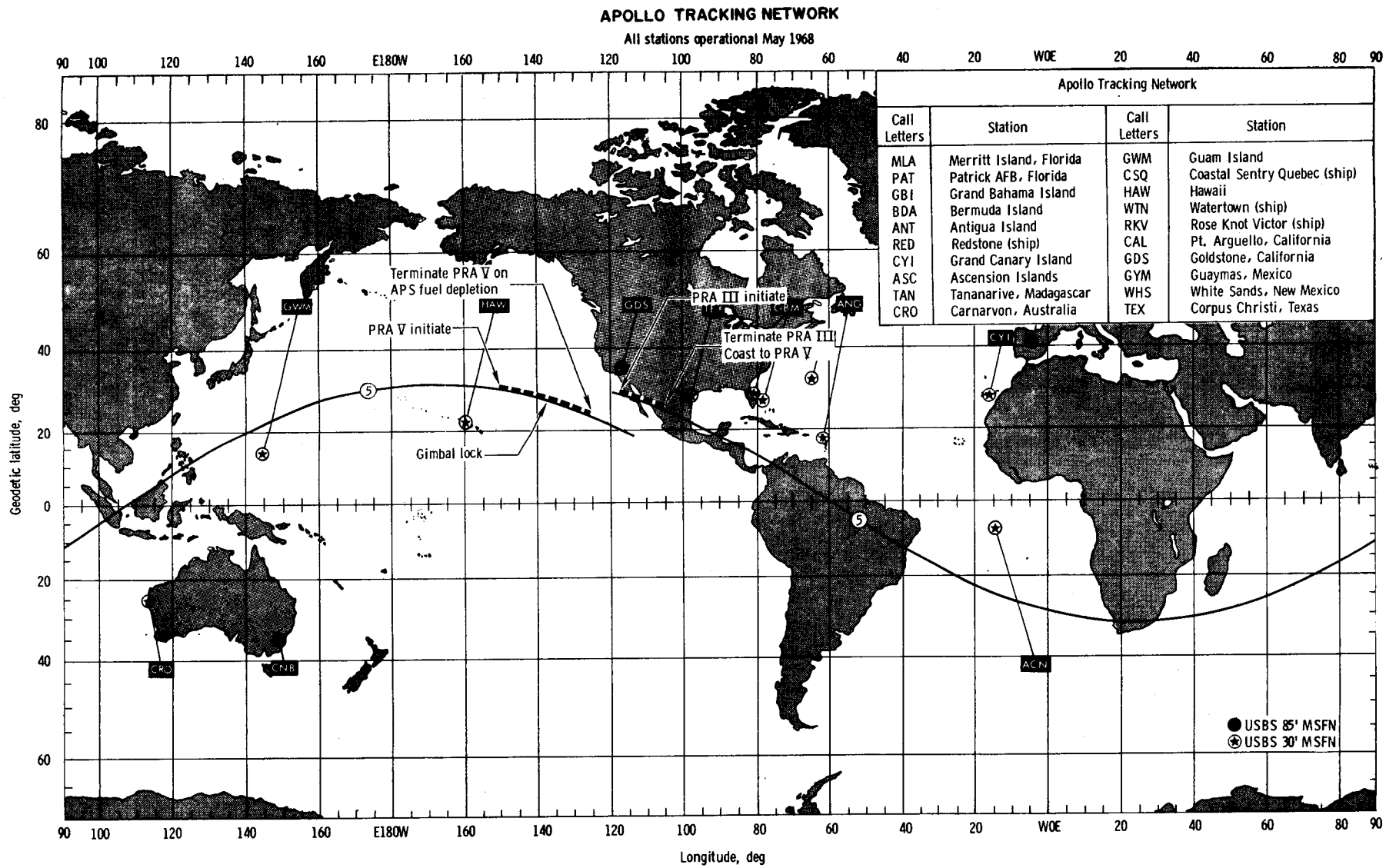
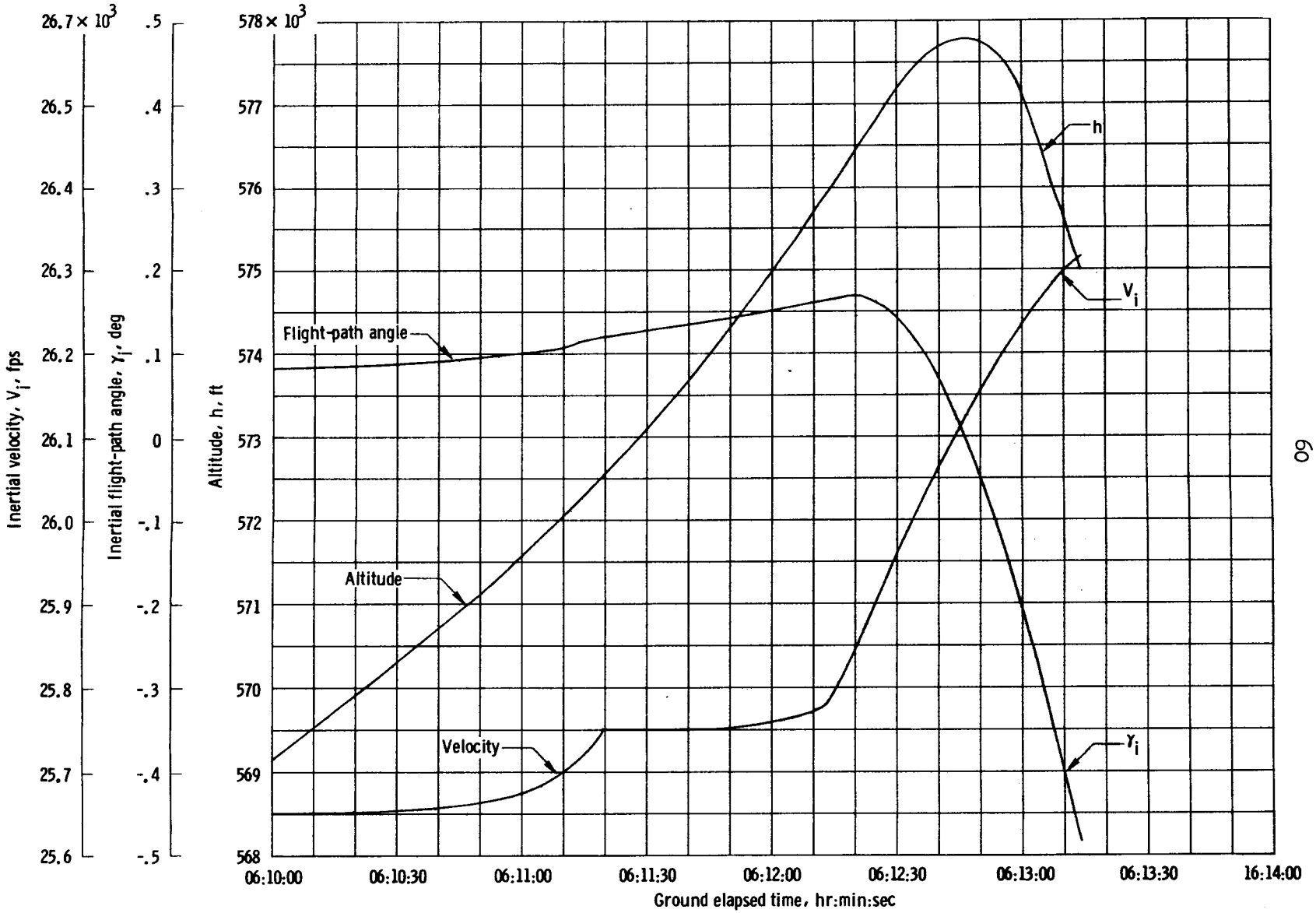
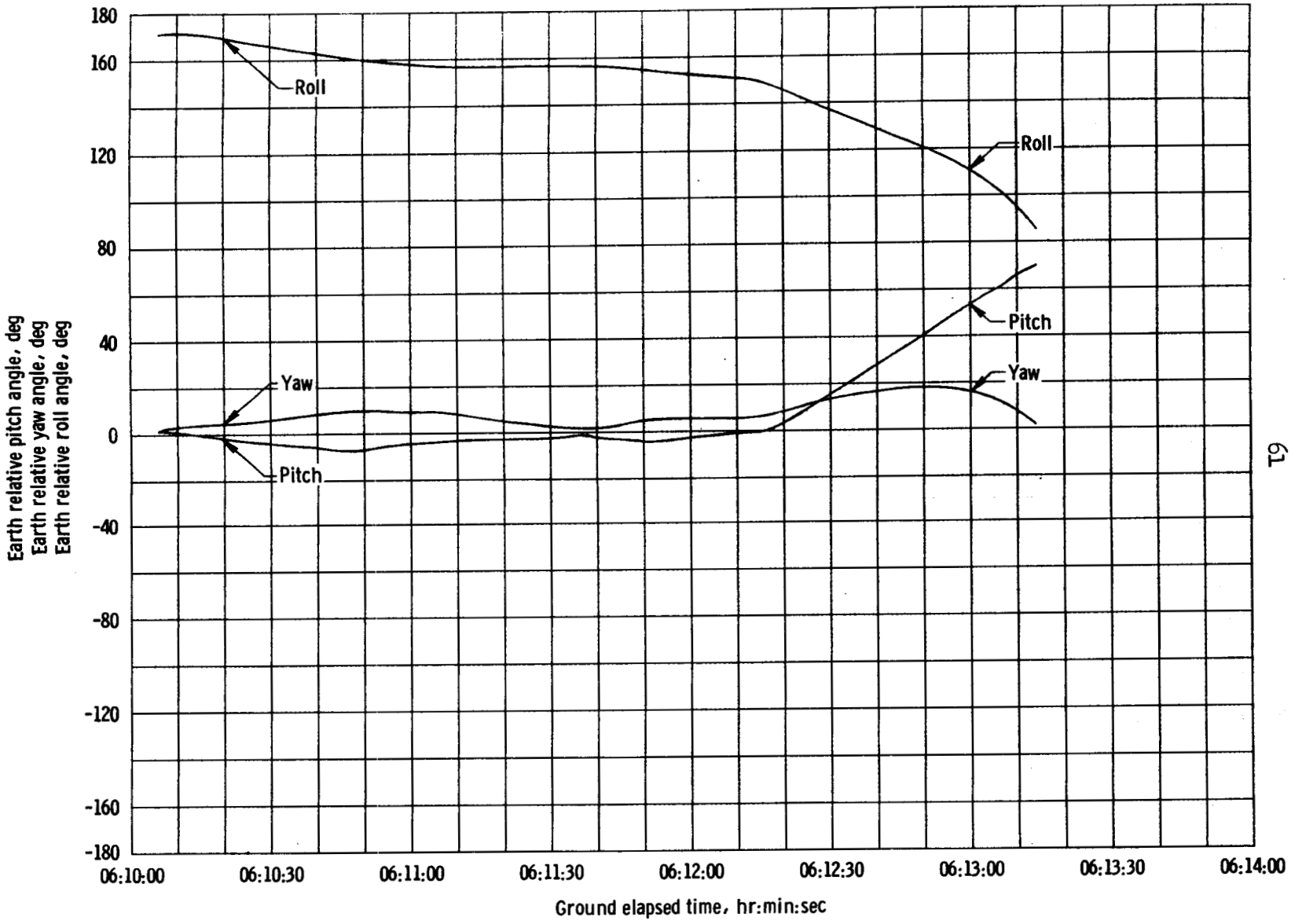


Figure 3.- Concluded.



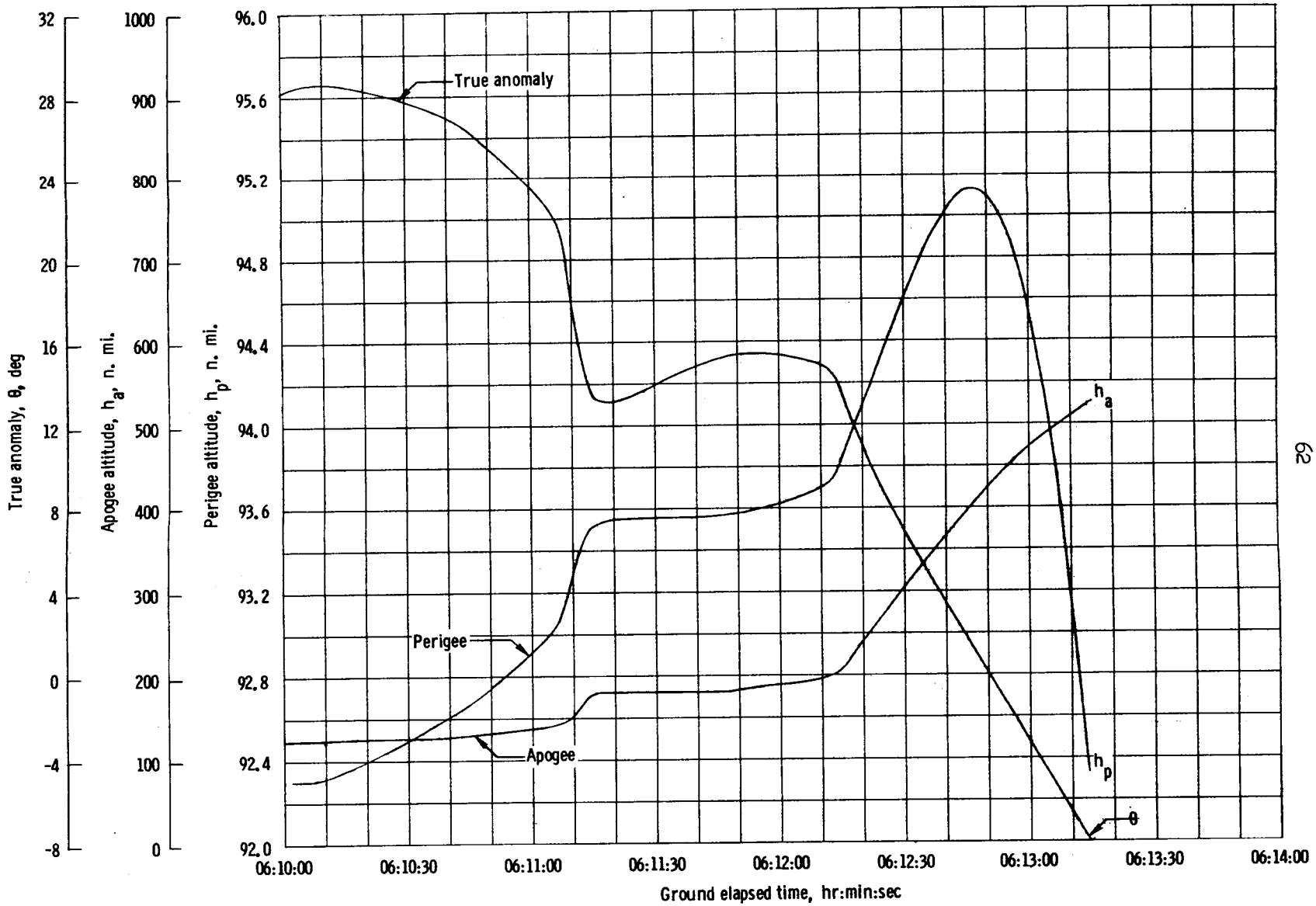
(a) Inertial velocity, inertial flight-path angle, and altitude.

Figure 4.- Trajectory parameter time histories for the PRA III sequence.



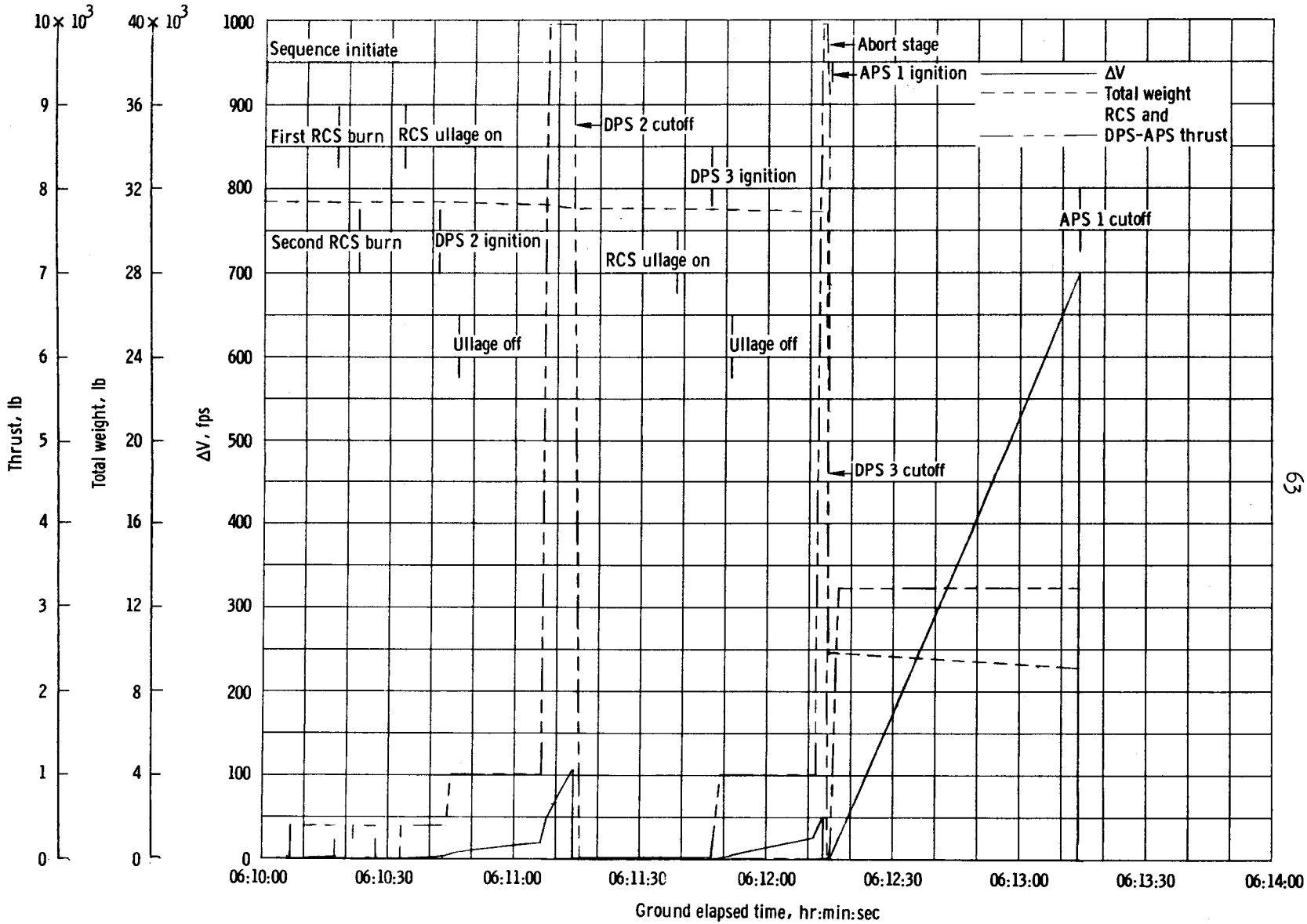
(b) Body pitch, body yaw and body roll.

Figure 4.- Continued.



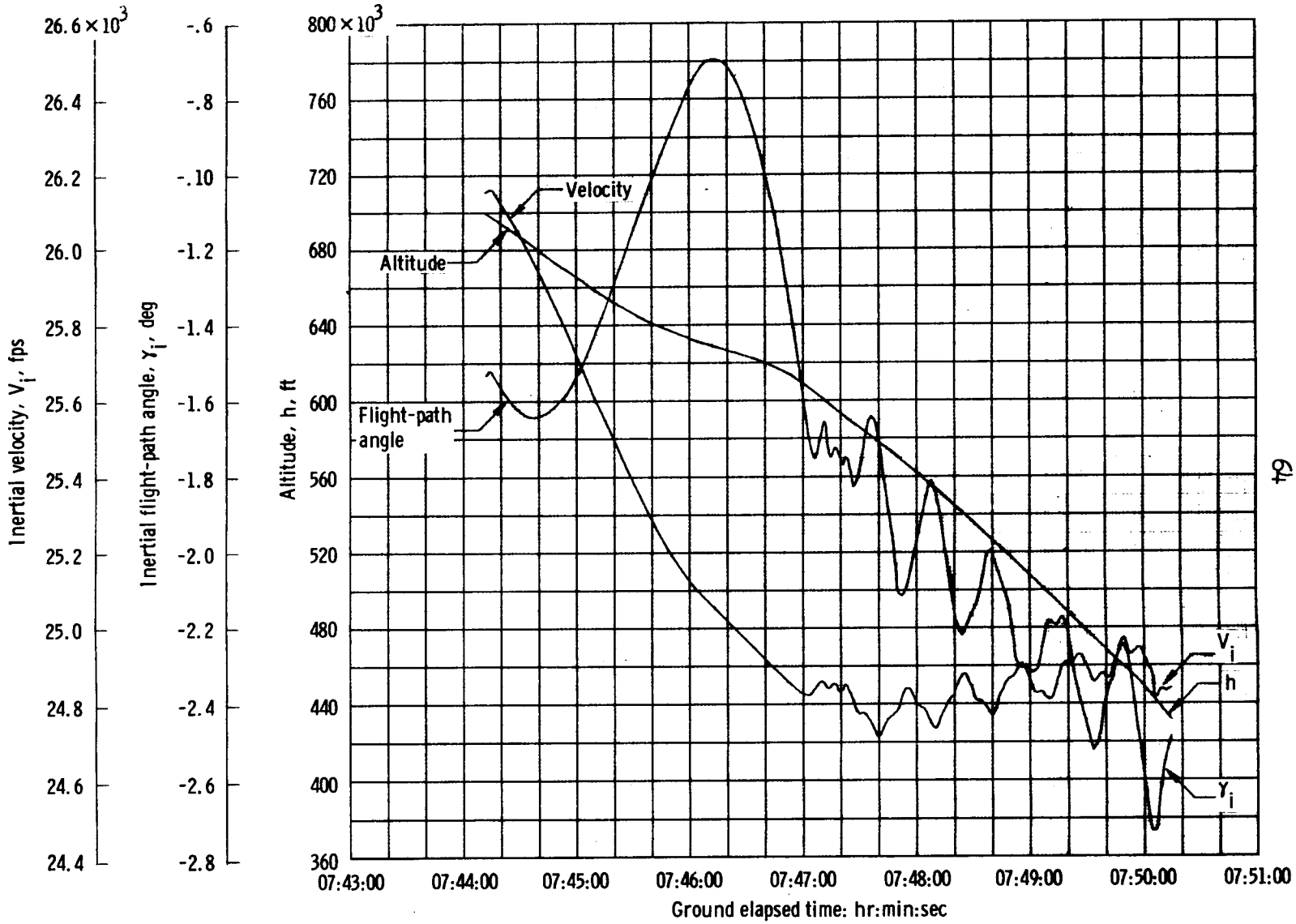
(c) True anomaly, apogee altitude, and perigee altitude.

Figure 4. - Continued.



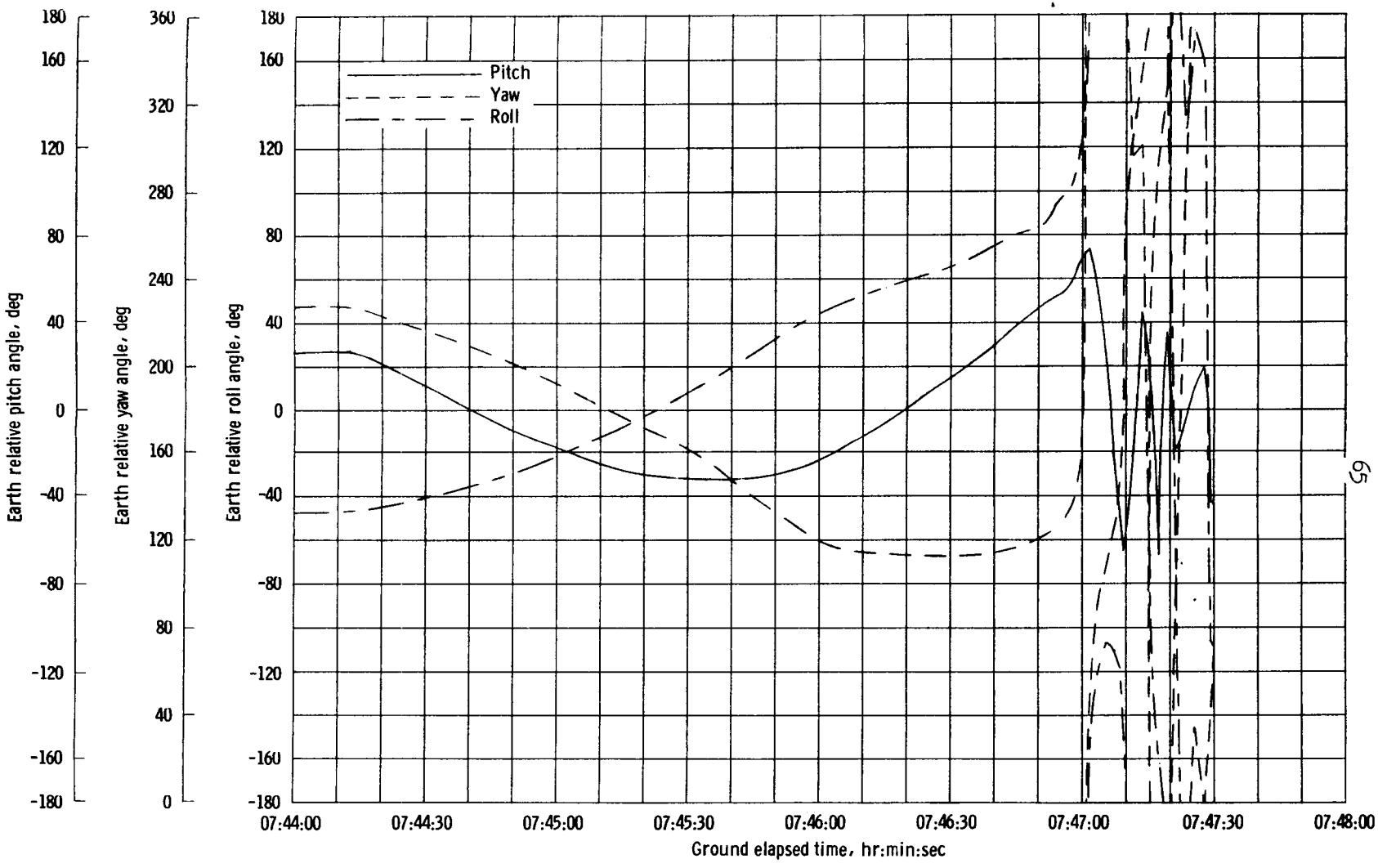
(d) Change in velocity, weight, and thrust.

Figure 4.- Concluded.



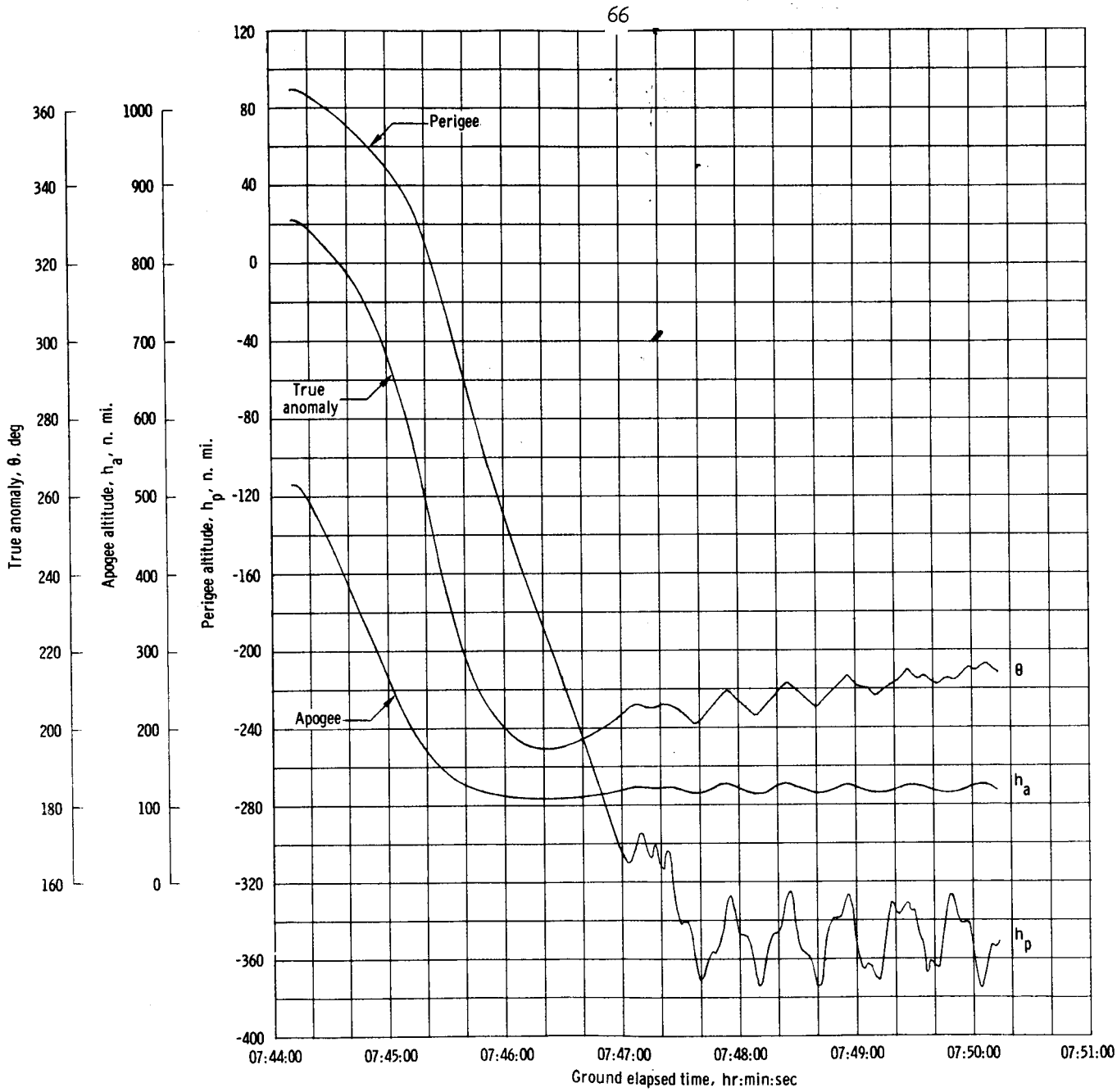
(a) Inertial velocity, inertial flight-path angle, and altitude.

Figure 5. - Trajectory parameter time histories for the PRA V sequence.



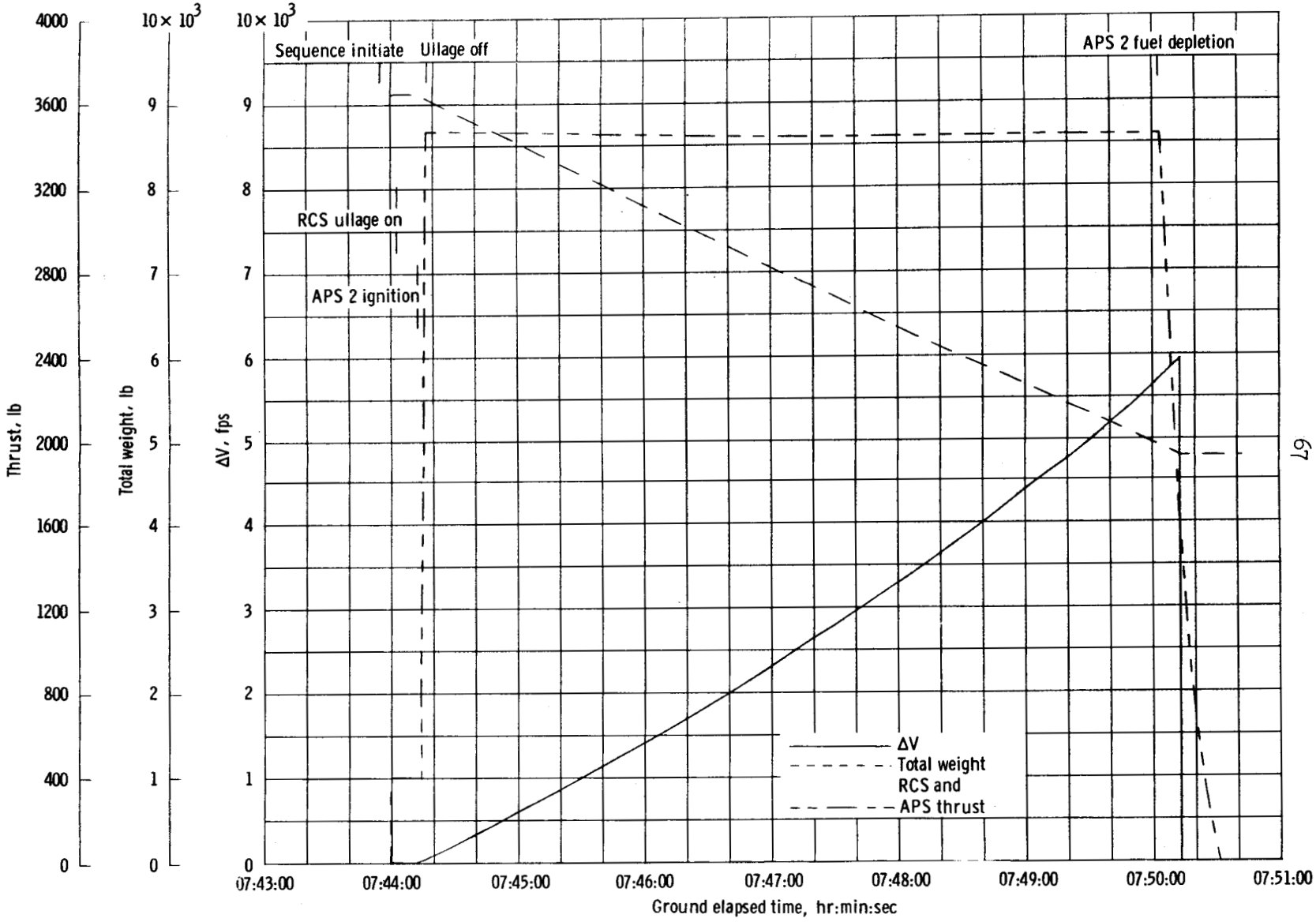
(b) Body pitch, body yaw and body roll.

Figure 5. - Continued.



(c) True anomaly, apogee altitude, and perigee altitude.

Figure 5. - Continued.



(d) Change in velocity, weight, and thrust.

Figure 5. - Concluded.

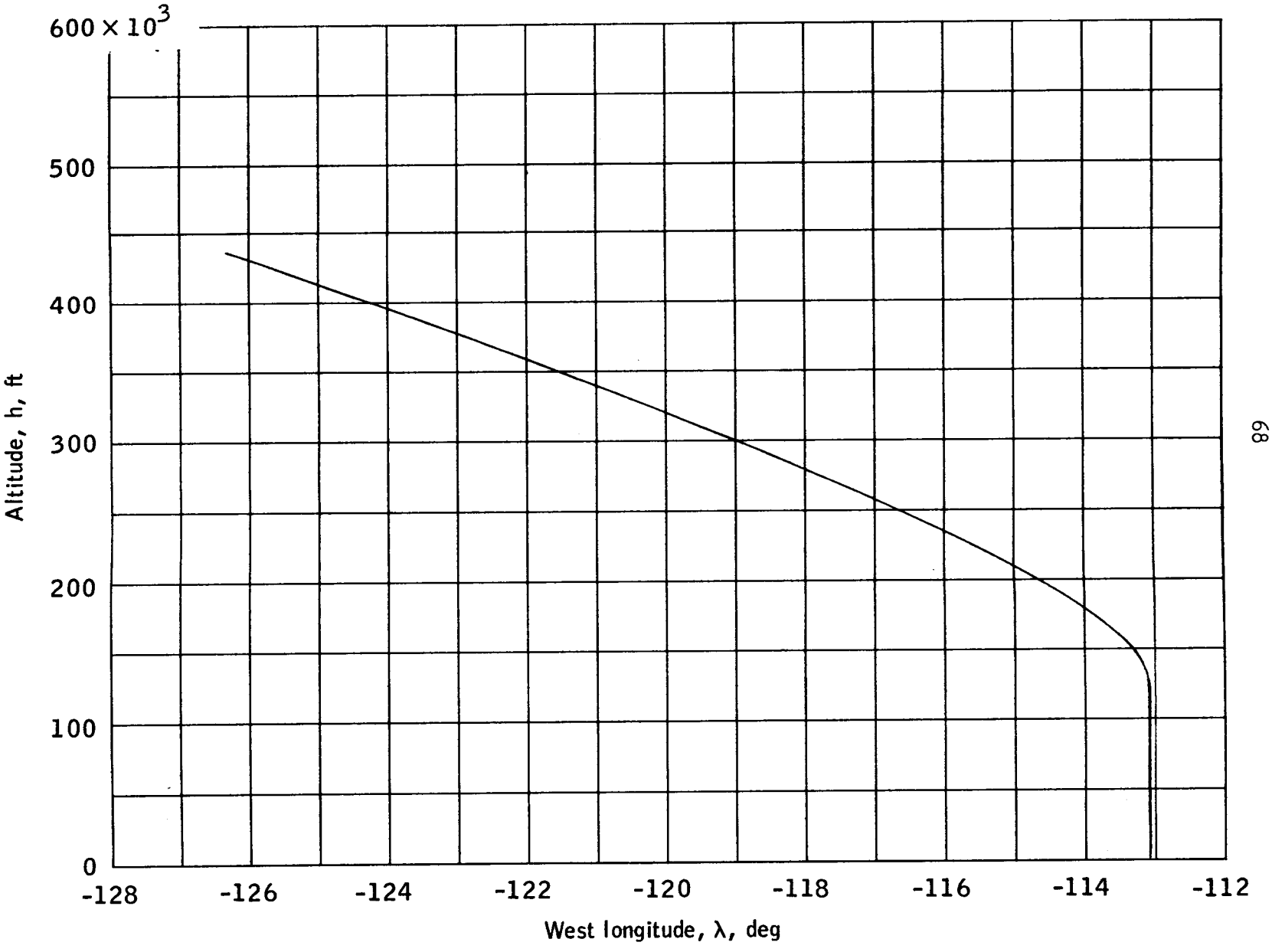


Figure 6.- Reentry altitude history.

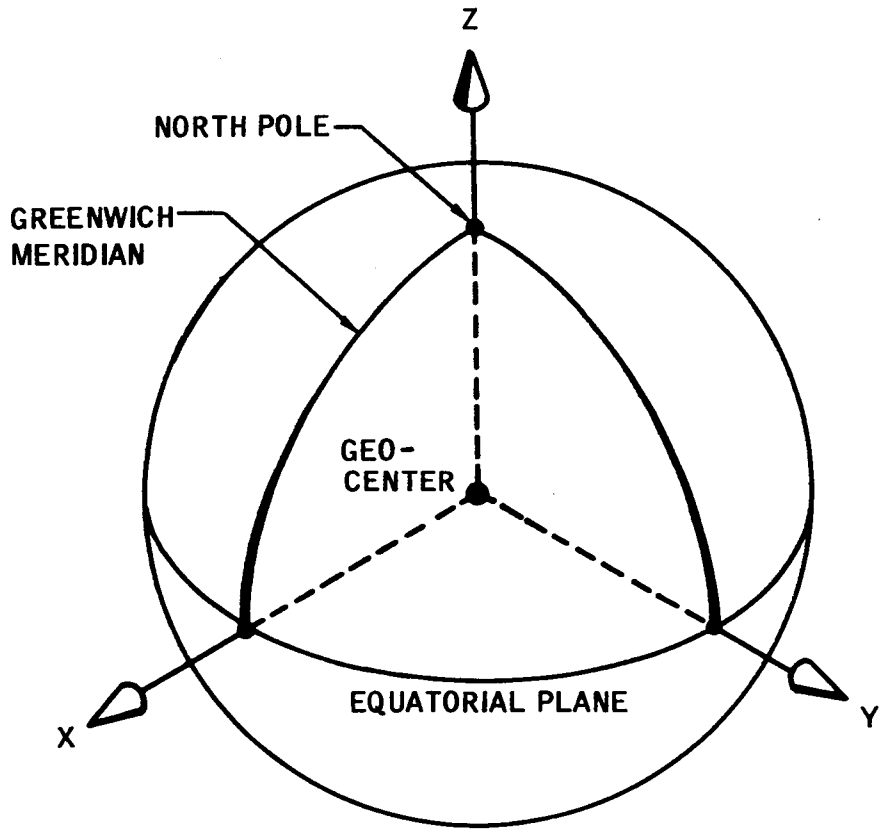


Figure 7.- Earth centered inertial (ECI) coordinate system.

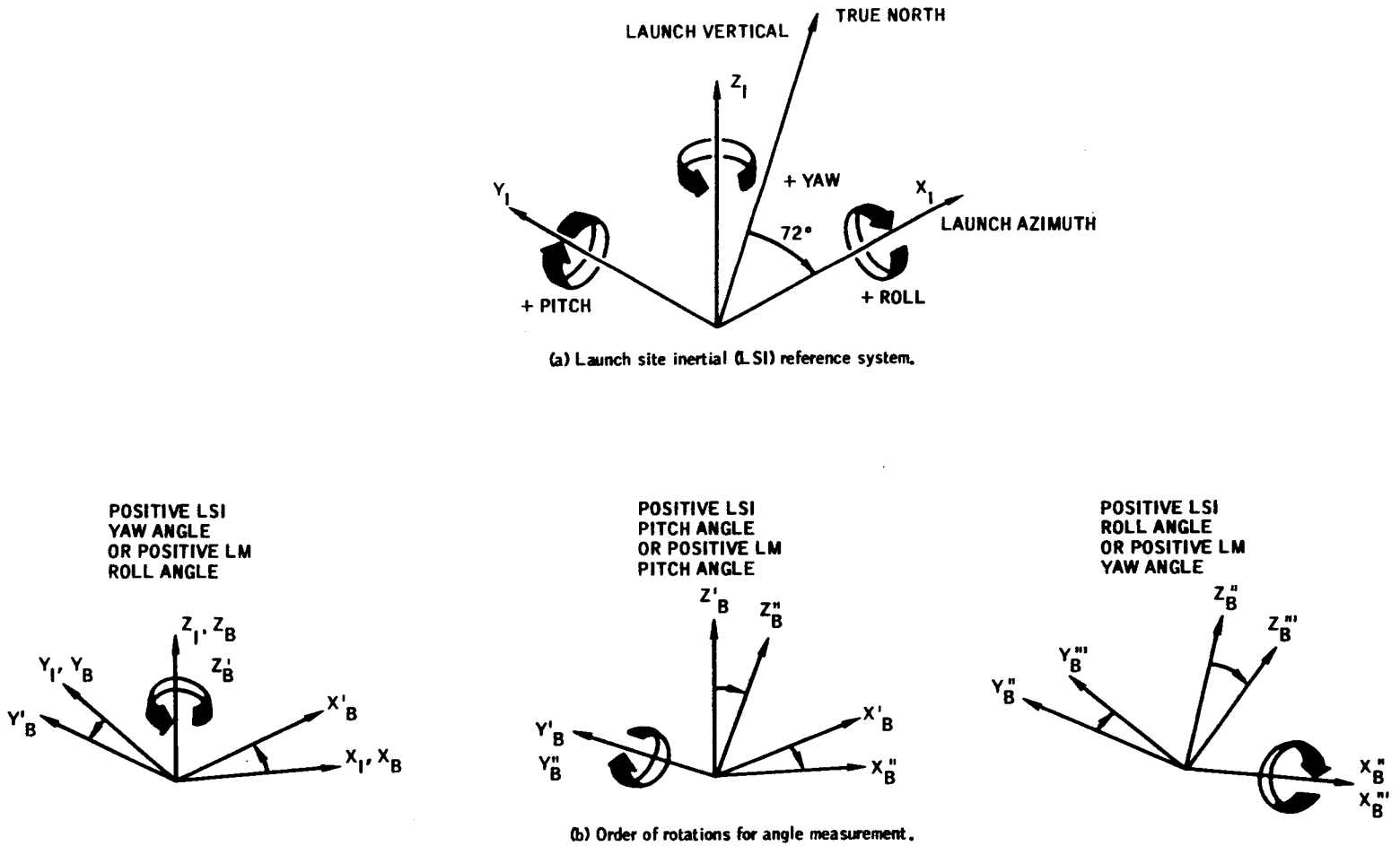
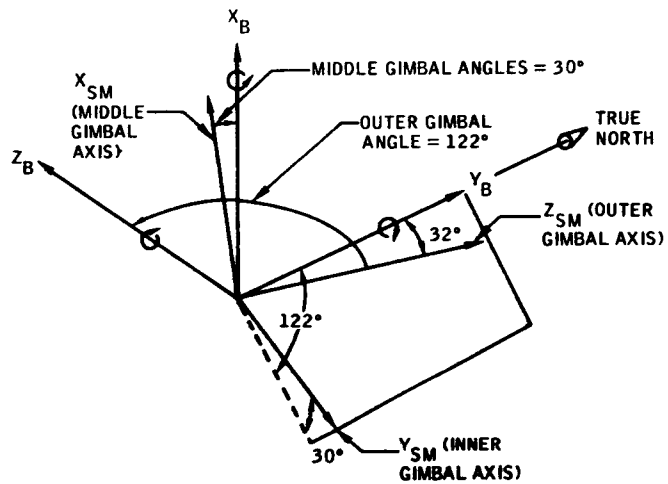
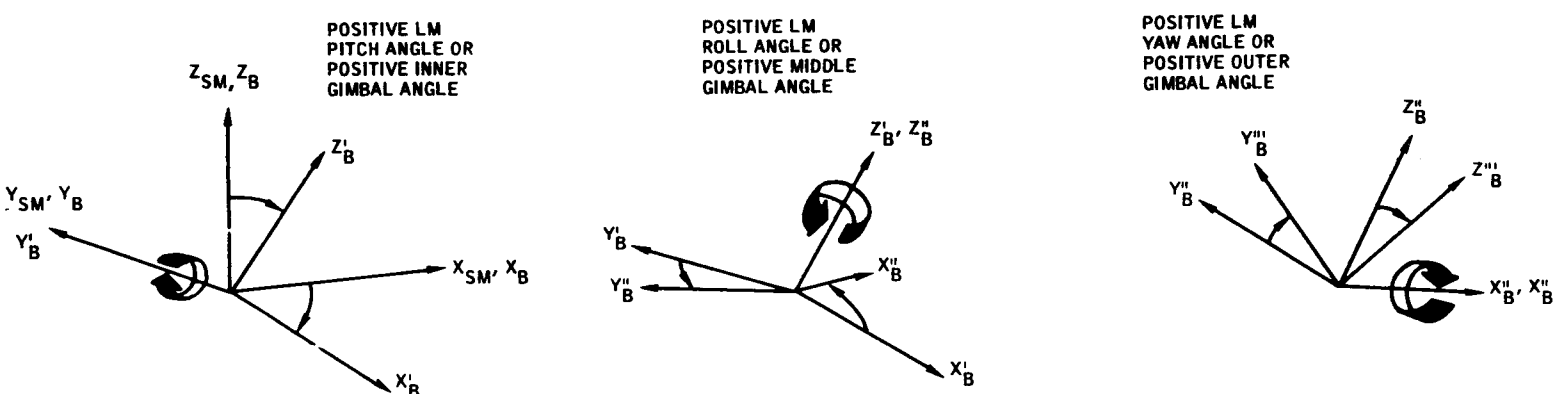


Figure 8.- Launch site inertial (LSI) reference system and order of rotation for angle measurement.

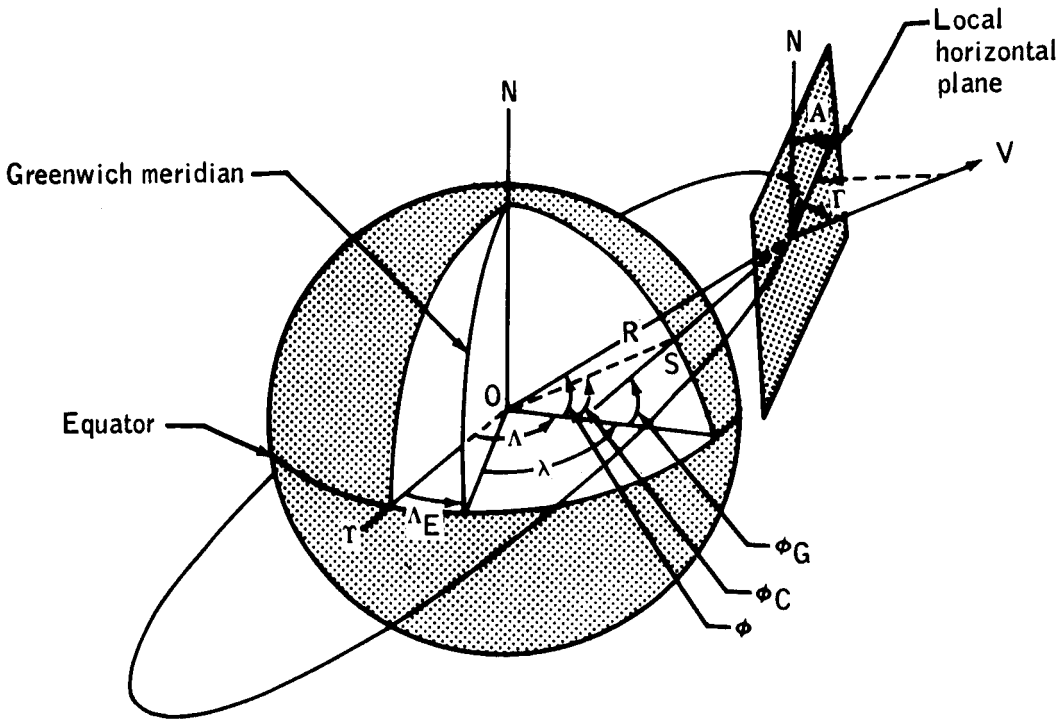


(a) Inertial measurement unit (IMU) reference system.



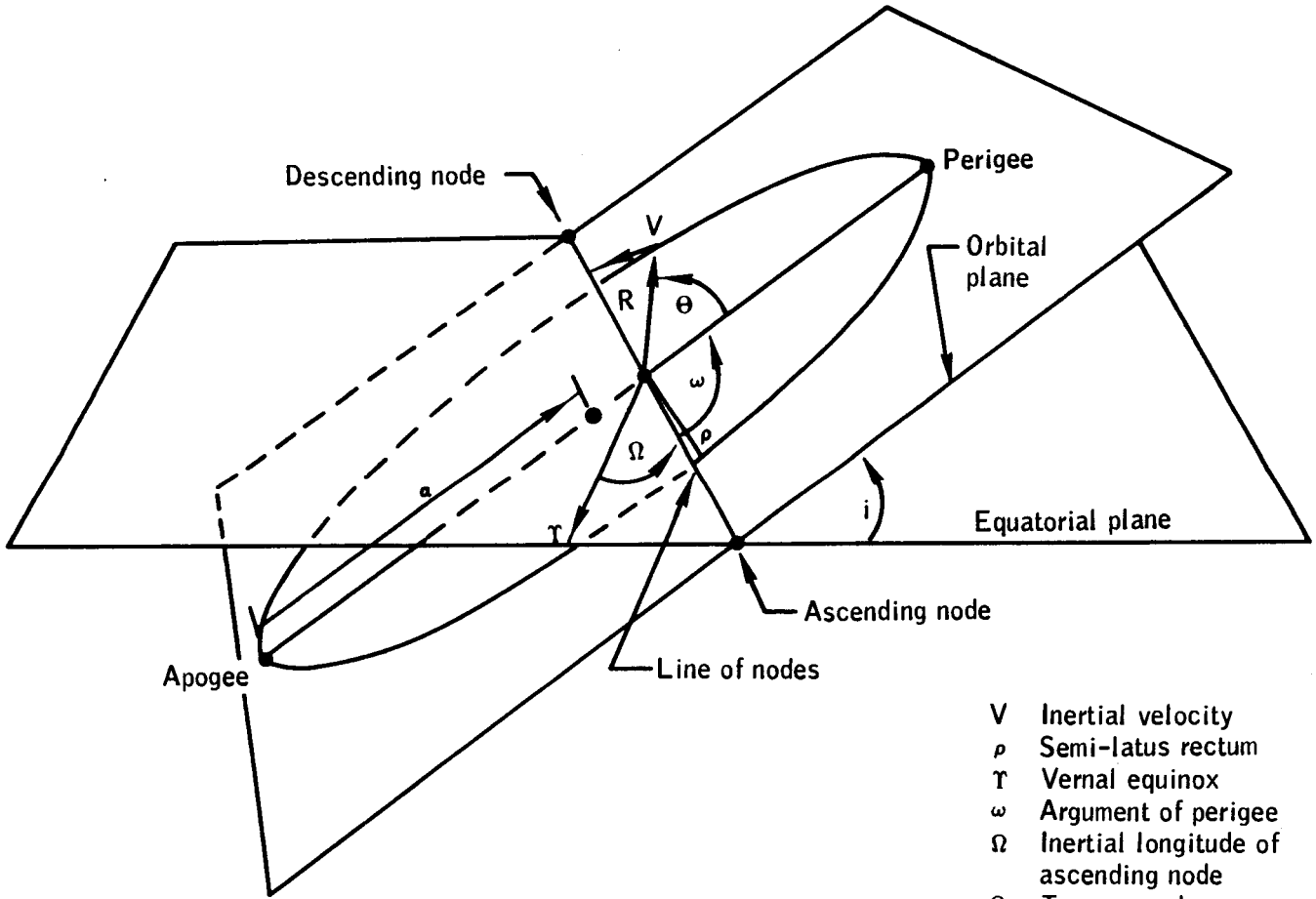
(b) Order of rotation for angle measurement.

Figure 9.- Inertial measurement unit (IMU) reference system (on-pad alignment) and order of rotation for angle measurement.



Λ_E	Right ascension of Greenwich
Λ	Right ascension of vehicle
λ	Vehicle longitude
Φ_G	Geodetic latitude
Φ_C	Geocentric latitude
Φ	Vehicle declination
R	Radius vector
V	Inertial velocity
A	Inertial azimuth
N	True North
Γ	Inertial flight-path-angle
Υ	Vernal equinox
S	Subsatellite point
O	Center of the earth

Figure 10.- Trajectory parameters.



V Inertial velocity
ρ Semi-latus rectum
♈ Vernal equinox
ω Argument of perigee
Ω Inertial longitude of ascending node
Θ True anomaly
i Inclination
a Semimajor axis
R Radius vector

Figure 11.- Orbital geometry.

REFERENCE

1. Apollo V Mission Evaluation Team: Apollo V Mission Report. MSC-PA-R-68-7, March 27, 1968.