https://ntrs.nasa.gov/search.jsp?R=19760004105 2017-10-31T13:40:54+00:00Z

General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.

- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.

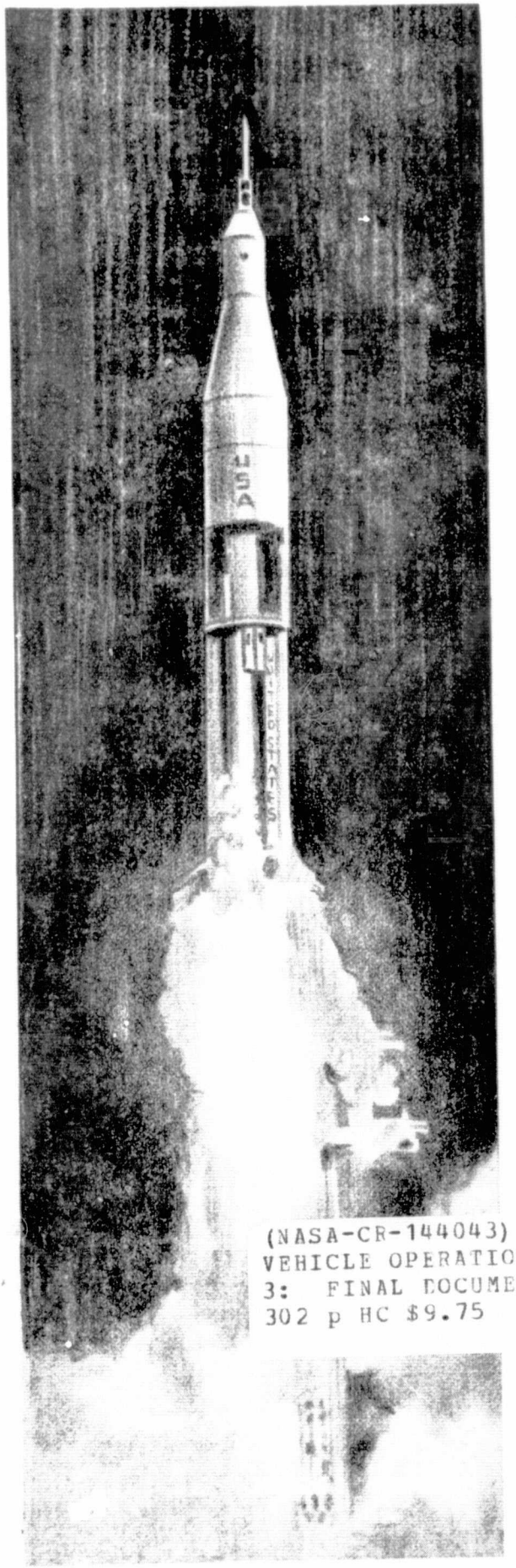
- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.

- This document is paginated as submitted by the original source.

- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

Produced by the NASA Center for Aerospace Information (CASI)

TN-FT-74-35



Contract NAS8-4016
Apollo/Soyuz Test Project

DRL 444-V3c

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

PART III
FINAL DOCUMENTATION

JANUARY 21, 1975

SPACE DIVISION CHRYSLER CORPORATION

(NASA-CR-144043) ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY. PART 3: FINAL DOCUMENTATION (Chrysler Corp.) 302 p HC $9.75 CSCL 22C

N76-11193

Unclas
G3/13 01379

NOV 1975
RECEIVED
NASA STI FACILITY
INPUT BRANCH

TECHNICAL NOTE TN-FT-74-35

DRL 444 - V3c

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

Part III

Final Documentation

January 21, 1975

Contract NAS 8-4016
Apollo/Soyuz Test Project

by

FLIGHT TECHNOLOGY BRANCH

CHRYSLER CORPORATION SPACE DIVISION

Prepared by: A. B. Carter, G. W. Klug, and N. W. Williams

Approved by: R. M. Blackstock
R. M. Blackstock, Supervisor
Performance and Mission
Analysis Group

R. D. Taylor
R. D. Taylor, Managing Engineer
Flight Mechanics Section

J. G. Swider
J. G. Swider, Manager
Flight Technology Branch

R. H. Ross
R. H. Ross, Deputy Project Manager
Vehicle Systems

FOREWORD

This document is Data Requirements List (DRL) Item 444-V3c, the final documentation required for the ASTP (SA-210) Launch Vehicle Operational Flight Trajectory. The trajectory was developed in compliance with Contract NAS 8-4016, Schedule II, Modification MSFC-1, Amendment 199.

Acknowledgements are made to the personnel of Marshall Space Flight Center, SA&I-EL24 for their assistance and cooperation.

TABLE OF CONTENTS

	Page
FOREWORD	i
TABLE OF CONTENTS	ii
LIST OF TABLES	iv
LIST OF ILLUSTRATIONS	vi
DEFINITIONS AND SYMBOLS	ix
SUMMARY	1
1.0 INTRODUCTION	4
2.0 MISSION DESCRIPTION	5
2.1 Mission Objectives	6
2.2 Trajectory Groundrules and Constraints	6
3.0 LAUNCH VEHICLE AND FLIGHT ENVIRONMENT	9
3.1 Configuration	9
3.2 Mass Characteristics	9
3.3 Aerodynamic Properties	10
3.4 Propulsion Systems	10
3.5 Guidance Systems	11
3.6 Control Systems	13
3.7 Flight Environment Description	13
4.0 TRAJECTORY	14
4.1 S-IB Stage Powered Flight Phase	18
4.2 S-IVB Stage Powered Flight Phase	18
4.3 Orbital Flight Phase	18
4.4 Spent S-IB Stage Trajectory	19

TABLE OF CONTENTS (CONT'D)

		Page
5.0	TRACKING AND PERFORMANCE SUMMARY	20
	5.1 Tracking Summary	20
	5.2 Launch Vehicle Performance Characteristics	20
6.0	GOVERNMENT FURNISHED DOCUMENTATION	21
7.0	REFERENCES	23
APPENDIX A.	"LAUNCH VEHICLE CHARACTERISTICS AND FLIGHT ENVIRONMENT"	101
APPENDIX B.	"LAUNCH VEHICLE TRAJECTORY GUIDANCE PRESETTINGS"	119
APPENDIX C.	"NOMINAL TRAJECTORY LISTINGS, ENGLISH UNITS"	133
APPENDIX D.	"LAUNCH WINDOW OPENING TRAJECTORY DATA"	179
APPENDIX E.	"LAUNCH WINDOW CLOSING TRAJECTORY DATA"	231
DISTRIBUTION		282

LIST OF TABLES

Table	Description	Page
Nominal Trajectory Data		
1	Powered Flight Sequence of Events	26
2	Powered Flight Trajectory Event Summary	27
3	S-IB Stage End Conditions of Flight	28
4	S-IVB Stage End Conditions of Flight	29
5	Trajectory Listing: S-IB Stage Flight Data	31
6	Trajectory Listing: S-IVB Stage Flight Data	36
7	Trajectory Listing: S-IB Stage Reentry Data	46
8	Tracking and Communications Network	50
9	S-IVB Stage Orbital Flight Sequence of Events	51
10	S-IVB/CSM Separation Conditions	53
11	S-IVB Stage Orbital Flight Trajectory Listing	54
Appendix A: "Launch Vehicle Characteristics and Flight Environment"		
Nominal Trajectory Data		
1A	Vehicle Weight Breakdown	102
2A	Launch Vehicle Performance Characteristics	103
3A	S-IB Stage Mass Characteristics	104
4A	S-IVB Stage Mass Characteristics	105
5A	S-IB Stage Aerodynamic Characteristics	107
6A	S-IB Stage Propulsion Characteristics	108
7A	S-IVB Stage Propulsion Characteristics	109
Appendix B: "Launch Vehicle Trajectory Guidance Presettings"		
1B	S-IB Stage Steering Program	120
2B	S-IB Stage Pitch Attitude Command History	121
3B	Guidance Presettings	122

LIST OF TABLES (CONT'D)

Table	Description	Page
Appendix C: "Nominal Trajectory Listings, English Units"		
1C	S-IB Stage Flight Data	134
2C	S-IVB Stage Flight Data	139
3C	S-IVB Stage Orbital Flight Data	149
4C	S-IB Stage Reentry Data	174
Appendix D: "Launch Window Opening Trajectory Data"		
1D	Powered Flight Sequence of Events	180
2D	Powered Flight Trajectory Event Summary	181
3D	S-IB Stage End Conditions of Flight	182
4D	S-IVB Stage End Conditions of Flight	183
5D	Trajectory Listing: S-IB Stage Flight Data, Metric Units	185
6D	Trajectory Listing: S-IVB Stage Flight Data, Metric Units	190
7D	S-IVB/CSM Separation Conditions	200
8D	Trajectory Listing: S-IB Stage Flight Data, English Units	201
9D	Trajectory Listing: S-IVB Stage Flight Data, English Units	206
Appendix E: "Launch Window Closing Trajectory Data"		
1E	Powered Flight Sequence of Events	232
2E	Powered Flight Trajectory Event Summary	232
3E	S-IB Stage End Conditions of Flight	234
4E	S-IVB Stage End Conditions of Flight	235
5E	Trajectory Listing: S-IB Stage Flight Data, Metric Units	237
6E	Trajectory Listing: S-IVB Stage Flight Data, Metric Units	242
7E	S-IVB/CSM Separation Conditions	252
8E	Trajectory Listing: S-IB Stage Flight Data, English Units	253
9E	Trajectory Listing: S-IVB Stage Flight Data, English Units	258

LIST OF ILLUSTRATIONS

Figure	Description	Page
	Nominal Trajectory Data	
1	Launch Window Requirements	79
	Powered Flight Phase	
2	Flight Profiles: Altitude vs. Ground Range	80
3	Altitude Histories	81
4	Velocity Histories	82
5	Space Fixed Path Angle Histories	83
6	Earth Fixed Path Angle Histories	84
7	Pitch Angle of Attack History	85
8	Dynamic Pressure History	86
9	Aerodynamic Load Indicator History	87
10	Longitudinal Acceleration History	88
11	Inertial Pitch Attitude and Pitch Attitude Command Histories	89
12	Inertial Yaw Attitude and Yaw Attitude Command Histories	90
13	Pitch, Yaw and Roll Body Rate Histories	91
14	Inertial Path Angle vs. Inertial Velocity	92
15	Altitude vs. Inertial Velocity	93
16	Tracking Summary	94
	Orbital Flight Phase	
17	Altitude History	95
18	Space Fixed Velocity History	96
19	Inertial Pitch Attitude History	97

LIST OF ILLUSTRATIONS (CONT'D)

Figure	Description	Page
20	Inertial Yaw Attitude History	98
21	Inertial Roll Attitude History	99
22	Tracking and Telemetry Summary	100
Appendix A: "Launch Vehicle Characteristics and Flight Environment"		
1A	Vehicle Profile	111
2A	S-IB Stage Thrust History	112
3A	H-1 Engine Thrust Decay	113
4A	J-2 Engine Thrust Buildup	114
5A	J-2 Engine Thrust History	115
6A	J-2 Engine Thrust Decay	116
7A	July Mean Wind Profiles, Inertial Pitch and Yaw Plane Components	117
Appendix D: "Launch Window Opening Trajectory Data"		
1D	Flight Profile: Altitude vs. Ground Range	216
2D	Altitude History	217
3D	Velocity Histories	218
4D	Space Fixed Path Angle History	219
5D	Earth Fixed Path Angle History	220
6D	Pitch Angle of Attack History	221
7D	Dynamic Pressure History	222
8D	Aerodynamic Load Indicator History	223
9D	Longitudinal Acceleration History	224
10D	Inertial Pitch Attitude and Pitch Attitude Command Histories	225
11D	Inertial Yaw Attitude and Yaw Attitude Command Histories	226

LIST OF ILLUSTRATIONS (CONT'D)

Figure	Description	Page
12D	Pitch, Yaw, and Roll Body Rate Histories	227
13D	Inertial Path Angle vs. Inertial Velocity	228
14D	Altitude vs. Inertial Velocity	229
Appendix E: "Launch Window Closing Trajectory Data"		
1E	Flight Profile: Altitude vs. Ground Range	268
2E	Altitude History	269
3E	Velocity Histories	270
4E	Space Fixed Path Angle History	271
5E	Earth Fixed Path Angle History	272
6E	Pitch Angle of Attack History	273
7E	Dynamic Pressure History	274
8E	Aerodynamic Load Indicator History	275
9E	Longitudinal Acceleration History	276
10E	Inertial Pitch Attitude and Pitch Attitude Command Histories	277
11E	Inertial Yaw Attitude and Yaw Attitude Command Histories	278
12E	Pitch, Yaw, and Roll Body Rate Histories	279
13E	Inertial Path Angle vs. Inertial Velocity	280
14E	Altitude vs. Inertial Velocity	281

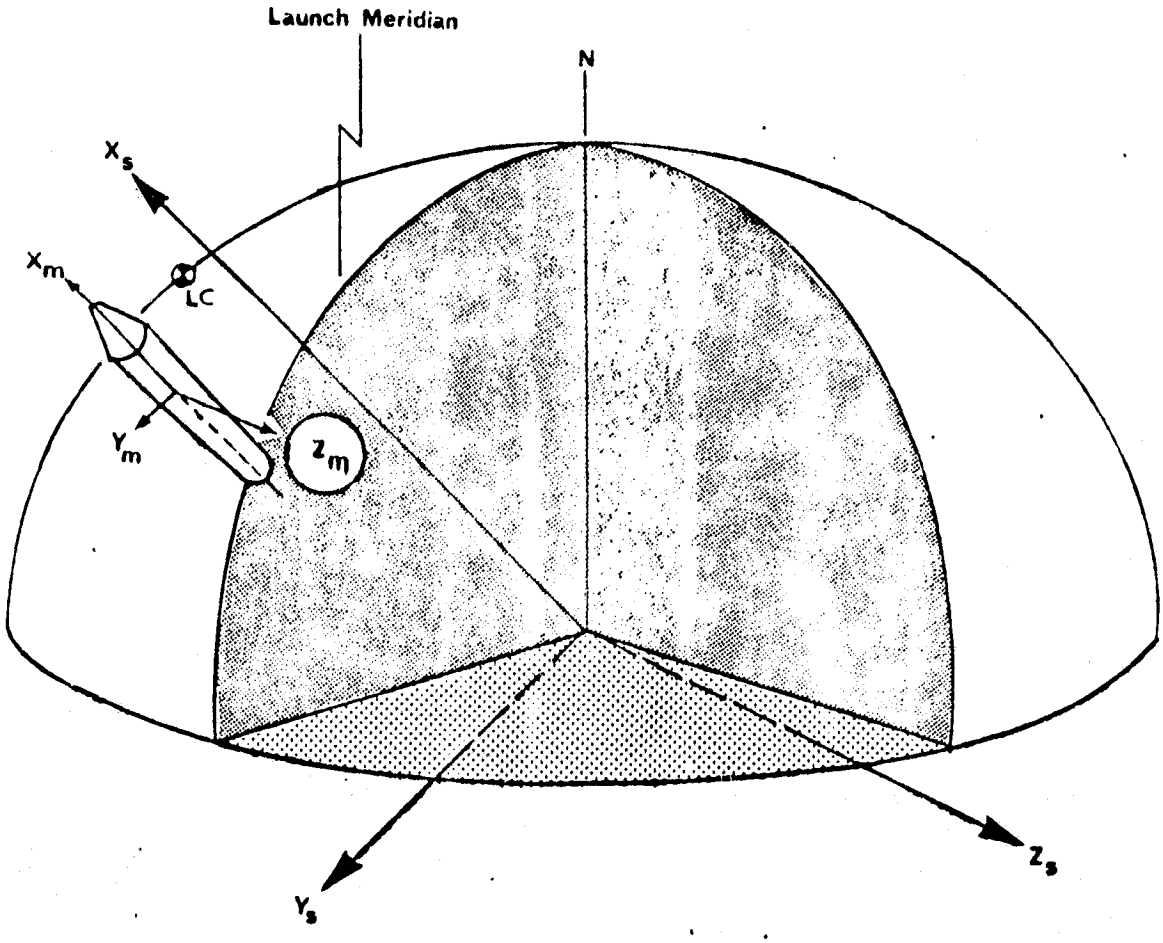
DEFINITIONS AND SYMBOLS

Aerodynamic Heating Indicator	$\int \frac{qV_r}{\pi/2 - \lvert\alpha_t\rvert} dt$ $\quad q$ = dynamic pressure, V_r = relative velocity, α_t = total angle of attack
Aerodynamic Load Indicator	Product of dynamic pressure and angle of attack.
Altitude	Vehicle altitude above the reference ellipsoid measured along the geocentric position vector.
Angle of Attack, Pitch	Angle between the pitch plane component of the relative velocity vector and the longitudinal axis of the vehicle, measured positive nose up.
Apogee Altitude	Apogee height of the osculating conic above the reference ellipsoid, referenced to the equatorial radius, 6378165 meters.
Attitude Command	Eulerian angle command, derived by the guidance system and transmitted to the control system.
Attitude Error	Difference between the vehicle attitude (pitch, yaw and roll Eulerian angles) and the vehicle attitude command.
Axial Force	Component of the resultant aerodynamic force along the vehicle longitudinal axis (X axis of PASCS 8a), measured positive toward the nose of the vehicle.
Descending Node Argument	Angle measured in the equatorial plane between the orbit descending node and the space fixed launch meridian defined at Guidance Reference Release.
Drag	Component of the resultant aerodynamic force along the relative velocity vector, measured positive opposite to the velocit vector.
Dynamic Pressure	$\frac{1}{2}$ x (Density) x (Relative Velocity)^2

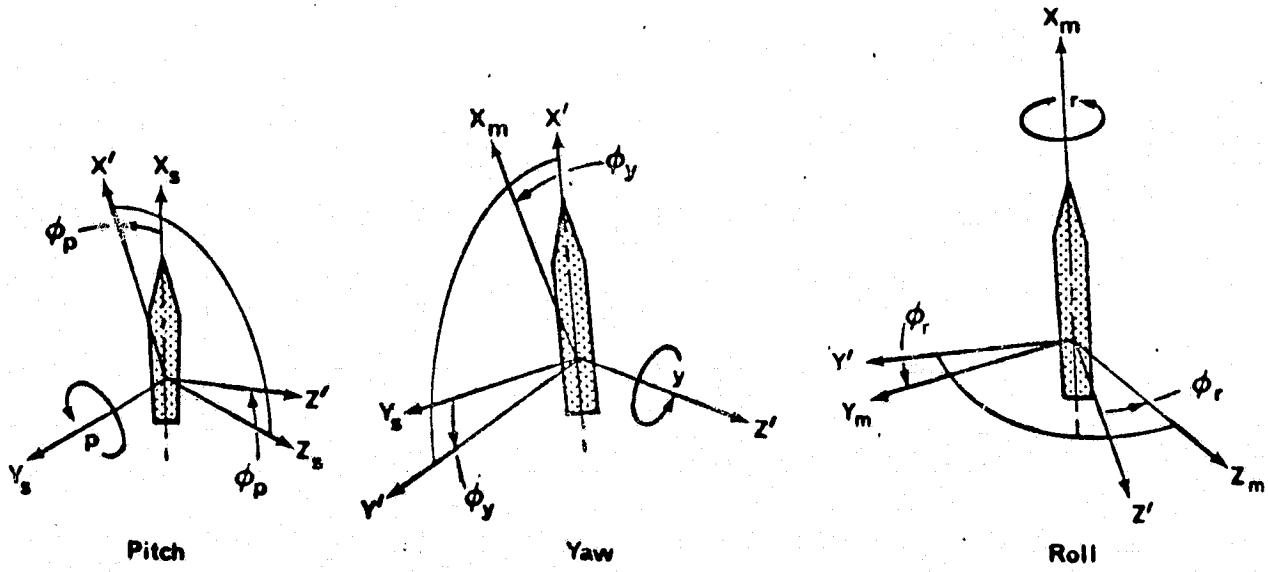
DEFINITIONS AND SYMBOLS (CONT'D)

Earth Fixed Cross Range	Ye component of PASCS 10 position vector.
Earth Fixed Flight Path Angle	Angle between the earth fixed velocity vector and the earth fixed geocentric position vector (PASCS 11), measured positive downrange from the position vector.
Earth Fixed Position	Position vector/components in an earth-fixed pad-centered plumbline coordinate system. The Xe axis is coincident with the reference ellipsoid normal, positive upward. The Ze axis is parallel to the earth-fixed aiming azimuth and is positive downrange. The Ye axis completes a right handed system. (PASCS 10)
Earth Fixed Velocity	Velocity vector/components in PASCS 10.
Earth Fixed Velocity Magnitude	$\sqrt{\dot{X}e^2 + \dot{Y}e^2 + \dot{Z}e^2}$
Eccentricity	Eccentricity of the osculating conic.
Flight Azimuth	Angle defining orientation of the space fixed coordinate system downrange axis, Zs, at Guidance Reference Release, measured positive east of north in plane normal to the space fixed Xs axis.
Geocentric Declination	Angle between the geocentric radius vector and the true equatorial plane, measured positive north of the equator.
Geodetic Latitude	Angle between the reference ellipsoid normal through the point of interest and the true equatorial plane, measured positive north of the equator.
Ground Range	Surface distance from launch site to the sub-vehicle point, positive east (0° - 180°).
Inclination	Angle between the instantaneous flight plane and the equatorial plane.
Inertial Range Angle	Angle between the instantaneous space fixed position vector and the space fixed position vector at Guidance Reference Release.

Longitude	Angle between the Greenwich meridian plane and the projection of the geocentric position vector in the equatorial plane, measured positive east of Greenwich.
Longitudinal Acceleration	That part of the total measurable acceleration directed along the longitudinal axis of the vehicle.
Mach Number	(Relative Velocity) ÷ (Local Speed of Sound)
Mass	Mass of the vehicle.
Navigation Coordinate System	This system is identical to PASCS 13 with ideal navigation.
Normal Force	Magnitude of the resultant aerodynamic force normal to the vehicle longitudinal axis, and in the plane defined by that axis and the relative velocity vector.
Perigee Altitude	Perigee height of the osculating conic above the reference ellipsoid, referenced to the equatorial radius, 6378165 meters.
Period	Period of the osculating conic.
Pitch, Yaw, Roll (Inertial)	Eulerian angles of vehicle attitude measured with respect to the space fixed coordinate system. Vehicle attitude is defined by the ordered rotation of pitch, yaw, and roll. (See illustration)
Radius	Space fixed position vector magnitude, $\sqrt{XS^2 + YS^2 + ZS^2}$.
Range	Surface distance from launch site to the sub-vehicle point, positive east (0° - 180°).
Relative Vehicle Attitude	Pitch, yaw and roll angles of the vehicle in an earth relative system. The roll axis is the projection of the velocity vector in the local horizontal plane; the yaw axis is in the local vertical plane, positive toward the center of the earth; the pitch axis completes a right handed system. Vehicle attitude is defined by ordered rotation-pitch, yaw and roll.



$$\bar{X}_m = (\phi_r)_1 (\phi_y)_3 (\phi_p)_2 \bar{X}_s$$



DEFINITIONS AND SYMBOLS (CONT'D)

Relative Velocity	Velocity relative to the atmosphere (includes wind velocity).
Semi-Major Axis	Length of the chord in the orbit plane connecting the apogee and the perigee of the osculating conic.
Space Fixed Cross Range	Ys component of PASCS 13 position vector.
Space Fixed Flight Path Angle	Angle between the space fixed velocity vector and the radius vector (PASCS 13), measured positive downrange from radius vector.
Space Fixed Position	Position vector/components in a space fixed earth centered, plumbline coordinate system defined at Guidance Reference Release. The Xs axis is parallel to the reference ellipsoid normal which passes through the launch site. The Zs axis is parallel to, and positive in the same direction as, the earth-fixed firing azimuth. The Ys axis completes the right handed system. This is Project Apollo Standard Coordinate System 13. (PASCS 13).
Space Fixed Velocity	Velocity vector/components in PASCS 13.
Space Fixed Velocity Magnitude	$\sqrt{\dot{X}s^2 + \dot{Y}s^2 + \dot{Z}s^2}$
Time	Instantaneous flight time referenced to first motion.
Three Sigma (3σ)	Three standard deviations.
Thrust	Total effective thrust magnitude, $\sqrt{FTX^2 + FTY^2 + FTZ^2}$.
True Anomaly	Angular displacement of the vehicle C.G. from the perigee, measured in the direction of the motion.
Velocity Vector Azimuth	The angle between the velocity vector projection on the earth's surface and true north.

Vehicle Weight	Instantaneous total vehicle weight.
X_4 Position Vector	Vehicle c.g. displacement components in a space fixed, right handed, target coordinate system with its origin at the center of the earth. The X_4 axis passes through the descending node of the orbit plane. The Z_4 axis lies in the desired orbit plane 90° downrange from the X_4 axis. The Y_4 axis completes a right handed system and is perpendicular to the orbit plane.

DEFINITION AND SYMBOLS (CONT'D)

AFETR	Air Force Eastern Test Range
AFB	Air Force Base
AHI	Aerodynamic Heating Indicator
APS	Auxiliary Propulsion System
APSO	Apollo Soyuz Program Office
AS	Apollo Saturn
ASTP	Apollo Soyuz Test Project
B-7	Trajectory Data Tape
C	C-Band Radar Stations
C/O	Cutoff
CS	Command System
CCSD	Chrysler Corporation Space Division
C.G.	Center of Gravity
CM	Command Module
CSM	Command and Service Modules
DELTA (Δ)	Increment
(ΔP)	Parameter Increment
DIA	Vehicle Diameter
DM	Docking Module
DRL	Data Requirements List
ECF	End Conditions of Flight
EMR	Engine Mixture Ratio
F	Average Longitudinal Sea Level Thrust
FPR	Flight Performance Reserve
FT	Flight Technology
g	Acceleration of Gravity at Sea Level (9.80665 m/sec^2)

GCS	Guidance Cutoff Signal
GET	Ground Elapsed Time
GFD	Government Furnished Documentation
GH_2	Gaseous Hydrogen
GMT	Greenwich Mean Time
GRR	Guidance Reference Release
GSFC	Goddard Space Flight Center
H-1	S-IB Stage Engine
i	Inclination
IBM	International Business Machines Corp.
IECO	Inboard Engine Cutoff Signal
IGM	Iterative Guidance Mode
IMU	Inertial Measurement Unit
ISP	Specific Impulse
IU	Instrument Unit
J-2	S-IVB Stage Engine
KSC	Kennedy Spaceflight Center
LAC	Loss of Attitude Control
LC	Launch Complex
LES	Launch Escape System
LH_2	Liquid Hydrogen
LMSC/HREC	Lockheed Missiles and Space Company/Huntsville Research and Engineering Center
LOX	Liquid Oxygen
LSA	Level Sensor Actuation
LVDC	Launch Vehicle Digital Computer

DEFINITIONS AND SYMBOLS (CONT'D)

L/V	Launch Vehicle
LWC	Launch Window Closing
LWO	Launch Window Opening
MDAC	McDonnell Douglas Aircraft Corporation
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
N_2	Liquid Nitrogen
N/A	Not Applicable
N/D	Non-Dimensional
NPV	Non-Propulsive Vent
OECO	Outboard Engine Cutoff Signal
OI	Orbit Insertion
OT	Operational Trajectory
PASCS	Project Apollo Standard Coordinate System
POT	Preliminary Operational Flight Trajectory
PSF	Pounds Per Square Foot
q	Dynamic Pressure
RP-1	S-IB Propellant
RSS	Root-Sum-Square
S-IB	First Stage of the Saturn IB Launch Vehicle
S-IU	Saturn Launch Vehicle Instrument Vehicle
S-IVB	Second Stage of the Saturn IB Launch Vehicle
SA	Saturn
SC	Spacecraft

DEFINITIONS AND SYMBOLS (CONT'D)

SIGMA (σ)	Standard Deviation
(Σ)	Summation of
SLA	Spacecraft Launch Adapter
SM	Service Module
STA	Vehicle Station Location
T	Telemetry Stations; Time Base One Time
TO	Time Base Zero
T1	Time Base One
T2	Time Base Two
T3	Time Base Three
T4	Time Base Four
TN	Technical Note
UHF	Ultra High Frequency
USA	United States of America
USSR	Union of Soviet Socialist Republics
VHF	Very High Frequency
$\dot{W}$	Flowrate

SUMMARY

This report is the final documentation of the ASTP (SA-210) Launch Vehicle Operational Flight Trajectory. It contains trajectory data for a nominal and two launch window trajectory simulations. These trajectories are designed to insert a manned Apollo spacecraft into a 150/167 km. (81/90 n. mi.) earth orbit inclined at 51.78 degrees for rendezvous with a Soyuz spacecraft, which will be orbiting at approximately 225 km. (121.5 n. mi.). The specified launch date is July 15, 1975.

The launch window allocation defined for this launch is 500 pounds of S-IVB stage propellant. The Launch Window Opening (LWO) trajectory simulation depicts the earliest launch time deviation from a planar flight launch which conforms to this constraint. However, the Launch Window Closing (LWC) trajectory simulation is developed for the more stringent Air Force Eastern Test Range (AFETR) flight azimuth restriction of 37.4 degrees east-of-north. These trajectories enclose a 12.09 minute launch window, pertinent features of which are provided in the following tabulation. Planar flight data are included for mid-window reference.

Trajectory	Time Deviation From Planar Launch (min)	Target Node (deg)	Launch Azimuth (deg)	S-IVB Propellant Required for Yaw Steering (lbs)
Launch Window Opening	-6.45	157.775	48.463	500
Nominal	-2.84	156.887	45.158	96
Planar Flight	0.00	156.188	42.557	0
Launch Window Closing	5.64	154.802	37.400	384

It should be noted that the nominal launch time is 2.84 minutes prior to the planar launch opportunity. Consequently, 96 pounds of the 500 pound launch window allocation are required to provide the yaw steering necessary to achieve orbit insertion coplanar with the Soyuz.

The trajectory simulations documented reflect the launch window opening, the nominal, and the launch window closing launch times. These simulations extend from Guidance Reference Release (GRR) to 7.5 hours flight time. The latter is the expected lifetime of the Instrument Unit (IU) batteries, therefore the extent of S-IVB stage attitude control. The nominal simulation also includes the S-IB stage reentry trajectory. Detailed data tapes and print tapes for these three simulations are available at Marshall Space Flight Center (MSFC) SA&I-EL24. Pertinent data are displayed in this report for the complete nominal trajectory simulation and from GRR to S-IVB/CSM separation for the two launch window trajectory simulations.

The weight delivered to the specified 81/90 n. mi. orbit via the nominal boost trajectory is predicted to be 68,744 pounds. This weight includes a 37,400 pound payload and 2,612 pounds of available S-IVB stage propellants, including a 460 pound LH_2 bias. A breakdown of the nominal residual S-IVB stage propellants at Guidance Cutoff Signal (GCS) follows.

	LOX (Pounds)	LH_2 (Pounds)	Total (Pounds)
Total on board at GCS	2208	1792	4000
(1) Unuseable	440	948	1388
(2) Total Available	1768	844	2612
3 sigma FPR allocation (estimated)	1173	688	1861
Remaining launch window allocation (4.8:1 EMR)	334	70	404
Total allocation	1507	758	2265
Excess available over allocation	261	86	347
Excess useable at 4.8:1 EMR	261	54	315
Excess bias	0	32	32

(1) Unuseable determined by MSFC/MDAC to assure the required 6.7 m/sec depletion cutoff thrust decay velocity increment.

(2) Total available LH_2 includes a 460 pound bias.

The 315 pounds of excess useable propellant shown in the preceding table will provide a payload margin of approximately 333 pounds. Therefore, the SA-210 launch vehicle predicted payload capability, for the currently defined Apollo Soyuz Test Project (ASTP) mission with a 500 pound launch window allocation and a three sigma Flight Performance Reserve (FPR), is approximately 37,400 + 333 = 37,733 pounds.

The orbital simulation documented herein does not reflect the latest mission planning for a controlled S-IVB stage deorbit. However, it does provide orbital position and vehicle attitude data to aid in selection of a satisfactory propellant dump time. This report also contains descriptions of the launch vehicle configuration, systems and subsystems characteristics, flight environment, and tracking coverage.

Section 1.0

INTRODUCTION

The Apollo Soyuz Test Project (ASTP) is a joint American and Russian venture to accomplish a rendezvous and docking of a manned Apollo and a manned Soyuz spacecraft. The docking will be facilitated by an androgynous Docking Module (DM) carried by the Apollo spacecraft, which will connect with a compatible unit mounted on the Soyuz spacecraft. The DM will then serve as an airlock for crew transfers between the spacecraft.

The primary goal of the ASTP is to conduct space experiments which test and assure the compatibility of future manned spacecraft and station systems for rendezvous, dockings, and crew transfers. Accordingly, these tests will consist of evaluating compatible rendezvous systems in orbit, testing of androgynous docking assemblies, verifying crew transfer techniques, and acquiring joint flight experience for USA and USSR crews.

The ASTP currently consists of one Apollo-Soyuz rendezvous mission. The Soyuz will be launched first at approximately 1220 GMT on July 15, 1975 from Baikonur Kosmodrome, Kazakhstan. The Apollo will be launched approximately 7.5 hours later from the Kennedy Spaceflight Center and will subsequently rendezvous and dock with the Soyuz (References 1 and 2).

The Apollo spacecraft will be boosted to orbit by the Saturn IB launch vehicle SA-210. This report documents the ASTP (SA-210) Launch Vehicle Operational Flight Trajectory (OT). It is the third and final document required under DRL 444-V3 for the OT. Parts I and II were previously published as References 3 and 4, respectively.

Section 2.0

MISSION DESCRIPTION

The ASTP mission consists of a dual Apollo and Soyuz spacecraft launch. The Soyuz vehicle will be launched first on July 15, 1975 from Baikonur Kosmodrome, Kazakhstan, and inserted into a 188/228 km. (101.5/123.1 n. mi.) earth orbit at an inclination of 51.78 degrees. After insertion, the Soyuz spacecraft will perform two maneuvers to circularize the orbit at 225 km. (121.5 n. mi.). The Apollo spacecraft will be launched from launch complex 39B at the Kennedy Space Center (KSC) by Saturn IB SA-210 approximately seven hours and 30 minutes after the Soyuz launch. Apollo will be inserted into a 150/167 km. (81/90 n. mi.) orbit coplanar to the orbiting Soyuz, then it will separate from the launch vehicle and extract the DM. The spent launch vehicle will be deorbited into the Pacific Ocean if real time assessments of all systems indicate a high probability of success.

Subsequently, Apollo will perform an orbit transfer to rendezvous with the Soyuz and then dock on the 29th Apollo revolution. The two vehicles will remain docked for approximately two days. During this time, the American and Russian crewmen will visit the other spacecraft and exchange operational techniques and procedures. At the end of this period, additional docking systems tests are planned.

After final undocking, each spacecraft crew will conduct independent activities. The first Apollo launch opportunity sequence specifies that Soyuz will land about 46 hours after the initial undocking, while Apollo will remain in orbit, conducting experiments, five additional days,

for a total mission duration of about nine days. Further mission details are available in References 1 and 2.

2.1 Mission Objectives

Primary mission objectives are spacecraft rendezvous, docking and undocking, intervehicular crew transfers, interaction of control centers and interaction of spacecraft crews. Supplementary mission objectives are docked spacecraft attitude control, radio and cable communications, and further docking and undocking tests.

Specific launch vehicle objectives are defined in two categories, i.e., mandatory and highly desirable. The mandatory objectives are to:

1) launch and insert the Apollo spacecraft into the desired earth orbit; and to
2) maintain the prescribed attitude while the spacecraft separates and extracts the docking module from the launch vehicle.

The highly desirable objective is to deorbit the spent S-IVB/IU/SLA (fixed portion) into the Pacific Ocean.

2.2 Trajectory Groundrules and Constraints

The following mission groundrules and constraints have been imposed on trajectory simulations.

1) Launch from KSC Complex 39B; pad position I is 90 degrees east-of-north.
2) Launch window definition:

   Launch Window Opening (LWO) constrained by a 500 pound S-IVB stage yaw steering propellant allocation; and

   Launch Window Closing (LWC) constrained by the 37.4 degree

AFETR minimum launch azimuth limit.

3) Optimum Flight Azimuth (computed as specified in Reference 5):

Nominal = 45.158 degrees east-of-north;

LWO = 48.463 degrees east-of-north; and

LWC = 37.400 degrees east-of-north.

4) Aerodynamic Heating Indicator at S-IB/S-IVB Separation

73.55×10^7 N/(m x rad.) or $75. \times 10^6$ kg/(m x rad.).

5) Vehicle attitude command rates $\leq$ 1 degree/second during boost flight.

6) S-IB stage pitch attitude program biased for a July mean variable azimuth wind and designed to maintain a near zero pitch angle of attack in the high dynamic pressure flight interval and $\leq$ 0.5 degrees at J-2 engine ignition.

7) Nominal flight environment is the Patrick AFB 1963 atmosphere model with a July mean variable azimuth wind.

8) Aerodynamic loads during a full lift, free fall abort from any point along the trajectory shall not exceed 16 g's.

9) Orbit Target Conditions:

Radius	6528.178 km;
Space Fixed Velocity	7818.46 m/sec;
Space Fixed Path Angle	90.000 deg;
Inclination	51.78 deg;

Descending Node Argument

Nominal	156.887 deg;
LWO	157.775 deg;
LWC	154.802 deg.

10) Continuous communications and tracking coverage during powered flight.

11) S-IVB stage pitch and yaw inertial attitude rate limits of $\pm$ 0.3 degree/second and an inertial roll attitude rate limit of $\pm$ 0.5 degree/second during orbital flight.

12) Launch vehicle inertial yaw attitude limit of $\pm$ 45 degrees.

Trajectory, launch vehicle systems, and flight environment data were obtained from the Government Furnished Documentation (GFD) listed in Section 6. A complete list of references is provided in Section 7.

Section 3.0

LAUNCH VEHICLE AND FLIGHT ENVIRONMENT

Detailed launch vehicle and flight environment data are displayed in Appendix A. A discussion of these data follows.

3.1 Configuration

The American ASTP space vehicle, for which this OT was developed, consists of the Saturn IB 210 launch vehicle, an Apollo spacecraft and a Launch Escape System (LES). The launch vehicle is composed of the S-IB-10 first stage, an interstage, the S-IVB-210 second stage, and the S-IU-210 Instrument Unit. Major spacecraft elements are the CM-111 Command Module, the SM-111 Service Module, the SLA-18 Spacecraft Launch Adapter, and the DM-2 Docking Module. A profile of the vehicle is presented in Figure 1A.

The backup American space vehicle for the ASTP is SA-209. Launch vehicle components are the S-IB-9, S-IVB-209, and S-IU-209. Spacecraft elements are CM-119, SM-119, SLA-25, and DM-1.

3.2 Mass Characteristics

The vehicle mass characteristics are provided by Reference 6 and amended by References 26 and 27. Table 1A presents a weight breakdown of the space vehicle. These data are consistent with Reference 6, as amended, and the trajectory presented herein. Tables 3A and 4A present time histories of the vehicle mass with the associated center of gravity and moment of inertia data for the S-IB and S-IVB stages of flight, respectively.

3.3 Aerodynamic Properties

Bivariant aerodynamic data for the S-IB and S-IVB stages of powered flight were obtained from References 7 through 11. Flight time histories of aerodynamic data for the S-IB stage of flight are presented in Table 5A. Orbital aerodynamic data were provided by Reference 12.

3.4 Propulsion Systems

The S-IB stage is powered by eight H-1 engines, which have a nominally rated sea level thrust of 205,000 pounds each. The predicted nominal thrust magnitude history for each H-1 engine, including thrust decay and the associated turbine engine thrust, were obtained from Tape No. 3951/55491/13974 (Reference 13). The thrust magnitude time history for each H-1 engine is delineated in Table 6A. Figure 2A depicts total effective thrust history and Figure 3A displays detailed thrust decay histories.

The S-IVB stage is powered by a single J-2 engine, which has a rated vacuum thrust of 230,000 pounds at a mixture ratio of 5.5:1. An open loop two position propellant utilization system is employed to enable J-2 engine ignition at a 4.8:1 Engine Mixture Ratio (EMR) and, 6 seconds later, to facilitate an EMR shift to 5.5:1 for approximately 319 seconds, then a shift back to 4.8:1 for the remainder of the S-IVB stage burn. The predicted J-2 engine thrust history from ignition to Guidance Cutoff Signal (GCS) was obtained from Tape No. 28311 (Reference 13). The thrust decay history was obtained from Reference 14. Thrust buildup, full thrust history, and thrust decay are displayed in Figures 4A, 5A and 6A, respectively.

Four solid propellant retro-motors (TE-M-29-5) mounted on the S-IB/S-IVB interstage provide thrust to decelerate the S-IB stage after separation. The retro-motors are rated at a nominal thrust level of 35,222 pounds each (Reference 15).

Three solid propellant ullage motors mounted on the S-IVB stage aft skirt provide a positive acceleration for the S-IVB stage to settle propellants for J-2 engine start. The ullage motors are rated at 3,420 pounds of thrust each (Reference 16).

The S-IVB Stage Auxiliary Propulsion System (APS) consists of two modules. Each module contains three 150 pound thrust (vacuum) hypergolic rocket engines. This system provides roll control during the J-2 burn phase, and pitch, yaw and roll control after J-2 cutoff. Additional propulsion systems data are available in References 17 and 18.

3.5 Guidance Systems

The Saturn IB inertial guidance system performs navigation evaluations, issues discrete commands, initiates guidance and control functions, and issues steering commands to guide the launch vehicle to the pre-specified targeting conditions. These functions are accomplished by the flight program which is stored in the Launch Vehicle Digital Computer (LVDC). Inputs to the LVDC for navigation and steering command evaluations are the predetermined constants for the different guidance modes and the inertial velocity increments sensed by the stabilized platform accelerometers.

Guidance during boost flight is divided into two distinct phases, i.e., (1) pre-Iterative Guidance Mode (IGM) and, (2) IGM. The pre-IGM phase extends from Guidance Reference Release (GRR) to IGM initiation. During this phase, the Launch Vehicle Digital Computer (LVDC) provides pitch, yaw and roll vehicle attitude commands as a function of time. Prior to T1 (liftoff) + 9.8 seconds, pitch and yaw commands are zero and the roll command is equal to the Position I launch pad alignment error (flight azimuth - 90 degrees). These commands minimize vehicle attitude deviations prior to tower clearance. Between T1 + 9.8 and T1 + 128.8 seconds (attitude command arrest), pitch commands are computed by evaluating a third degree polynomial (see Table 1B). The yaw command remains zero and the roll command is incremented at one degree/second to zero, where it remains for the balance of this guidance phase. All attitude commands are arrested from T1 + 128.8 seconds to IGM initiation. The resultant pitch attitude command history for the pre-IGM guidance phase is displayed in Table 2B.

The IGM phase is initiated on the next guidance cycle after Time Base 3 (Outboard Engine Cutoff) + 35 seconds and continues until J-2 engine cutoff. During this phase, a two-stage three-dimensional formulation of the IGM equations is utilized in the LVDC to provide pitch and yaw attitude commands. The roll attitude command is maintained at zero. The IGM equations and logic of the LVDC flight program are defined in Reference 19. The nominal trajectory guidance presettings required for the flight program are provided in Table 3B. The presetting changes required for the launch window trajectories are also noted in Table 3B.

The orbital guidance mode provides pitch, yaw and roll attitude commands for the planned maneuvers during the orbital phase of the mission. The specific guidance equations are defined in Reference 19.

3.6 Control Systems

Pitch, yaw and roll attitude control are maintained by the four outboard H-1 engines during the S-IB stage of powered flight. The control law, gains, and network characteristics for the S-IB stage control systems are defined in References 20, 21 and 22.

The J-2 engine provides pitch and yaw attitude control throughout the S-IVB stage of powered flight. Roll attitude control is maintained by the Auxiliary Propulsion System (APS). The control law, gains, and network characteristics of the S-IVB stage control system are defined in Reference 20. The APS provides total attitude control during the orbital flight phase while the IU is active.

3.7 Flight Environment Description

The 1963 Patrick Reference Atmosphere model (Reference 23) defines the atmospheric properties used in the trajectory simulation. The earth model and potential function are those of the Fischer Ellipsoid. The wind profile is the July mean variable azimuth profile defined in Reference 24, supplemented by data from Reference 25 for altitudes above 27 kilometers. Inertial pitch and yaw plane components of this profile are depicted in Figure 7A.

Section 4.0

TRAJECTORY

Three trajectory simulations are documented in this report, a nominal and two launch window cases. The distinguishing characteristics and the launch window relationship of these cases are displayed below.

Trajectory	Time Deviation From Planar Launch (min)	Target Node (deg)	Launch Azimuth (deg)	S-IVB Propellant Required for Yaw Steering (lbs)
Launch Window Opening (LWO)	-6.45	157.775	48.463	500
Nominal	-2.84	156.887	45.158	96
Planar Flight	0.00	156.188	42.557	0
Launch Window Closing (LWC)	5.64	154.802	37.400	384

The nominal target node, specified in Reference 28, is a 0.699 degree deviation from the planar flight target node. This corresponds to a launch time 2.84 minutes prior to the planar flight launch opportunity. Consequently, 96 pounds of S-IVB stage propellants are utilized in the nominal case to steer to the target orbital plane. The LWO trajectory simulation reflects the maximum target node, or the earliest launch time, deviation from planar flight which can be attained by utilizing 500 pounds of S-IVB stage propellant for yaw steering to the target orbital plane. The LWC trajectory simulation target node is optimum for the 37.4 degree AFETR flight azimuth constraint. This late launch requires 384 pounds of yaw steering propellant. It can be determined from the preceding table that the launch window duration is 12.09 minutes. Figure 1 displays more extensive launch window data. Specifically, it exhibits S-IVB stage propellant requirements, yaw attitude at Guidance

Cutoff Signal (GCS), and optimum launch azimuths for launch window target node and launch time deviations from the planar launch opportunity.

The S-IB stage steering program and the IGM presettings are designed to provide maximum vehicle performance (weight in orbit) within the specified groundrules/constraints. The S-IB stage steering program, defined in Table 1B, was derived for the nominal trajectory, but it is applicable throughout the launch window. The IGM presettings, displayed in Table 3B, are the nominal trajectory presettings with the necessary launch window trajectory changes noted.

The nominal sequence of events for the powered flight phase of the OT is summarized in Table 1. These data are consistent with the mass and propulsion data referenced herein and the sequence data provided in References 28 and 29.

Table 1A provides a vehicle weight breakdown. It shows that the nominal OI weight is 68,744 pounds, which includes a 37,400 pound payload and 2,612 pounds of available S-IVB stage propellants. The latter includes a 460 pound LH_2 bias. Supplementary residual S-IVB stage propellant data for the nominal trajectory follow.

		LOX (Pounds)	LH_2 (Pounds)	Total (Pounds)
	Total on board at GCS	2208	1792	4000
(1)	Unuseable	440	948	1388
(2)	Total available	1768	844	2612

	LOX (Pounds)	LH_2 (Pounds)	Total (Pounds)
(3) 3 sigma FPR allocation (estimated)	1173	688	1861
Remaining launch window allocation (4.8:1 EMR)	334	70	404
Total allocation	1507	758	2265
Excess available over allocation	261	86	347
Excess useable at 4.8:1 EMR	261	54	315
Excess bias	0	32	32

(1) Unuseable determined by MSFC/MDAC to assure the required 6.7 m/sec depletion cutoff thrust decay velocity increment (Reference 36).

(2) Total available LH_2 includes a 460 pound bias.

(3) The Flight Performance Reserve estimate source is Reference 30, since the ASTP (SA-210) OT FPR is not yet available.

The preceding table shows that the SA-210 launch vehicle can insert the specified payload (37,400 pounds) into the prescribed orbit, provide the required 500 pound launch window allocation, and assure the estimated three sigma FPR with 315 pounds of useable residual propellant in the S-IVB stage. This excess propellant provides approximately 333 pounds of additional payload capability. Consequently, the current predicted SA-210 payload capability for the ASTP mission is derived as follows:

Payload capability = 37,400 + 333 = 37,733 pounds.

Table 2 provides a summary of nominal OT parameters at pertinent events from GRR to orbit insertion. Convenient summaries of the end conditions

of flight for the S-IB and S-IVB stages of powered flight are presented in Tables 3 and 4, respectively. Tabulated listings of the powered flight trajectory are presented in Tables 5 and 6. Corresponding tabular listings, in English units, are given in Appendix C. Graphical displays of pertinent powered flight trajectory data are shown in Figures 2 through 15. Corresponding data, including powered flight sequences, for the launch window opening and closing trajectories are contained in Appendices D and E, respectively.

A nominal orbital flight phase sequence of events is presented in Table 9. This sequence was obtained from Reference 31. Table 10 provides nominal S-IVB/CSM separation conditions. Corresponding separation conditions for the launch window trajectories are included in Appendices D and E.

Table 11 is a listing of nominal orbital phase trajectory data in metric units. Pertinent graphical displays appear in Figures 17 through 21. English unit orbital trajectory listings are included in Appendix C.

Detailed data tapes (B-7 format) and print tapes are available at MSFC, SA&I-EL24, for the nominal and each of the launch window trajectory simulations. These tapes contain trajectory data from GRR to 7.5 hours flight time. This interval is the predicted life of the IU batteries and, therefore, the extent of attitude control. Nominal S-IB stage reentry trajectory data are included on the aforementioned tapes.

The Government Furnished Documentation (GFD), upon which the trajectory simulations are based, is delineated in Section 6. It is more precisely identified in the References (Section 7).

4.1 S-IB Stage Powered Flight Phase

This phase is initiated at Guidance Reference Release (GRR), which is assumed to be 17.2 seconds prior to first motion. The time of umbilical disconnect and the corresponding establishment of Time Base One (T1) is 0.2 second after first motion. The phase ends at S-IB/S-IVB physical separation, which is 1.379 seconds after Outboard Engine Cutoff signal (OECO). This phase includes H-1 engine burns, H-1 engine thrust decay, and ullage rocket ignition.

4.2 S-IVB Stage Powered Flight Phase

This phase begins at S-IB/S-IVB separation and ends at Orbit Insertion (OI). Orbit insertion is defined as Guidance Cutoff Signal (GCS) plus 10 seconds. GCS occurs when the space fixed velocity magnitude equals the target velocity less the predicted J-2 engine thrust decay velocity increment. This phase of the trajectory includes the ullage rocket burns, J-2 engine thrust buildup, mainstage burn, ullage case jettisoning, Launch Escape System (LES) jettisoning, Engine Mixture Ratio (EMR) shifts, and J-2 thrust decay.

4.3 Orbital Flight Phase

The orbital flight phase extends from OI to the end of IU battery lifetime, which is defined as 7.5 hours flight time. The maneuvers and vents simulated are those listed in Table 9 and specified in Reference 31. All orbital vents are nonpropulsive, therefore, they do not perturb the orbit. Vent flowrates were obtained from Reference 32. Ideal attitude control, with prescribed rate limits, is simulated during this phase.

Mission planning specifies a controlled S-IVB stage deorbit with the required deceleration provided by a propellant dump, if a real time assessment of all systems indicates a high probability of success. This propellant dump was not prescribed for this OT simulation; however, the simulation does provide vehicle attitude and position data to aid in selection of a proper dump time.

4.4 Spent S-IB Stage Trajectory

The nominal reentry trajectory for the spent S-IB stage is summarized in Table 7. This phase of the trajectory, which is initiated at S-IB/S-IVB separation, includes the retro-rocket burns and terminates upon S-IB stage impact. Pertinent data are graphically displayed in Figures 2 through 6. English unit reentry trajectory data listings appear in Table 4C.

Section 5.0

TRACKING AND PERFORMANCE SUMMARY

5.1 Tracking Summary

The tracking and communications network is listed in Table 8. A summary of the coverage provided by this network for the powered flight phase of the nominal OT is presented in Figure 16. These data indicate that coverage is complete during this phase, i.e., continuous UHF command, VHF telemetry, and C-Band radar coverage is provided by the Merritt and Bermuda stations.

A summary of the coverage provided by the network during the nominal orbital flight phase is displayed in Figure 22. The surveillance range, above two degrees elevation, of each station is indicated by an ellipse. These data indicate exposure to the command and telemetry coverage of at least one station during each revolution while the IU is active. Similar C-Band radar coverage will be available on all but the fourth revolution. However, of the significant events, CSM separation, CSM docking, and DM extraction, only the first will occur within range of a tracking station (Vanguard ship). But sufficient coverage is available to confirm CSM docking and the subsequent DM extraction. A detailed tracking analysis is now in progress. The results are scheduled to be published in a CCSD Technical Note on February 4, 1975.

5.2 Launch Vehicle Performance Characteristics

The predicted S-IB and S-IVB stage performance characteristics are presented in Table 2A. These data are time averages of the nominal stage thrusts, flowrates and specific impulses.

Section 6.0

GOVERNMENT FURNISHED DOCUMENTATION

The GFD used in this analysis is listed below.

Government Furnished Documentation

DRL 444-V3c

MSFC Approval Date		Description	Identification
10-8-74 and 11-12-74	a.	Mission Definition and Constraints	PM-SAT-ASTP-8010.1, Revisions B and C.
10-8-74	b.	Targeting Conditions	GFD/Groundrules for SE&I Tasks, 10-8-74.
10-8-74	c.	Sequence of Events	ICD 68M00001C; GFD/Ground Rules Approval Form, 10-8-74.
10-8-74	d.	LVDC Equation Defining Document	IBM 70-207-0001, (Rev. H).
10-8-74	e.	L/V Guidance Equations	IBM 70-207-0001, (Rev. H).
10-8-74	f.	Flight Environment	TMX-64771; S&E-AERO-YT-77-71; TMX-53139.
10-8-74	g.	Control Systems Specifications	S&E-ASTR-SD-93-70; S&E-ASTR-SD-110-71; ED13-74-23.
10-8-74	h.	L/V Reference Trajectory	S&E-AERO-MFP-38-74.
10-8-74	i.	L/V Propulsion Data	B6 Tape 3951/55491/13974; B5 Tape 28311; S&E-ASTN-SAB (72-20); S&E-ASTN-PE(73-66); SP-544B.
10-8-74, 10-24-74, and 11-4-74	j.	L/V Mass Characteristics	EL52(74-62) (as amended by telecons from J. L. Crafts 10-24-74, and 11-4-74).
10-8-74	k.	L/V Aerodynamic Data	R-AERO-AD-68-19; R-AERO-AD-68-9; TMX-53657; TMX-53401; TB-FT-74-7.
11-12-74	l.	Tracking Station Network Description	CCSD TN-FT-74-13.

MSFC Approval Date		Description	Identification
11-12-74	m.	Tracking Constraints and Groundrules.	GSFC STDN No. 705.
11-22-74	n.	S-IVB/SC Venting Sequence and Flowrates.	GFD/Ground Rules Approval Form, ASTP (SA-210), DRL 444-V3; A3-250-ADW3-M.
11-22-74	o.	S-IVB/SC Attitude Timeline.	GFD/Ground Rules Approval Form, ASTP (SA-210), DRL 444-V3.
11-22-74	p.	S-IVB/SC and S-IVB Orbital Drag Data	LMSC/HREC A782929; LMSC/HREC A782759; LMSC/HREC A782810; LMSC/HREC A783126.

Section 7.0

REFERENCES

1. NASA/MSFC SAT-ASTP-8010.1, Saturn Mission Implementation Plan for the Apollo Soyuz Test Project, Revision B, dated May 15, 1974, and Revision C, dated November 4, 1974.

2. NASA/OMSF/ASPO, Mission Implementation Plan for the ASTP Mission, Revision 2, dated August, 1974.

3. CCSD TN-FT-74-33, ASTP (SA-210) Launch Vehicle Operational Flight Trajectory, Part I, Guidance Presettings, dated December 10, 1974.

4. CCSD TN-FT-74-34, ASTP (SA-210) Launch Vehicle Operational Flight Trajectory, Part II, Orbital Gimbal Angles, dated January 7, 1975.

5. NASA/MSFC S&E-AERO-MFG-6-71, Subject: Chrysler Corporation Space Division Response to TD-S&E-AERO-67 (MFG), dated January 7, 1971.

6. NASA/MSFC EL52(74-62), Subject: Apollo/Soyuz Test Project (ASTP) Final Predicted Mass Properties, Depletion Cutoff, dated October 22, 1974 (See Reference 37).

7. NASA/MSFC R-AERO-AD-68-19, Subject: Design Criteria: Axial Force Characteristics for the AS-206/LM and AS-207/CSM Vehicles (SA-276 Mission), dated March 28, 1968.

8. NASA/MSFC R-AERO-AD-68-9; Subject: Static Stability and Normal Force Distributions for the Apollo-Saturn I Vehicle at High Angles of Attack, dated February 23, 1968.

9. NASA/MSFC TMX-53657, Static Aerodynamic Characteristics of the Apollo-Saturn IB Vehicle, dated September 25, 1967.

10. NASA/MSFC TMX-53401, Range Safety Aerodynamic Characteristics of the Apollo-Saturn IB Vehicles, dated February 24, 1966.

11. CCSD TB-FT-74-7, Subject: Apollo-Saturn IB Second Stage Aerodynamic Characteristics for Use in Staging Analysis, dated June 13, 1974.

12. LMSC/HREC A782759, A782810, A782929, and A783126, Study of Drag Coefficients for Unusual Vehicle Configurations, April through July Progress Reports, dated: May 16, 1966; June 15, 1966; July 15, 1966; and August 15, 1966, respectively.

13. NASA/MSFC Propulsion Tapes, B6 Reel No. 3951/55491 (CCSD 13974), S-IB stage prediction; and MDAC B5 Reel No. 28311, S-IVB stage prediction.

14. NASA/MSFC S&E-ASTN-SAB (72-20), Subject: Saturn IB Vehicle Engine Start and Shutdown Performance Characteristics Predicted for Skylab and Subsequent Missions, dated December 12, 1972.

15. NASA/MSFC S&E-ASTN-PE (73-66), Subject: S-IB Retro Motor Data, dated June 19, 1973.

16. Thiokol Chemical Corporation SP-544B, Model Specification, Motor, Rocket, Solid Propellant, Thiokol Chemical Corporation Model No. TX280-10 (1A81960-1), dated January 30, 1968.

17. NASA/MSFC No. IV-4-401-1, Astrionics System Handbook, Saturn Launch Vehicles, IBM No. 68-966-0002, dated November 1, 1968.

18. NASA/MSFC MAN-206, Saturn IB Flight Manual, dated September 30, 1972.

19. IBM No. 70-207-0001, LVDC Equation Defining Document (EDD) for the Saturn IB Flight Program, Parts I and II, Revision H, dated November 7, 1973.

20. NASA/MSFC S&E-ASTR-SD-93-70, Subject: Skylab 2, 3 and 4, Flight Control System Gains and Network, dated July 31, 1970.

21. NASA/MSFC S&E-ASTR-SD-110-71, Subject: Revised Skylab 2, 3 and 4 Flight Control System Gains and Networks, dated November 16, 1971.

22. NASA/MSFC ED13-74-23, Subject: Control System Gains and Networks for the ASTP Mission, dated October 8, 1974.

23. NASA/MSFC TMX-53139, A Reference Atmosphere for Patrick AFB, Florida, Annual (1963 Revision), dated September 23, 1964.

24. NASA/MSFC S&E-AERO-YT-77-71, Subject: Monthly Vector Mean Winds Versus Altitude for Cape Kennedy, Florida, for Skylab (INT-21) Wind Bias Trajectory Analysis, dated January 29, 1971.

25. NASA/MSFC TM-64771, Nominal Probabilities for Cape Kennedy Wind Components - Monthly Reference Periods for all Flight Azimuths - Altitudes 0 to 70 Kilometers, dated April 16, 1973.

26. MSFC/CCSD Telecon - J. L. Crafts to R. D. Taylor, Subject: ASTP (SA-210) Operational Trajectory Payload Change from 37,000 pounds to 37,400 pounds, October 24, 1974.

27. MSFC/CCSD Telecons- J. L. Crafts to R. M. Blackstock, Subject: ASTP (SA-210) Operational Trajectory Mass Data Corrections, October 15, 1974 and November 4, 1974.

28. NASA/MSFC Saturn IB Government Furnished Data/Ground Rules Approval Form, ASTP (SA-210) DRL 444-V3, approved October 8, 1974.

29. NASA/MSFC ICD 68M00001C, Definition of Saturn SA-207 & Subs. Flight Sequence Program, dated January 16, 1973, and IRNS R45 through R52.

30. NASA/MSFC EL24 (74-18), Subject: ASTP (SA-210) Preliminary Operational Flight Trajectory Dispersion Analysis, Volume I, dated August 6, 1974.

31. NASA/MSFC, Saturn IB GFD/Ground Rules Approval Form for ASTP (SA-210), DRL 444-V3, approved 11/22/74.

32. NASA/MDAC A3-250-ADW3-M, Subject: Update of Nominal Propulsion System Orbital Predictions-SL-2 Mission.

33. NASA/MSFC S&E-AERO-MFP-38-74, Subject: SA-210 Preliminary Operational Flight Trajectory, dated May 30, 1974.

34. CCSD TN-FT-74-13, ASTP (SA-210) Launch Vehicle Preliminary Operational Flight Trajectory Tracking Analysis, dated May 23, 1974.

35. NASA/GSFC, STDN #705, Antenna Coverage Document, Vols., I, II, and III, dated July 1974.

36. MSFC/CCSD Telecon - J. L. Crafts to R. M. Blackstock, Subject: Calculation of S-IVB Stage Useable Residuals, December 4, 1974.

37. MSFC/CCSD Telecon - J. Brooks to R. Blackstock, Subject: ASTP Operational Trajectory GFD Revision/Verification, December 13, 1974.

TABLE 1

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL POWERED FLIGHT SEQUENCE OF EVENTS

FLIGHT TIME (HR: MIN: SEC)	FLIGHT TIME (SEC)	LVDC FLIGHT PROGRAM TIME(SEC)	EVENT
-0:00:17.20	- 17.20	$(0.00)_0$	Guidance Reference Release (GRR); Initiation of Time Base 0.
-0:00:03.30	- 3.30	---	Time for S-IB Mainstage Ignition.
-0:00:00.20	- 0.20	---	Hold Down Arm Release Signal.
0:00:00.00	0.00	---	First Motion.
0:00:00.20	0.20	$(0.00)_1$	Lift-Off Signal; Initiate Time Base 1.
0:00:10.00	10.00	$(9.80)_1$	Initiate Pitch and Roll Maneuvers.
0:00:57.74	57.74	---	Mach One.
0:01:13.25	73.25	---	Maximum Dynamic Pressure.
0:01:40.20	100.20	$(100.00)_1$	Control Gain Switch Point.
0:02:00.20	120.20	$(120.00)_1$	Control Gain Switch Point.
0:02:08.07	128.07	$(127.87)_1$	Enable S-IB Propellant Level Sensors.
0:02:09.00	129.00	$(128.80)_1$	Arrest Attitude Commands.
0:02:13.07	133.07	$(0.00)_2$	Level Sensor Actuation; Initiate Time Base 2.
0:02:16.07	136.07	$(3.00)_2$	Inboard Engine Cutoff (IECO).
0:02:19.47	139.47	$(0.00)_3$	Outboard Engine Cutoff (OECO); Initiate Time Base 3.
0:02:20.57	140.57	$(1.10)_3$	Ullage Rockets Ignition.
0:02:20.77	140.77	$(1.30)_3$	Separation Signal.
0:02:20.85	140.85	---	S-IB/S-IVB Physical Separation.
0:02:22.17	142.17	$(2.70)_3$	J-2 Engine Start Command.
0:02:25.57	145.57	---	90% J-2 Thrust Level.
0:02:28.17	148.17	$(8.70)_3$	Command 5.5:1 EMR.
0:02:28.57	148.57	---	Ullage Burn Out.
0:02:32.77	152.77	$(13.30)_3$	Jettison Ullage Rocket Motors.
0:02:45.17	165.17	---	Dynamic Pressure = 1 PSF.
0:02:51.47	171.47	---	LES Jettison.
0:02:54.47	174.47	$(35.00)_3$	Command Active Guidance Initiation.
0:03:01.47	181.47	$(42.00)_3$	Control Gain Switch Point.
0:05:45.57	345.57	$(206.10)_3$	Control Gain Switch Point.
0:07:47.57	467.57	$(328.10)_3$	Command EMR Shift to 4.8:1.
0:09:43.18	583.18	---	Guidance Cutoff Signal (GCS).
0:09:43.38	583.38	$(0.00)_4$	Initiate Time Base 4; Inertial Attitude Freeze.
0:09:43.98	583.98	$(0.60)_4$	Begin LOX NPV.
0:09:53.18	593.18	---	Orbit Insertion.

TABLE 2

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
POWERED FLIGHT TRAJECTORY EVENT SUMMARY

EVENT	FLIGHT TIME (SEC)	ALTITUDE (KM)	SPACE FIXED VELOCITY (M/S)	SPACE FIXED FLIGHT PATH ANGLE (DEG)	SPACE FIXED AZIMUTH (DEG)	GEODETIC LAT. (DEG)	LONGITUDE POSITIVE EAST (DEG
GUIDANCE REF. RELEASE	-17.20	.09	408.57	90.000	90.00	28.63	-80.62
FIRST MOTION	.00	.09	408.57	90.000	90.00	28.63	-80.62
MACH ONE	57.74	7.34	582.61	59.674	79.83	28.64	-80.61
MAX. DYN. PRESSURE	73.25	12.70	738.08	57.218	72.56	28.66	-80.59
TILT ARREST	129.00	47.78	1986.00	64.087	54.28	28.93	-80.28
INBOARD ENGINE CUTOFF	136.07	54.16	2242.70	65.422	53.18	29.00	-80.20
OUTBOARD ENGINE CUTOFF	139.47	57.36	2307.09	66.020	52.94	29.04	-80.16
S-IB/S-IVB PHYSICAL SEP.	140.85	58.65	2306.30	66.290	52.94	29.05	-80.14
J-2 ENG. START COMMAND	142.17	59.87	2301.54	66.554	52.95	29.07	-80.12
ULLAGE CASE JETTISON	152.77	69.22	2315.93	68.566	52.85	29.19	-79.99
LES JETTISON	171.47	84.18	2395.43	71.827	52.56	29.41	-79.73
IGM INITIATION	175.00	86.80	2412.91	72.405	52.54	29.46	-79.68
EMR SHIFT, 5.5:1/4.8:1	469.00	164.97	5470.16	90.617	51.00	35.31	-72.32
S-IB STAGE IMPACT	531.00	.00	406.53	102.756	89.97	31.67	-76.99
GUIDANCE CUTOFF SIGNAL	583.18	158.57	7811.74	90.008	52.94	39.35	-66.34
ORBIT INSERTION	593.18	158.72	7818.46	90.001	53.39	39.77	-65.67

TABLE 3

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE END CONDITIONS OF FLIGHT

FLIGHT TIME: OECO + 1.379 SECONDS	140.847	(SEC)
RADIUS:	6431804.	(M)
ALTITUDE:	58649.	(M)
SPACE FIXED VELOCITY:	2306.30	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	66.290	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	52.938	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	45.040	(DEG)
GEOCENTRIC DECLINATION:	28.890	(DEG)
GEODETIC LATITUDE:	29.053	(DEG)
LONGITUDE: (POSITIVE EAST)	-80.142	(DEG)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	6430759.	(M)
YS	57698.	(M)
ZS	100526.	(M)
$\dot{X}S$	892.11	(M/S)
$\dot{Y}S$	273.98	(M/S)
$\dot{Z}S$	2109.05	(M/S)

VEHICLE ATTITUDES AND ATTITUDE RATES

PITCH ATTITUDE ANGLE	-64.005	(DEG)
YAW ATTITUDE ANGLE	-.099	(DEG)
ROLL ATTITUDE ANGLE	.001	(DEG)
PITCH RATE	.005	(DEG/S)
YAW RATE	-.026	(DEG/S)
ROLL RATE	-.000	(DEG/S)

TABLE 4

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE END CONDITIONS OF FLIGHT

FLIGHT TIME: GCS	583.183	(SEC)
RADIUS:	6528180.	(M)
ALTITUDE:	158569.	(M)
SPACE FIXED VELOCITY:	7811.74	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	90.006	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	52.939	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	51.244	(DEG)
GEOCENTRIC DECLINATION:	39.165	(DEG)
GEODETIC LATITUDE:	39.353	(DEG)
LONGITUDE: (POSITIVE EAST)	-66.342	(DEG)
INCLINATION:	51.778	(DEG)
DESCENDING NODE ARGUMENT:	156.883	(DEG)
INERTIAL RANGE ANGLE:	17.528	(DEG)
WEIGHT:	68876.	(LBS)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	6228746.	(M)
YS	111048.	(M)
ZS	1951287.	(M)
$\dot{X}S$	-2331.18	(M/S)
$\dot{Y}S$	-247.58	(M/S)
$\dot{Z}S$	7451.68	(M/S)

VEHICLE ATTITUDE ANGLES

PITCH ATTITUDE ANGLE	-99.765	(DEG)
YAW ATTITUDE ANGLE	-6.359	(DEG)
ROLL ATTITUDE ANGLE	.511	(DEG)

OSCULATING CONIC PARAMETERS

* PERIGEE ALTITUDE	142.07	(KM)
* APOGEE ALTITUDE	150.35	(KM)
ECCENTRICITY	.0006	
SEMI-MAJOR AXIS	6524.37	(KM)
TRUE ANOMALY	194.113	(DEG)
PERIOD	87.41	(MIN)

* REFERENCED TO EQUATORIAL RADIUS (6378.165 KM)

TABLE 4 (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE END CONDITIONS OF FLIGHT

FLIGHT TIME: ORBIT INSERTION	593.183	(SEC)
RADIUS:	6528178.	(M)
ALTITUDE:	158718.	(M)
SPACE FIXED VELOCITY:	7818.46	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	90.001	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	53.386	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	51.720	(DEG)
GEOCENTRIC DECLINATION:	39.576	(DEG)
GEODETIC LATITUDE:	39.765	(DEG)
LONGITUDE: (POSITIVE EAST)	-65.673	(DEG)
INCLINATION:	51.780	(DEG)
DESCENDING NODE ARGUMENT:	156.887	(DEG)
INERTIAL RANGE ANGLE:	18.212	(DEG)
WEIGHT:	68744.	(LBS)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	6204978.	(M)
YS	108557.	(M)
ZS	2025727.	(M)
$\dot{X}S$	-2421.37	(M/S)
$\dot{Y}S$	-249.83	(M/S)
$\dot{Z}S$	7429.87	(M/S)

VEHICLE ATTITUDE ANGLES

PITCH ATTITUDE ANGLE	-99.767	(DEG)
YAW ATTITUDE ANGLE	-6.366	(DEG)
ROLL ATTITUDE ANGLE	.293	(DEG)

OSCULATING CONIC PARAMETERS

* PERIGEE ALTITUDE	149.96	(KM)
* APOGEE ALTITUDE	164.93	(KM)
ECCENTRICITY	.0011	
SEMI-MAJOR AXIS	6535.61	(KM)
TRUE ANOMALY	359.258	(DEG)
PERIOD	87.64	(MIN)

* REFERENCED TO EQUATORIAL RADIUS (6378.165 KM)

TABLE 5
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC2)	DYNAMIC PRESSURE (N/M2)	A.H.I. (KG-M/M2-RAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1)	-17.20	594950.	0.	0.	.000	0.	0.	.00	.000
2)	.00	588040.	7252697.	715.	12.354	2.	0.	.01	.000
	5.00	573697.	7428046.	3362.	12.963	126.	152.	.04	6.188
	10.00	559243.	7478481.	12984.	13.370	575.	2889.	.09	3.305
	15.00	544737.	7526089.	29355.	13.783	1448.	16672.	.15	.270
	20.00	530193.	7575584.	51496.	14.213	2822.	60040.	.21	-2.729
	25.00	515622.	7627083.	74535.	14.669	4753.	164810.	.28	-1.528
	30.00	501035.	7684378.	101841.	15.153	7290.	378648.	.35	-1.254
	35.00	486433.	7747227.	132698.	15.671	10424.	769803.	.44	-.874
	40.00	471823.	7816387.	167549.	16.226	14102.	1429077.	.54	-.501
	45.00	457190.	7891597.	216128.	16.801	18201.	2469476.	.65	-.155
	50.00	442548.	7966841.	267833.	17.408	22546.	4024302.	.77	.055
	55.00	427908.	8032200.	493824.	17.626	26757.	6232783.	.92	.056
3)	57.74	419900.	8061619.	667774.	17.617	28744.	7753437.	1.00	.043
	65.00	398598.	8154309.	737612.	18.613	32792.	12893710.	1.25	.013
	70.00	383903.	8216203.	643791.	19.729	34608.	17429458.	1.47	.006
4)	73.25	374354.	8249414.	585295.	20.476	35007.	20818147.	1.63	.030
	80.00	354529.	8307374.	463795.	22.125	32634.	28687001.	2.00	-.170
	85.00	339855.	8339051.	377115.	23.428	28087.	34723980.	2.25	-.176
	90.00	325275.	8360336.	292265.	24.804	23116.	40463360.	2.52	-.027
	95.00	310703.	8368877.	218321.	26.233	18495.	45743362.	2.80	.029
	100.00	296146.	8368955.	159006.	27.723	14457.	50451972.	3.11	-.089
	105.00	281610.	8359881.	113991.	29.281	10985.	54533032.	3.44	-.237
	110.00	267102.	8347196.	75529.	30.969	8071.	57947217.	3.77	-.717
	115.00	252621.	8332429.	39301.	32.830	5823.	60729840.	4.13	-1.154
	120.00	238174.	8311736.	12506.	34.848	4127.	62955703.	4.50	-1.642
	125.00	223765.	8284897.	-3291.	37.044	2897.	64711968.	4.91	-2.308
5)	129.00	212276.	8261620.	-10340.	38.973	2171.	65834831.	5.26	-2.837
6)	133.07	200631.	8226907.	-18567.	41.100	1642.	66764710.	5.72	-2.028
7)	136.07	192074.	8185753.	-26962.	42.759	1328.	67334071.	6.13	-1.167
8)	139.47	186324.	2870954.	-25833.	15.547	964.	67849688.	6.42	-.292
9)	140.57	185750.	157344.	-23428.	.973	850.	67983858.	6.46	-.026
10)	140.77	185646.	168338.	-22961.	1.031	830.	68006426.	6.46	.020
11)	140.85	185631.	159698.	-22779.	.983	822.	68015192.	6.46	.039

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	-17.20	6373379.	408.57	90.000	6373353.	12740.	-12670.	.00	289.10	289.70
2)	.00	6373379.	408.57	90.000	6373349.	17694.	-7686.	-.45	287.93	289.87
	5.00	6373414.	408.75	87.954	6373382.	19133.	-6236.	14.01	287.80	289.92
	10.00	6373528.	409.55	85.593	6373493.	20572.	-4786.	30.76	287.63	289.93
	15.00	6373732.	411.43	82.965	6373693.	22009.	-3337.	49.55	287.49	290.12
	20.00	6374035.	415.61	80.108	6373992.	23447.	-1883.	70.43	287.55	291.69
	25.00	6374449.	422.79	77.081	6374401.	24885.	-416.	93.42	287.40	295.68
	30.00	6374984.	433.59	73.958	6374930.	26321.	1078.	118.58	287.12	302.48
	35.00	6375651.	448.76	70.845	6375590.	27756.	2615.	145.87	286.95	312.68
	40.00	6376460.	468.83	67.842	6376392.	29190.	4212.	175.29	286.85	326.78
	45.00	6377423.	494.12	65.054	6377346.	30625.	5890.	206.70	286.79	345.22
	50.00	6378547.	524.90	62.565	6378462.	32058.	7672.	239.96	286.74	368.40
	55.00	6379843.	561.08	60.529	6379748.	33492.	9583.	273.95	286.62	397.01
3)	57.74	6380624.	582.61	59.674	6380523.	34277.	10695.	291.94	286.52	414.86
	65.00	6382930.	646.71	58.130	6382812.	36356.	13901.	338.81	286.33	470.58
	70.00	6384724.	699.57	57.476	6384591.	37788.	16369.	373.11	286.21	517.95
4)	73.25	6385984.	738.08	57.218	6385841.	38718.	18108.	396.34	286.14	553.00
	80.00	6388852.	829.01	57.089	6388685.	40649.	22117.	446.42	285.79	637.41
	85.00	6391202.	906.03	57.303	6391012.	42076.	25484.	484.73	285.10	710.38
	90.00	6393749.	991.53	57.700	6393535.	43499.	29237.	524.29	284.19	792.14
	95.00	6396503.	1085.68	58.226	6396258.	44918.	33420.	565.10	283.25	882.68
	100.00	6399468.	1188.77	58.873	6399187.	46332.	38080.	606.65	282.37	982.55
	105.00	6402650.	1301.00	59.608	6402326.	47742.	43263.	648.75	281.53	1092.00
	110.00	6406051.	1422.78	60.429	6405675.	49147.	49018.	690.76	280.53	1211.80
	115.00	6409672.	1554.90	61.323	6409233.	50547.	55401.	732.40	279.51	1342.82
	120.00	6413513.	1698.03	62.269	6412999.	51942.	62468.	773.46	278.53	1485.76
	125.00	6417573.	1852.94	63.265	6416967.	53332.	70282.	813.37	277.37	1641.61
5)	129.00	6420977.	1986.00	64.087	6420283.	54439.	77115.	844.29	276.39	1776.22
6)	133.07	6424579.	2130.24	64.904	6423781.	55562.	84636.	875.91	275.42	1922.20
7)	136.07	6427333.	2242.70	65.422	6426447.	56387.	90572.	901.85	274.68	2034.93
8)	139.47	6430517.	2307.09	66.020	6429521.	57320.	97619.	903.38	274.12	2105.10
9)	140.57	6431545.	2307.10	66.234	6430510.	57621.	99938.	894.68	274.01	2108.84
10)	140.77	6431731.	2306.53	66.274	6430689.	57676.	100359.	892.84	273.99	2108.99
11)	140.85	6431804.	2306.30	66.290	6430759.	57698.	100526.	892.11	273.98	2109.05

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	EARTH FIXED POSITION (M)	EARTH FIXED VELOCITY (M/S)	EARTH FIXED PATH ANGLE (DEG)	EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	-17.20	90.	.00	N/A	90.	0.	-0.	.00	-.00	-.00
2)	.00	90.	.00	N/A	90.	-0.	0.	.00	-.00	-.00
	5.00	125.	14.59	.482	125.	-0.	0.	14.59	-.09	-.01
	10.00	239.	31.47	.563	239.	-1.	-0.	31.47	-.25	-.08
	15.00	443.	50.39	.555	443.	-3.	-1.	50.39	-.37	.01
	20.00	747.	71.42	1.343	747.	-4.	2.	71.40	-.32	1.47
	25.00	1161.	94.69	3.365	1161.	-6.	18.	94.54	-.49	5.33
	30.00	1697.	120.44	5.847	1696.	-9.	60.	119.84	-.81	11.99
	35.00	2367.	148.93	8.627	2363.	-14.	144.	147.30	-1.03	22.01
	40.00	3185.	180.51	11.599	3172.	-20.	287.	176.89	-1.18	35.92
	45.00	4166.	215.42	14.670	4135.	-26.	510.	208.50	-1.31	54.13
	50.00	5327.	253.96	17.776	5261.	-33.	836.	241.99	-1.44	77.06
	55.00	6682.	295.66	20.991	6557.	-40.	1290.	276.24	-1.63	105.40
3)	57.74	7511.	319.09	22.794	7338.	-45.	1602.	294.39	-1.76	123.09
	65.00	10015.	385.50	27.654	9647.	-59.	2689.	341.74	-2.02	178.37
	70.00	12024.	438.77	30.993	11442.	-69.	3695.	376.45	-2.18	225.39
4)	73.25	13471.	477.16	33.121	12703.	-76.	4483.	399.97	-2.26	260.19
	80.00	16881.	567.08	37.411	15574.	-92.	6514.	450.77	-2.59	344.06
	85.00	19800.	642.95	40.428	17924.	-107.	8412.	489.71	-3.23	416.61
	90.00	23099.	727.19	43.231	20473.	-125.	10695.	529.99	-4.04	497.90
	95.00	26819.	820.03	45.801	23227.	-147.	13406.	571.62	-4.85	587.93
	100.00	31004.	921.69	48.185	26191.	-173.	16590.	614.11	-5.54	687.27
	105.00	35701.	1032.42	50.393	29370.	-203.	20296.	657.26	-6.14	796.16
	110.00	40955.	1152.64	52.471	32765.	-235.	24570.	700.46	-6.80	915.37
	115.00	46815.	1283.12	54.442	36375.	-270.	29469.	743.44	-7.41	1045.77
	120.00	53334.	1424.55	56.314	40199.	-309.	35050.	786.00	-7.87	1188.06
	125.00	60568.	1577.76	58.107	44234.	-349.	41373.	827.59	-8.40	1343.25
5)	129.00	66910.	1709.43	59.489	47609.	-384.	47012.	860.01	-8.78	1477.31
6)	133.07	73903.	1852.36	60.807	51175.	-420.	53316.	893.28	-9.04	1622.72
7)	136.07	79435.	1964.09	61.645	53895.	-447.	58352.	920.52	-9.24	1734.99
8)	139.47	86011.	2027.26	62.450	57034.	-479.	64379.	923.18	-9.25	1804.84
9)	140.57	88171.	2026.71	62.694	58046.	-489.	66368.	914.71	-9.22	1808.54
10)	140.77	88564.	2026.04	62.738	58228.	-491.	66729.	912.91	-9.21	1808.68
11)	140.85	88719.	2025.77	62.755	58300.	-492.	66872.	912.20	-9.21	1808.74

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	-17.20	.090	.000	.00	90.000	N/A	-80.621	28.466	28.627
2)	.00	.090	.000	1.82	90.000	N/A	-80.621	28.466	28.627
	5.00	.125	.001	14.70	89.986	N/A	-80.621	28.466	28.627
	10.00	.239	.002	31.52	89.971	N/A	-80.621	28.466	28.627
	15.00	.443	.004	50.46	89.942	N/A	-80.621	28.466	28.627
	20.00	.747	.007	71.45	89.796	29.211	-80.621	28.466	28.627
	25.00	1.161	.022	94.57	89.392	38.121	-80.621	28.466	28.627
	30.00	1.696	.065	120.21	88.713	40.269	-80.621	28.466	28.628
	35.00	2.363	.149	148.60	87.747	41.766	-80.620	28.467	28.628
	40.00	3.172	.294	180.06	86.480	42.734	-80.619	28.468	28.629
	45.00	4.135	.519	214.91	84.920	43.347	-80.617	28.469	28.631
	50.00	5.261	.847	253.50	83.094	43.743	-80.615	28.471	28.633
	55.00	6.557	1.303	295.42	81.025	43.984	-80.612	28.474	28.636
3)	57.74	7.339	1.616	319.03	79.828	44.075	-80.610	28.476	28.638
	65.00	9.647	2.705	386.20	76.518	44.303	-80.602	28.483	28.645
	70.00	11.443	3.712	440.42	74.126	44.429	-80.595	28.490	28.652
4)	73.25	12.705	4.500	479.85	72.562	44.503	-80.589	28.495	28.657
	80.00	15.577	6.530	570.79	69.362	44.601	-80.574	28.508	28.670
	85.00	17.930	8.425	647.35	67.089	44.610	-80.561	28.520	28.682
	90.00	20.483	10.702	734.32	64.970	44.609	-80.544	28.535	28.696
	95.00	23.241	13.405	829.24	63.040	44.622	-80.525	28.552	28.714
	100.00	26.213	16.576	932.72	61.300	44.652	-80.502	28.572	28.734
	105.00	29.402	20.262	1044.70	59.744	44.693	-80.476	28.596	28.758
	110.00	32.812	24.511	1165.27	58.346	44.730	-80.445	28.623	28.785
	115.00	36.443	29.376	1299.20	57.097	44.773	-80.410	28.654	28.816
	120.00	40.295	34.911	1445.01	55.987	44.824	-80.370	28.689	28.852
	125.00	44.368	41.177	1603.11	54.994	44.872	-80.325	28.729	28.892
5)	129.00	47.782	46.760	1735.81	54.278	44.913	-80.284	28.765	28.927
6)	133.07	51.397	52.994	1879.66	53.620	44.960	-80.239	28.804	28.967
7)	136.07	54.161	57.971	1991.52	53.179	44.994	-80.203	28.836	28.999
8)	139.47	57.357	63.922	2054.66	52.942	45.028	-80.160	28.874	29.037
9)	140.57	58.389	65.884	2054.05	52.937	45.037	-80.146	28.886	29.049
10)	140.77	58.575	66.241	2053.25	52.938	45.039	-80.143	28.889	29.052
11)	140.85	58.649	66.382	2052.93	52.938	45.040	-80.142	28.890	29.053

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	-17.20	.000	.000	-44.842	-.003	.003	.002	.000	.000	.000
2)	.00	-.045	.044	-44.808	-.003	.003	.002	-.045	.044	.034
	5.00	-.017	-.016	-44.843	-.001	.001	.003	-.001	-.023	-.001
	10.00	-.011	-.020	-44.843	.002	.000	.000	.007	-.022	-.001
	15.00	-.662	-.005	-40.739	-.202	.006	1.001	.148	.121	-.897
	20.00	-2.000	.023	-35.771	-.329	-.002	1.003	.191	.166	-.929
	25.00	-3.847	-.039	-30.773	-.406	-.000	1.000	.271	.116	-.931
	30.00	-6.078	-.024	-25.771	-.481	.002	1.000	.328	.132	-.929
	35.00	-8.614	-.010	-20.770	-.532	.001	1.000	.399	.140	-.928
	40.00	-11.374	-.009	-15.771	-.570	-.002	1.000	.481	.127	-.929
	45.00	-14.300	-.021	-10.773	-.598	-.004	.999	.543	.082	-.931
	50.00	-17.433	-.043	-5.777	-.685	-.007	1.000	.614	.019	-.935
	55.00	-20.888	-.075	-.804	-.699	-.006	.922	.601	-.066	-.805
3)	57.74	-22.814	-.083	.051	-.705	.007	-.068	.600	-.083	.050
	65.00	-27.958	-.080	-.001	-.711	.000	.000	.610	-.080	-.001
	70.00	-31.483	-.099	-.000	-.697	-.004	-.000	.606	-.099	-.001
4)	73.25	-33.737	-.094	-.000	-.688	.002	-.000	.597	-.094	-.001
	80.00	-38.262	-.111	.004	-.634	.015	.001	.549	-.111	.003
	85.00	-41.287	-.013	.004	-.592	.006	-.001	.608	-.013	.004
	90.00	-44.110	.047	-.000	-.510	.005	-.002	.512	.047	.000
	95.00	-46.690	.055	-.002	-.513	-.004	.000	.461	.055	-.002
	100.00	-49.220	.020	-.001	-.503	-.008	.001	.440	.020	-.001
	105.00	-51.574	-.031	.001	-.510	-.019	.001	.580	-.031	.001
	110.00	-54.104	-.086	.005	-.504	-.007	.001	.530	-.086	.005
	115.00	-56.599	-.104	.007	-.494	.001	.000	.506	-.104	.006
	120.00	-59.055	-.094	.007	-.490	.002	-.000	.515	-.094	.007
	125.00	-61.608	-.180	.007	-.473	.011	-.000	.422	-.180	.007
5)	129.00	-63.529	-.158	.007	-.484	.003	-.000	.470	-.158	.006
6)	133.07	-64.056	-.153	.004	.030	-.005	-.002	-.058	-.153	.004
7)	136.07	-64.048	-.168	.002	.002	-.002	-.001	-.049	-.168	.003
8)	139.47	-64.014	-.085	.001	.010	.005	-.001	-.015	-.085	.001
9)	140.57	-64.006	-.092	.001	.005	-.020	.000	-.007	-.092	.001
10)	140.77	-64.005	-.097	.001	.005	-.024	-.000	-.006	-.097	.001
11)	140.85	-64.005	-.099	.001	.005	-.026	-.000	-.006	-.099	.001

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 6
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/S2)	DYNAMIC PRESSURE (N/M2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
1)	140.85	139653.	40499.	3725.	.263	822.	1.086	-63.999	.039
2)	142.17	139621.	40337.	3232.	.266	704.	1.110	-63.999	.384
3)	145.57	139397.	735425.	2368.	5.259	473.	1.172	-63.999	1.539
4)	148.57	138753.	934345.	1736.	6.722	336.	1.227	-63.999	2.280
5)	152.77	137783.	1024475.	1100.	7.428	208.	1.305	-63.999	2.890
	160.00	135898.	1034592.	536.	7.609	89.	1.443	-63.999	4.463
6)	165.17	134613.	1032592.	315.	7.669	48.	1.543	-63.999	5.552
	170.00	133415.	1034917.	190.	7.756	27.	1.638	-63.999	6.569
7)	171.47	133049.	1035492.	160.	7.782	22.	1.667	-63.999	6.876
8)	175.00	128020.	1036335.	107.	8.094	14.	1.737	-63.999	7.616
	180.00	126774.	1037282.	83.	8.182	7.	1.839	-58.999	11.845
	190.00	124288.	1036754.	43.	8.341	2.	2.046	-56.105	18.471
	200.00	121796.	1035066.	15.	8.498	1.	2.259	-57.288	18.820
	210.00	119311.	1034398.	6.	8.670	0.	2.478	-58.231	19.411
	220.00	116825.	1037443.	3.	8.880	0.	2.703	-59.364	19.828
	230.00	114333.	1035546.	2.	9.057	0.	2.934	-60.729	19.873
	240.00	111847.	1035230.	1.	9.256	0.	3.172	-61.738	20.216
	250.00	109363.	1034881.	1.	9.463	0.	3.416	-62.817	20.484
	260.00	106879.	1037645.	0.	9.709	0.	3.667	-63.938	20.643
	270.00	104388.	1038526.	0.	9.949	0.	3.925	-65.266	20.556
	280.00	101897.	1036118.	0.	10.168	0.	4.191	-66.443	20.504
	290.00	99411.	1036101.	0.	10.422	0.	4.464	-67.420	20.639
	300.00	96925.	1036088.	0.	10.690	0.	4.745	-68.534	20.601
	310.00	94440.	1036058.	0.	10.970	0.	5.034	-69.680	20.486
	320.00	91955.	1036020.	0.	11.267	0.	5.332	-70.821	20.330
	330.00	89471.	1035957.	0.	11.579	0.	5.638	-71.956	20.126
	340.00	86987.	1035893.	0.	11.909	0.	5.953	-73.093	19.869
	350.00	84503.	1035824.	0.	12.258	0.	6.278	-74.232	19.517
	360.00	82019.	1035750.	0.	12.628	0.	6.612	-75.361	19.213
	370.00	79536.	1035633.	0.	13.021	0.	6.957	-76.496	18.874
	380.00	77053.	1035502.	0.	13.439	0.	7.312	-77.634	18.500
	390.00	74570.	1035393.	0.	13.885	0.	7.677	-78.776	18.073
	400.00	72088.	1035288.	0.	14.361	0.	8.055	-79.922	17.596
	410.00	69597.	1039200.	0.	14.932	0.	8.444	-81.169	16.997
	420.00	67107.	1036712.	0.	15.449	0.	8.845	-82.342	16.434
	430.00	64621.	1036641.	0.	16.042	0.	9.260	-83.428	15.986

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/S2)	DYNAMIC PRESSURE (N/M2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
440.00	62135.	1036573.	0.	16.682	0.	9.687	-84.579	15.443
450.00	59650.	1035595.	0.	17.361	0.	10.129	-85.730	14.854
460.00	57166.	1035502.	0.	18.114	0.	10.586	-86.888	14.220
9) 469.00	55004.	878924.	0.	15.979	0.	11.010	-87.936	13.635
470.00	54777.	878292.	0.	16.034	0.	11.058	-88.002	13.580
480.00	52682.	874810.	0.	16.605	0.	11.544	-89.123	13.079
490.00	50604.	874311.	0.	17.277	0.	12.044	-90.268	12.511
500.00	48525.	874399.	0.	18.019	0.	12.560	-91.408	11.956
510.00	46447.	874388.	0.	18.825	0.	13.090	-92.751	11.166
520.00	44369.	874345.	0.	19.706	0.	13.638	-93.954	10.439
530.00	42291.	874300.	0.	20.673	0.	14.202	-95.051	9.833
540.00	40213.	874175.	0.	21.739	0.	14.784	-96.179	9.198
550.00	38135.	873955.	0.	22.917	0.	15.385	-97.336	8.561
560.00	36057.	873673.	0.	24.230	0.	16.006	-98.487	7.913
570.00	33979.	873214.	0.	25.698	0.	16.648	-99.961	6.766
580.00	31902.	872571.	0.	27.351	0.	17.312	-99.748	7.393
10) 583.18	31242.	872292.	0.	27.920	0.	17.528	-99.748	7.551
11) 583.38	31225.	610616.	0.	19.555	0.	17.542	-99.748	7.560
12) 583.98	31188.	24715.	0.	.792	0.	17.583	-99.748	7.600
13) 593.18	31182.	0.	4.	-.000	0.	18.212	-99.767	8.236

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 6 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	140.85	6431807.	2306.30	66.290	6430762.	57698.	100532.	892.11	273.98	2109.05
2)	142.17	6433024.	2301.54	66.554	6431932.	58060.	103318.	879.53	273.87	2109.14
3)	145.57	6436088.	2294.02	67.230	6434869.	58990.	110492.	849.24	273.44	2113.42
4)	148.57	6438724.	2300.98	67.794	6437385.	59809.	116855.	828.64	272.68	2129.20
5)	152.77	6442327.	2315.93	68.566	6440809.	60953.	125852.	801.83	272.02	2155.60
	160.00	6448306.	2344.96	69.862	6446444.	62917.	141612.	756.54	271.05	2202.96
6)	165.17	6452410.	2367.12	70.762	6450273.	64317.	153093.	724.43	270.32	2237.27
	170.00	6456115.	2388.67	71.582	6453699.	65620.	163974.	694.58	269.64	2269.50
7)	171.47	6457218.	2395.43	71.827	6454712.	66016.	167313.	685.55	269.43	2279.37
8)	175.00	6459825.	2412.91	72.405	6457095.	66967.	175406.	664.30	268.89	2304.03
	180.00	6463409.	2438.35	73.190	6460342.	68309.	187014.	634.95	267.97	2338.93
	190.00	6470257.	2489.07	74.483	6466435.	70978.	210735.	585.01	265.71	2404.71
	200.00	6476730.	2542.86	75.686	6472042.	73622.	235116.	536.37	263.16	2471.68
	210.00	6482833.	2599.85	76.838	6477161.	76240.	260175.	487.40	260.32	2540.45
	220.00	6488573.	2660.22	77.934	6481790.	78828.	285931.	438.35	257.24	2611.22
	230.00	6493957.	2724.29	78.981	6485927.	81384.	312407.	388.88	253.96	2684.41
	240.00	6498989.	2791.68	79.980	6489566.	83906.	339626.	338.75	250.43	2759.72
	250.00	6503674.	2862.44	80.926	6492702.	86391.	367609.	288.29	246.53	2837.19
	260.00	6508020.	2936.64	81.820	6495330.	88836.	396377.	237.35	242.26	2916.99
	270.00	6512034.	3014.69	82.663	6497447.	91235.	425958.	185.86	237.62	2999.56
	280.00	6515721.	3096.43	83.463	6499045.	93587.	456378.	133.47	232.63	3084.79
	290.00	6519087.	3181.58	84.213	6500115.	95886.	487662.	80.39	227.18	3172.44
	300.00	6522141.	3270.36	84.913	6500651.	98129.	519835.	26.71	221.22	3262.76
	310.00	6524890.	3362.90	85.566	6500647.	100309.	552926.	-27.81	214.78	3355.92
	320.00	6527344.	3459.32	86.175	6500092.	102423.	586964.	-83.28	207.85	3452.07
	330.00	6529509.	3559.71	86.740	6498978.	104465.	621978.	-139.75	200.39	3551.32
	340.00	6531395.	3664.18	87.263	6497294.	106429.	658001.	-197.28	192.37	3653.80
	350.00	6533012.	3772.88	87.744	6495029.	108310.	695065.	-256.00	183.76	3759.69
	360.00	6534370.	3885.97	88.185	6492170.	110102.	733207.	-316.03	174.54	3869.16
	370.00	6535478.	4003.61	88.586	6488704.	111799.	772461.	-377.40	164.70	3982.37
	380.00	6536350.	4125.99	88.948	6484617.	113394.	812868.	-440.25	154.18	4099.54
	390.00	6536998.	4253.34	89.273	6479894.	114880.	854466.	-504.68	142.98	4220.87
	400.00	6537435.	4385.92	89.561	6474518.	116251.	897300.	-570.83	131.03	4346.64
	410.00	6537676.	4524.49	89.812	6468472.	117498.	941417.	-638.83	118.28	4477.60
	420.00	6537736.	4668.98	90.031	6461735.	118614.	986870.	-709.08	104.75	4613.63
	430.00	6537632.	4819.42	90.215	6454284.	119590.	1033707.	-781.48	90.33	4754.78

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6 (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
	440.00	6537382.	4976.45	90.363	6446098.	120417.	1081985.	-856.17	74.95	4901.68
	450.00	6537008.	5140.45	90.479	6437152.	121086.	1131761.	-933.47	58.56	5054.65
	460.00	6536530.	5312.03	90.562	6427419.	121585.	1183100.	-1013.58	41.09	5214.27
9)	469.00	6536052.	5470.16	90.617	6417965.	121880.	1230697.	-1088.44	24.69	5360.72
	470.00	6535973.	5485.73	90.628	6416870.	121904.	1236065.	-1097.01	23.05	5374.88
	480.00	6535317.	5644.66	90.716	6405467.	122050.	1290530.	-1184.07	5.86	5519.07
	490.00	6534568.	5810.14	90.778	6393173.	122019.	1346464.	-1274.28	-12.23	5668.67
	500.00	6533749.	5983.00	90.810	6379971.	121801.	1403925.	-1367.74	-31.37	5824.49
	510.00	6532865.	6163.90	90.816	6365811.	121388.	1462977.	-1465.03	-51.54	5987.04
	520.00	6532001.	6353.54	90.798	6350655.	120767.	1523691.	-1566.85	-72.82	6156.88
	530.00	6531126.	6552.55	90.751	6334467.	119926.	1586142.	-1672.97	-95.63	6334.66
	540.00	6530296.	6761.80	90.674	6317181.	118849.	1650414.	-1783.69	-120.09	6521.19
	550.00	6529543.	6982.32	90.568	6298769.	117519.	1716599.	-1899.66	-146.23	6717.34
	560.00	6528927.	7215.32	90.432	6279168.	115918.	1784798.	-2021.51	-174.18	6924.16
	570.00	6528462.	7462.56	90.293	6258303.	114026.	1855121.	-2153.18	-204.67	7142.25
	580.00	6528201.	7724.85	90.089	6236097.	111819.	1927692.	-2287.95	-236.96	7374.45
10)	583.18	6528180.	7811.74	90.008	6228746.	111048.	1951287.	-2331.18	-247.58	7451.68
11)	583.38	6528180.	7816.94	90.003	6228280.	110998.	1952778.	-2333.86	-248.21	7456.28
12)	583.98	6528179.	7818.13	90.002	6226878.	110849.	1957251.	-2339.41	-248.44	7455.78
13)	593.18	6528178.	7818.46	90.001	6204978.	108557.	2025727.	-2421.37	-249.83	7429.87

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 6 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	140.85	88726.	2025.77	62.755	58303.	-492.	66878.	912.20	-9.21	1808.74
2)	142.17	91316.	2020.30	63.047	59500.	-504.	69268.	899.87	-9.16	1808.80
3)	145.57	97957.	2011.07	63.801	62507.	-535.	75420.	870.25	-9.15	1813.00
4)	148.57	103820.	2016.73	64.455	65088.	-563.	80882.	850.33	-9.49	1828.68
5)	152.77	112071.	2029.95	65.360	68605.	-603.	88617.	824.53	-9.52	1854.93
	160.00	126422.	2056.18	66.881	74410.	-671.	102202.	781.03	-9.35	1902.05
6)	165.17	136800.	2076.50	67.938	78369.	-719.	112125.	750.23	-9.21	1936.21
	170.00	146584.	2096.46	68.901	81923.	-763.	121553.	721.62	-9.05	1968.33
7)	171.47	149577.	2102.75	69.188	82976.	-776.	124449.	712.98	-9.00	1978.17
8)	175.00	156813.	2119.17	69.868	85458.	-808.	131479.	692.67	-8.89	2002.75
	180.00	167152.	2143.26	70.791	88849.	-852.	141580.	664.67	-8.86	2037.57
	190.00	188178.	2191.93	72.314	95253.	-942.	162287.	617.45	-9.23	2103.14
	200.00	209690.	2244.01	73.730	101199.	-1037.	183650.	571.63	-9.75	2169.96
	210.00	231716.	2299.55	75.082	106685.	-1138.	205692.	525.59	-10.41	2238.66
	220.00	254286.	2358.71	76.364	111711.	-1246.	228430.	479.58	-11.17	2309.41
	230.00	277434.	2421.77	77.583	116276.	-1361.	251888.	433.27	-11.96	2382.66
	240.00	301195.	2488.33	78.744	120375.	-1485.	276090.	386.41	-12.83	2458.11
	250.00	325600.	2558.44	79.837	124004.	-1618.	301058.	339.36	-13.89	2535.80
	260.00	350686.	2632.17	80.866	127161.	-1763.	326814.	291.95	-15.16	2615.89
	270.00	376489.	2709.89	81.833	129842.	-1922.	353385.	244.13	-16.60	2698.82
	280.00	403048.	2791.42	82.745	132042.	-2096.	380800.	195.56	-18.21	2784.51
	290.00	430400.	2876.49	83.596	133752.	-2287.	409084.	146.44	-20.08	2872.69
	300.00	458582.	2965.30	84.388	134969.	-2499.	438263.	96.86	-22.26	2963.63
	310.00	487632.	3057.96	85.123	135687.	-2733.	468366.	46.59	-24.71	3057.51
	320.00	517592.	3154.58	85.805	135899.	-2994.	499424.	-4.45	-27.44	3154.46
	330.00	548501.	3255.25	86.435	135596.	-3283.	531466.	-56.33	-30.46	3254.62
	340.00	580402.	3360.05	87.015	134770.	-3604.	564527.	-109.10	-33.81	3358.11
	350.00	613339.	3469.14	87.546	133411.	-3960.	598640.	-162.87	-37.50	3465.11
	360.00	647355.	3582.66	88.031	131509.	-4355.	633842.	-217.75	-41.55	3575.80
	370.00	682498.	3700.78	88.470	129052.	-4793.	670169.	-273.79	-45.96	3690.35
	380.00	718817.	3823.66	88.865	126029.	-5276.	707662.	-331.08	-50.75	3808.96
	390.00	756360.	3951.55	89.218	122427.	-5809.	746363.	-389.74	-55.94	3931.88
	400.00	795180.	4084.68	89.529	118230.	-6396.	786315.	-449.90	-61.58	4059.36
	410.00	835335.	4223.82	89.799	113424.	-7042.	827569.	-511.64	-67.67	4192.17
	420.00	876886.	4368.89	90.033	107991.	-7751.	870177.	-575.39	-74.20	4330.20
	430.00	919893.	4519.93	90.229	101910.	-8528.	914191.	-641.01	-81.26	4473.51

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	EARTH FIXED POSITION (M)	EARTH FIXED VELOCITY (M/S)	EARTH FIXED PATH ANGLE (DEG)	EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
	440.00	964420.	4677.57	90.387	95164.	-9378.	959667.	-708.64	-88.91	4622.72
	450.00	1010535.	4842.18	90.509	87730.	-10308.	1006666.	-778.58	-97.14	4778.18
	460.00	1058311.	5014.36	90.596	79584.	-11323.	1055254.	-851.01	-106.04	4940.48
9)	469.00	1102795.	5173.03	90.653	71623.	-12316.	1100398.	-918.72	-114.37	5089.51
	470.00	1107823.	5188.66	90.664	70701.	-12430.	1105495.	-926.54	-115.14	5103.97
	480.00	1158955.	5348.11	90.756	61041.	-13622.	1157267.	-1005.85	-123.32	5251.22
	490.00	1211686.	5514.12	90.820	50574.	-14898.	1210538.	-1088.01	-131.96	5404.10
	500.00	1266084.	5687.50	90.852	39271.	-16263.	1265371.	-1173.10	-141.18	5563.41
	510.00	1322227.	5868.91	90.857	27101.	-17724.	1321831.	-1261.69	-150.94	5729.70
	520.00	1380197.	6059.06	90.837	14023.	-19284.	1379991.	-1354.44	-161.26	5903.53
	530.00	1440082.	6258.59	90.787	-1.	-20952.	1439929.	-1451.10	-172.54	6085.59
	540.00	1501981.	6468.35	90.705	-15012.	-22738.	1501733.	-1551.96	-184.86	6276.69
	550.00	1565999.	6689.38	90.593	-31056.	-24653.	1565497.	-1657.60	-198.19	6477.73
	560.00	1632256.	6922.89	90.450	-48182.	-26706.	1631326.	-1768.64	-212.61	6689.78
	570.00	1700878.	7170.66	90.305	-66464.	-28911.	1699333.	-1888.98	-228.68	6913.60
	580.00	1772011.	7433.45	90.093	-85967.	-31283.	1769648.	-2011.81	-245.80	7151.81
10)	583.18	1795205.	7520.49	90.009	-92433.	-32074.	1792537.	-2051.10	-251.41	7231.02
11)	583.38	1796672.	7525.71	90.004	-92843.	-32124.	1793984.	-2053.53	-251.74	7235.74
12)	583.98	1801074.	7526.89	90.002	-94077.	-32275.	1798325.	-2058.70	-251.40	7235.51
13)	593.18	1868556.	7527.12	90.001	-113370.	-34557.	1864794.	-2135.32	-244.55	7213.75

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 6 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	140.85	58.652	66.388	2052.93	52.938	45.040	-80.142	28.890	29.053
2)	142.17	59.874	68.745	2048.36	52.948	45.050	-80.125	28.905	29.068
3)	145.57	62.950	74.811	2035.74	52.956	45.075	-80.081	28.943	29.106
4)	148.57	65.597	80.192	2038.13	52.911	45.087	-80.042	28.977	29.141
5)	152.77	69.215	87.807	2046.91	52.847	45.119	-79.986	29.026	29.189
	160.00	75.221	101.164	2072.36	52.741	45.183	-79.889	29.110	29.274
6)	165.17	79.345	110.911	2092.81	52.668	45.230	-79.817	29.172	29.336
	170.00	83.069	120.162	2112.89	52.603	45.274	-79.750	29.231	29.395
7)	171.47	84.177	123.003	2119.22	52.584	45.288	-79.729	29.249	29.413
8)	175.00	86.798	129.895	2135.72	52.536	45.321	-79.679	29.292	29.457
	180.00	90.402	139.792	2159.91	52.467	45.363	-79.606	29.355	29.519
	190.00	97.291	160.057	2208.75	52.340	45.438	-79.457	29.483	29.640
	200.00	103.806	180.938	2260.99	52.217	45.511	-79.303	29.614	29.780
	210.00	109.953	202.456	2316.66	52.099	45.584	[illegible].144	29.750	29.916
	220.00	115.738	224.632	2375.93	51.986	45.658	-78.980	29.889	30.056
	230.00	121.168	247.492	2439.10	51.878	45.735	-78.810	30.033	30.200
	240.00	126.248	271.060	2505.76	51.776	45.814	-78.635	30.180	30.348
	250.00	130.983	295.361	2575.96	51.678	45.893	-78.453	30.333	30.501
	260.00	135.380	320.420	2649.77	51.584	45.973	-78.265	30.489	30.658
	270.00	139.447	346.266	2727.56	51.494	46.053	-78.071	30.651	30.820
	280.00	143.189	372.930	2809.16	51.410	46.136	-77.870	30.817	30.987
	290.00	146.611	400.440	2894.28	51.330	46.219	-77.662	30.988	31.158
	300.00	149.723	428.825	2983.14	51.254	46.303	-77.447	31.165	31.335
	310.00	152.533	458.117	3075.86	51.183	46.388	-77.224	31.347	31.518
	320.00	155.049	488.349	3172.52	51.117	46.474	-76.993	31.534	31.706
	330.00	157.278	519.557	3273.22	51.057	46.564	-76.754	31.727	31.899
	340.00	159.231	551.775	3378.07	51.003	46.656	-76.506	31.926	32.099
	350.00	160.917	585.043	3487.20	50.955	46.751	-76.250	32.131	32.305
	360.00	162.346	619.400	3600.76	50.914	46.849	-75.983	32.343	32.517
	370.00	163.529	654.889	3718.91	50.879	46.951	-75.707	32.561	32.735
	380.00	164.477	691.552	3841.84	50.852	47.058	-75.421	32.785	32.961
	390.00	165.204	729.438	3969.76	50.833	47.170	-75.123	33.017	33.193
	400.00	165.722	768.594	4102.93	50.822	47.287	-74.815	33.256	33.433
	410.00	166.048	809.076	4242.11	50.818	47.409	-74.494	33.503	33.680
	420.00	166.197	850.942	4387.23	50.825	47.539	-74.161	33.758	33.936
	430.00	166.183	894.250	4538.31	50.841	47.676	-73.814	34.020	34.199

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS, EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
	440.00	166.028	939.061	4695.99	50.866	47.820	-73.454	34.291	34.470
	450.00	165.751	985.442	4860.65	50.902	47.972	-73.079	34.571	34.751
	460.00	165.374	1033.466	5032.89	50.949	48.132	-72.688	34.859	35.040
9)	469.00	164.970	1078.153	5191.61	51.005	48.287	-72.322	35.127	35.309
	470.00	164.921	1083.203	5207.25	51.014	48.306	-72.281	35.157	35.339
	480.00	164.374	1134.548	5366.76	51.112	48.500	-71.858	35.464	35.646
	490.00	163.736	1187.481	5532.84	51.223	48.706	-71.418	35.779	35.962
	500.00	163.032	1242.073	5706.29	51.346	48.922	-70.962	36.102	36.286
	510.00	162.286	1298.400	5887.77	51.482	49.151	-70.487	36.434	36.618
	520.00	161.525	1356.543	6078.01	51.634	49.394	-69.994	36.776	36.960
	530.00	160.776	1416.593	6277.62	51.798	49.647	-69.479	37.126	37.312
	540.00	160.075	1478.646	6487.47	51.976	49.913	-68.944	37.487	37.673
	550.00	159.462	1542.806	6708.59	52.169	50.194	-68.385	37.857	38.044
	560.00	158.979	1609.188	6942.20	52.380	50.490	-67.801	38.238	38.426
	570.00	158.656	1677.921	7190.07	52.606	50.801	-67.191	38.630	38.818
	580.00	158.542	1749.148	7452.97	52.854	51.133	-66.552	39.034	39.222
10)	583.18	158.569	1772.365	7540.04	52.939	51.244	-66.342	39.165	39.353
11)	583.38	158.572	1773.833	7545.26	52.945	51.251	-66.329	39.173	39.362
12)	583.98	158.581	1778.238	7546.45	52.971	51.279	-66.289	39.198	39.387
13)	593.18	158.718	1845.798	7527.12	53.386	51.720	-65.673	39.576	39.765

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 6 (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	140.65	-64.005	-.099	.001	.005	-.026	-.000	-.006	-.099	.001
2)	142.17	-65.985	-.207	-.001	.033	-.137	-.003	.014	-.207	-.001
3)	145.57	-63.592	-1.066	-.062	.138	-.202	-.056	.407	-1.066	-.065
4)	148.57	-63.512	-.894	-.340	-.060	.225	-.098	.489	-.893	-.345
5)	152.77	-63.811	-.204	-.566	-.038	.039	-.004	.189	-.203	-.567
	160.00	-63.872	-.298	-.685	-.011	.005	-.034	.128	-.297	-.686
6)	165.17	-63.931	-.269	-.648	-.009	.000	.005	.070	-.269	-.648
	170.00	-63.963	-.274	-.717	-.006	-.000	-.031	.037	-.274	-.717
7)	171.47	-63.971	-.274	-.769	-.005	.000	-.040	.029	-.274	-.770
8)	175.00	-63.976	-.315	-.645	-.002	-.008	.044	.025	-.315	-.645
	180.00	-60.758	-.762	.037	1.132	-.041	.109	-1.758	-.358	.053
	190.00	-55.852	-.825	-.097	-.220	-.023	-.143	.253	-.294	-.100
	200.00	-57.126	-.993	-.608	-.117	-.017	-.035	.164	-.297	-.610
	210.00	-58.094	-1.118	-.644	-.097	-.010	.064	.139	-.313	-.646
	220.00	-59.163	-1.219	-.030	-.128	-.007	.057	.201	-.330	-.034
	230.00	-60.548	-1.277	.513	-.130	-.009	.055	.180	-.326	.509
	240.00	-61.594	-1.434	.433	-.101	-.017	-.042	.143	-.321	.429
	250.00	-62.663	-1.598	.003	-.111	-.016	-.044	.154	-.326	-.001
	260.00	-63.783	-1.759	-.443	-.113	-.016	-.045	.156	-.330	-.447
	270.00	-65.091	-1.884	-.601	-.130	-.013	.051	.176	-.337	-.606
	280.00	-66.303	-2.039	-.071	-.110	-.018	.055	.141	-.335	-.075
	290.00	-67.271	-2.251	.505	-.104	-.019	.056	.147	-.343	.499
	300.00	-68.377	-2.434	.428	-.114	-.017	-.047	.156	-.354	.422
	310.00	-69.524	-2.601	-.046	-.115	-.017	-.048	.156	-.355	-.053
	320.00	-70.668	-2.773	-.524	-.114	-.017	-.048	.155	-.361	-.531
	330.00	-71.804	-2.944	-.547	-.113	-.018	.052	.154	-.365	-.555
	340.00	-72.938	-3.116	-.026	-.114	-.018	.052	.155	-.373	-.034
	350.00	-74.124	-3.292	.479	-.114	-.017	.051	.107	-.387	.474
	360.00	-75.244	-3.454	.453	-.114	-.015	-.049	.115	-.393	.446
	370.00	-76.380	-3.616	-.042	-.114	-.016	-.050	.116	-.398	-.049
	380.00	-77.519	-3.775	-.540	-.114	-.015	-.050	.116	-.402	-.548
	390.00	-78.663	-3.933	-.525	-.115	-.016	.050	.115	-.407	-.533
	400.00	-79.807	-4.092	-.029	-.115	-.015	.049	.115	-.418	-.037
	410.00	-81.044	-4.218	.439	-.125	-.013	.046	.124	-.425	.431
	420.00	-82.235	-4.363	.525	-.110	-.017	-.050	.104	-.426	.517
	430.00	-83.313	-4.533	.030	-.113	-.015	-.051	.114	-.435	.021

1) S-IF/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
	440.00	-84.463	-4.680	-.488	-.116	-.014	-.052	.118	-.441	-.498
	450.00	-85.618	-4.824	-.568	-.115	-.014	.048	.114	-.446	-.577
	460.00	-86.773	-4.965	-.091	-.116	-.013	.047	.116	-.456	-.100
9)	469.00	-87.819	-5.087	.334	-.116	-.013	.047	.116	-.463	.324
	470.00	-87.930	-5.103	.382	-.102	-.022	.051	.071	-.433	.376
	480.00	-88.999	-5.302	.568	-.121	-.006	-.056	.121	-.478	.557
	490.00	-90.157	-5.387	.026	-.110	-.013	-.053	.109	-.472	.016
	500.00	-91.286	-5.510	-.512	-.121	-.008	-.056	.123	-.485	-.523
	510.00	-92.611	-5.550	-.532	-.140	-.006	.040	.142	-.486	-.545
	520.00	-93.844	-5.693	-.089	-.111	-.018	.047	.110	-.482	-.099
	530.00	-94.940	-5.868	.388	-.111	-.016	.047	.109	-.491	.377
	540.00	-96.063	-6.006	.573	-.114	-.012	-.054	.114	-.501	.561
	550.00	-97.218	-6.121	.024	-.116	-.011	-.055	.116	-.505	.012
	560.00	-98.374	-6.230	-.529	-.116	-.011	-.055	.114	-.509	-.541
	570.00	-100.005	-6.441	-.220	.020	.005	.086	-.043	-.533	-.215
	580.00	-99.787	-6.368	.574	.025	.011	-.016	-.041	-.542	.578
10)	583.18	-99.765	-6.359	.511	-.000	-.001	-.022	-.019	-.533	.512
11)	583.38	-99.765	-6.359	.506	-.000	-.001	-.022	-.019	-.534	.508
12)	583.98	-99.765	-6.360	.493	-.000	-.001	-.022	-.019	-.534	.495
13)	593.18	-99.767	-6.366	.293	.000	-.001	-.022	-.020	-.540	.295

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 7
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE RE-ENTRY DATA

	FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC2)	DYNAMIC PRESSURE (N/M2)	A.H.I. (KG-M/M2-RAD)	MACH NO.
1)	140.85	45975.	119199.	112055.	.155	822.	68015193.	6.46
	141.00	45930.	-598275.	110019.	-15.421	807.	68031938.	6.46
	142.00	45634.	-620816.	96371.	-15.716	707.	68133057.	6.43
2)	142.97	45347.	0.	85289.	-1.881	625.	68218682.	6.42
	143.00	45347.	0.	84989.	-1.874	623.	68221112.	6.42
	160.00	45347.	0.	11568.	-.255	85.	68814474.	6.72
	180.00	45347.	0.	1209.	-.027	9.	68898089.	6.89
	200.00	45347.	0.	195.	-.004	1.	68907389.	6.34
	220.00	45347.	0.	67.	-.001	0.	68909327.	5.89
	240.00	45347.	0.	45.	-.001	0.	68910203.	5.70
3)	243.00	45347.	0.	45.	-.001	0.	68910314.	5.70
	260.00	45347.	0.	55.	-.001	0.	68910985.	5.74
	280.00	45347.	0.	125.	-.003	1.	68912346.	6.18
	300.00	45347.	0.	593.	-.013	4.	68917248.	6.74
	320.00	45347.	0.	5229.	-.116	39.	68955176.	6.85
	340.00	45347.	0.	52002.	-1.147	381.	69335164.	6.42
	360.00	45347.	0.	518629.	-11.437	3781.	73144771.	6.03
	380.00	45347.	0.	3398422.	-74.942	23091.	101121366.	4.16
	400.00	45347.	0.	1115992.	-24.610	6841.	116595459.	1.14
	420.00	45347.	0.	532371.	-11.740	4759.	118236171.	.67
	440.00	45347.	0.	500756.	-11.043	4916.	119340037.	.52
	460.00	45347.	0.	489301.	-10.790	4935.	120287100.	.43
	480.00	45347.	0.	476976.	-10.518	4872.	121093686.	.36
	500.00	45347.	0.	469541.	-10.354	4842.	121797682.	.31
	520.00	45347.	0.	464549.	-10.244	4801.	122424731.	.28
4)	531.00	45347.	0.	461481.	-10.177	4770.	122742058.	.26

1) PHYSICAL SEPARATION;
2) RETRO-ROCKET BURNOUT;
3) S-IB STAGE APOGEE;
4) S-IB STAGE IMPACT.

TABLE 7 (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

S-1B STAGE RE-ENTRY DATA

FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1) 140.85	6431804.	2306.30	66.290	6430759.	57698.	100526.	892.11	274.00	2109.05
141.00	6431937.	2304.87	66.323	6430887.	57740.	100831.	890.04	273.98	2107.81
142.00	6432854.	2284.06	66.550	6431769.	58014.	102931.	873.14	273.90	2092.73
2) 142.97	6433729.	2271.32	66.762	6432609.	58279.	104957.	859.81	273.82	2084.38
143.00	6433756.	2271.16	66.768	6432634.	58287.	105018.	859.51	273.82	2084.33
160.00	6447626.	2197.67	70.378	6445793.	62930.	140286.	690.53	272.34	2068.52
180.00	6460593.	2138.27	74.844	6457679.	68359.	181583.	498.48	270.57	2061.68
200.00	6469996.	2095.51	79.514	6465740.	73751.	222754.	307.75	268.66	2055.31
220.00	6475851.	2068.55	84.337	6469992.	79104.	263789.	117.56	266.60	2047.93
240.00	6478163.	2057.72	89.245	6470444.	84414.	304664.	-72.32	264.39	2039.35
3) 243.00	6478204.	2057.50	89.984	6470184.	85207.	310780.	-100.79	264.04	2038.00
260.00	6476935.	2063.21	94.165	6467100.	89679.	345356.	-262.11	262.02	2029.65
280.00	6472167.	2084.89	99.024	6459959.	94894.	385841.	-452.00	259.50	2018.67
300.00	6463853.	2122.29	103.750	6449018.	100058.	426095.	-642.17	256.82	2006.43
320.00	6451987.	2174.03	108.287	6434271.	105166.	466086.	-832.51	253.98	1992.20
340.00	6436580.	2232.10	112.586	6415735.	110216.	505734.	-1019.63	250.96	1969.68
360.00	6417904.	2224.71	116.565	6393728.	115200.	544489.	-1163.24	247.15	1880.20
380.00	6399289.	1508.54	118.843	6372061.	120118.	577333.	-846.41	246.52	1224.14
400.00	6390501.	614.57	113.995	6361729.	125120.	592665.	-300.06	253.99	472.39
420.00	6386378.	474.63	112.936	6356764.	130262.	600337.	-222.19	259.75	329.14
440.00	6382957.	435.56	111.232	6352638.	135492.	606440.	-191.76	262.57	289.83
460.00	6380037.	420.79	108.703	6349043.	140747.	612133.	-168.61	262.82	282.07
480.00	6377521.	414.25	106.465	6345850.	146003.	617776.	-151.72	262.70	282.82
500.00	6375306.	411.52	104.721	6342945.	151254.	623453.	-139.36	262.33	284.80
520.00	6373320.	408.72	103.350	6340258.	156493.	629163.	-129.72	261.36	286.20
4) 531.00	6372307.	406.53	102.756	6338855.	159376.	632307.	-125.22	261.79	284.69

1) PHYSICAL SEPARATION;
2) RETRO-ROCKET BURNOUT;
3) S-1B STAGE APOGEE;
4) S-1B STAGE IMPACT.

TABLE 7 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE RE-ENTRY DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	140.85	88719.	2025.77	62.755	58300.	-492.	66872.	912.19	-9.20	1808.74
	141.00	89000.	2023.74	62.789	58431.	-493.	67131.	910.15	-9.20	1807.51
	142.00	90952.	2002.75	63.009	59333.	-502.	68931.	893.32	-9.18	1792.45
2)	142.97	92828.	1989.42	63.227	60193.	-511.	70666.	880.12	-9.16	1784.12
	143.00	92885.	1989.23	63.234	60219.	-511.	70718.	879.82	-9.16	1784.06
	160.00	124964.	1906.86	67.231	73748.	-661.	100880.	713.89	-8.38	1768.17
	180.00	161132.	1838.37	72.296	86138.	-816.	136173.	525.49	-7.00	1761.65
	200.00	195818.	1788.43	77.688	94776.	-939.	171351.	338.41	-5.28	1756.11
	220.00	229224.	1756.65	83.327	99678.	-1025.	206414.	151.85	-3.22	1750.07
	240.00	261576.	1743.72	89.109	100851.	-1066.	241350.	-34.44	-.83	1743.38
3)	243.00	266352.	1743.43	89.981	100706.	-1068.	246578.	-62.38	-.44	1742.31
	260.00	293121.	1749.87	94.913	98300.	-1056.	276144.	-220.67	1.89	1736.00
	280.00	324124.	1775.21	100.615	92024.	-988.	310785.	-407.03	4.94	1727.91
	300.00	354865.	1818.69	106.103	82017.	-856.	345256.	-593.71	8.31	1719.04
	320.00	385630.	1878.61	111.292	68274.	-653.	379537.	-780.62	11.99	1708.70
	340.00	416668.	1946.38	116.132	50809.	-375.	413559.	-964.47	15.82	1690.55
	360.00	447775.	1949.44	120.688	29930.	-31.	446774.	-1106.05	17.69	1605.20
	380.00	474201.	1237.18	126.031	9354.	249.	474109.	-798.00	6.56	945.39
	400.00	483757.	322.28	140.849	-163.	224.	483757.	-264.23	-4.78	184.45
	420.00	485672.	192.58	163.789	-4437.	153.	485652.	-188.39	-1.88	39.90
	440.00	486029.	158.18	175.710	-7891.	142.	485965.	-158.18	.27	.09
	460.00	485979.	134.95	179.125	-10811.	150.	485859.	-134.71	.38	-8.06
	480.00	485879.	117.56	179.396	-13322.	157.	485696.	-117.31	.34	-7.62
	500.00	485810.	104.99	178.956	-15534.	162.	485562.	-104.43	.13	-5.89
	520.00	485772.	94.40	178.562	-17517.	159.	485456.	-94.28	-.65	-4.68
4)	531.00	485751.	89.76	179.778	-18528.	159.	485398.	-89.54	-.15	-6.31

1) PHYSICAL SEPARATION;
2) RETRO-ROCKET BURNOUT;
3) S-IB STAGE APOGEE;
4) S-IB STAGE IMPACT.

TABLE 7 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE RE-ENTRY DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	140.85	58.649	66.382	8052.93	52.938	45.040	-80.142	28.890	29.053
	141.00	58.782	66.638	8050.82	52.944	45.041	-80.140	28.891	29.054
	142.00	59.703	68.413	8030.58	53.005	45.046	-80.127	28.902	29.066
2)	142.97	60.582	70.124	8016.91	53.042	45.052	-80.115	28.913	29.076
	143.00	60.608	70.175	8016.69	53.043	45.052	-80.114	28.914	29.077
	160.00	74.539	99.867	1923.09	53.230	45.190	-79.898	29.102	29.266
	180.00	87.575	134.512	1855.19	53.407	45.369	-79.645	29.321	29.486
	200.00	97.048	168.994	1805.74	53.579	45.561	-79.391	29.539	29.704
	220.00	102.972	203.371	1774.32	53.752	45.766	-79.134	29.755	29.921
	240.00	105.354	237.689	1761.58	53.927	45.982	-78.881	29.969	30.136
3)	243.00	105.405	242.834	1761.31	53.953	46.016	-78.843	30.002	30.169
	260.00	104.196	271.991	1767.85	54.103	46.212	-78.624	30.183	30.351
	280.00	99.497	306.322	1792.94	54.282	46.453	-78.366	30.396	30.565
	300.00	91.253	340.724	1836.10	54.463	46.707	-78.106	30.609	30.778
	320.00	79.456	375.236	1895.58	54.649	46.974	-77.842	30.821	30.991
	340.00	64.119	409.847	1970.52	54.862	47.250	-77.574	31.033	31.203
	360.00	45.512	444.054	1976.60	55.296	47.486	-77.311	31.241	31.412
	380.00	26.954	472.598	1249.85	59.163	47.390	-77.090	31.415	31.586
	400.00	18.187	482.877	326.87	75.356	45.767	-77.011	31.478	31.650
	420.00	14.069	485.078	194.42	85.042	45.376	-76.994	31.492	31.664
	440.00	10.649	485.645	158.37	88.922	49.818	-76.990	31.495	31.667
	460.00	7.729	485.755	134.95	89.877	65.427	-76.989	31.496	31.668
	480.00	5.214	485.779	117.56	89.953	74.705	-76.989	31.496	31.668
	500.00	2.998	485.809	104.58	89.852	57.458	-76.988	31.496	31.668
	520.00	1.012	485.851	94.38	89.723	35.874	-76.988	31.496	31.668
4)	531.00	.000	485.868	89.78	89.970	52.596	-76.988	31.496	31.668

1) PHYSICAL SEPARATION;
2) RETRO-ROCKET BURNOUT;
3) S-IB STAGE APOGEE;
4) S-IB STAGE IMPACT.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 8

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY TRACKING AND COMMUNICATIONS NETWORK

STATION	CAPABILITY (1)	GEODETIC (2) LATITUDE (Deg N)	LONGITUDE (2) (Deg E)	ALTITUDE (2) (Meters)
Merritt Is.	CS, T, C	28.508	- 80.694	19.0
Wallops Is.	CS, C	37.861	- 75.509	4.0
Bermuda	CS, T, C	32.350	- 64.658	22.6
Newfoundland	CS, T	47.741	- 52.720	123.0
Ascension Is.	C	-7.955	- 14.328	544.2
Madrid	CS, T	40.457	- 4.167	766.0
Tananarive	C	-19.003	47.315	1319.6
Canton Is.	C	- 2.792	-171.688	12.0
Hawaii	CS, T	22.116	-159.673	1145.0
Vanguard(Ship)	CS, T	-25.000	-155.000	0.0

Notes:

(1) CS denotes UHF command system; T denotes VHF telemetry; and C denotes C-band radar. Reflects total station capability.

(2) All coordinates are referenced to Fischer Ellipsoid of 1960.

TABLE 9

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL TRAJECTORY
ORBITAL FLIGHT SEQUENCE OF EVENTS

Soyuz GET Approximate (HR:MIN:SEC)	Apollo Nominal Flight Time (HR:MIN:SEC)	Apollo Nominal Flight Time (SEC)	Program Time (SEC)	Event
7:39:43.18	0:09:43.38	583.38	$(0.00)_4$	Time Base 4 initiation; Maintain inertial attitude;
7:39:43.78	0:09:43.98	583.98	$(0.60)_4$	Begin LOX NPV;
7:39:52.98	0:09:53.18	593.18	-------	Orbit Insertion;
7:39:53.58	0:09:53.78	593.78	$(10.40)_4$	Begin LH_2 NPV;
7:40:03.18	0:10:03.38	603.38	$(20.00)_4$	Initiate a maneuver to align and maintain the S-IVB/CSM along the local horizontal, nose leading, position 1 down;
7:40:43.78	0:10:43.98	643.98	$(60.60)_4$	End LOX NPV;
7:51:04.58	0:21:04.78	1264.78	$(681.40)_4$	End LH_2 NPV;
7:51:23.18	0:21:23.38	1283.38	$(700.00)_4$	Initiate a maneuver to align and maintain the S-IVB/CSM nose three degrees above the local horizontal, tail leading, position 1 down;
8:19:53.18	0:49:53.38	2993.38	$(2410.00)_4$	Initiate a maneuver to position the S-IVB/CSM for separation;
8:28:53.18	0:58:53.38	3533.38	$(2950.00)_4$	Begin LH_2 NPV;
8:29:40.18	0:59:40.38	3580.38	$(2997.00)_4$	Begin inertial attitude hold;
8:43:53.18	1:13:53.38	4433.38	$(3850.00)_4$	End LH_2 NPV;
8:44:00.00	1:14:00.20	4440.20	-------	CSM separation; SLA panel jettison;
8:54:00.00	1:24:00.20	5040.20	-------	CSM docking;
9:14:53.18	1:44:53.38	6293.38	$(5710.00)_4$	Begin LH_2 NPV;
9:22:53.18	1:52:53.38	6773.38	$(6190.00)_4$	End LH_2 NPV;

TABLE 9 (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL TRAJECTORY
ORBITAL FLIGHT SEQUENCE OF EVENTS

Soyuz GET Approximate (HR:MIN:SEC)	Apollo Nominal Flight Time (HR:MIN:SEC)	Apollo Nominal Flight Time (SEC)	Program Time (SEC)	Event
9:51:53.18	2:21:53.38	8513.38	$(7930.00)_4$	Initiate a maneuver to position the vehicle for docking module extraction;
9:59:02.18	2:29:02.38	8942.38	$(8359.00)_4$	Begin inertial attitude hold;
10:04:00.00	2:34:00.20	9240.20	--------	Docking module extraction;
10:14:53.18	2:44:53.38	9893.38	$(9310.00)_4$	Initiate a maneuver to align and maintain the S-IVB/IU along the local horizontal, tail leading, position 1 down;
14:59:59.80	7:30:00.00	27000.00	--------	End of IU battery lifetime.

NOTES: 1) Launch window opening and closing trajectories follow the same Apollo program time sequence starting with Time Base 4 initiation at 584.27 and 584.01 seconds flight time, respectively. However, the non-programmed events do not deviate from the nominal flight times except for OI, which is GCS + 10 seconds for all simulations.

2) This sequence does not contain the planned propellant dump, since it was not prescribed for this simulation.

TABLE 10

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB/CSM SEPARATION CONDITIONS

FLIGHT TIME: S-IVB/CSM SEPARATION	4440.200	(SEC)
RADIUS:	6535126.	(M)
ALTITUDE:	163001.	(M)
SPACE FIXED VELOCITY:	7811.12	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	90.059	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	46.865	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	44.761	(DEG)
GEOCENTRIC DECLINATION:	-32.044	(DEG)
GEODETIC LATITUDE:	-32.217	(DEG)
LONGITUDE: (POSITIVE EAST)	-152.184	(DEG)
INCLINATION:	51.789	(DEG)
DESCENDING NODE ARGUMENT:	156.582	(DEG)
INERTIAL RANGE ANGLE:	78.686	(DEG)
WEIGHT: (S-IVB/IU/DM/FIXED SLA)	37132.	(LBS)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	1269052.	(M)
YS	174932.	(M)
ZS	-6408336.	(M)
$\dot{X}S$	7658.90	(M/S)
$\dot{Y}S$	135.57	(M/S)
$\dot{Z}S$	1528.57	(M/S)

VEHICLE ATTITUDE ANGLES

PITCH ATTITUDE ANGLE	105.597	(DEG)
YAW ATTITUDE ANGLE	.926	(DEG)
ROLL ATTITUDE ANGLE	178.342	(DEG)

OSCULATING CONIC PARAMETERS

* PERIGEE ALTITUDE	152.02	(KM)
* APOGEE ALTITUDE	166.12	(KM)
ECCENTRICITY	.0011	
SEMI-MAJOR AXIS	6537.23	(KM)
TRUE ANOMALY	287.407	(DEG)
PERIOD	87.67	(MIN)

* REFERENCED TO EQUATORIAL RADIUS (6378.165 KM)

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE II-1

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC2)	PITCH ANGLE OF ATTACK (DEG)	AXIAL FORCE (N)	NORMAL FORCE (N)
1)	593.18	31182.	0.	4.	-.000	8.236	-4.	1.
2)	593.78	31181.	0.	4.	-.000	8.277	-4.	1.
	600.00	31176.	0.	4.	-.000	8.704	-4.	1.
3)	603.38	31173.	0.	4.	-.000	8.936	-4.	1.
4)	643.98	31138.	0.	3.	-.000	-.005	-3.	0.
	800.00	31102.	0.	3.	-.000	-.022	-3.	0.
	1000.00	31066.	0.	3.	-.000	-.045	-3.	0.
	1200.00	31010.	0.	2.	-.000	-.067	-2.	0.
5)	1264.78	30995.	0.	2.	-.000	-.073	-2.	0.
6)	1283.38	30995.	0.	2.	-.000	-.075	-2.	0.
	1400.00	30995.	0.	6.	-.000	23.505	-4.	5.
	1600.00	30995.	0.	8.	.000	-118.278	3.	7.
	1800.00	30995.	0.	3.	.000	-176.905	3.	0.
	2000.00	30995.	0.	3.	.000	-176.912	3.	0.
	2200.00	30995.	0.	3.	.000	-176.927	3.	0.
	2400.00	30995.	0.	3.	.000	-176.947	3.	0.
	2600.00	30995.	0.	3.	.000	-176.971	3.	0.
	2800.00	30995.	0.	2.	.000	-176.996	2.	0.
7)	2993.38	30995.	0.	2.	.000	-177.017	2.	0.
	3000.00	30995.	0.	2.	.000	-175.327	2.	0.
	3200.00	30995.	0.	5.	.000	-129.069	3.	4.
	3400.00	30995.	0.	6.	-.000	-82.806	-1.	6.
8)	3533.38	30995.	0.	5.	-.000	-58.056	-3.	5.
9)	3580.38	30984.	0.	5.	-.000	-58.057	-3.	5.
	3600.00	30980.	0.	5.	-.000	-59.398	-2.	5.
	3800.00	30934.	0.	6.	-.000	-73.066	-2.	6.
	4000.00	30888.	0.	7.	-.000	-86.739	-0.	7.
	4200.00	30842.	0.	8.	.000	-100.420	1.	8.
	4400.00	30796.	0.	9.	.000	-114.109	3.	8.
10)	4433.38	30788.	0.	9.	.000	-116.395	3.	8.

1) ORBIT INSERTION; INERTIAL ATTITUDE HOLD AND LOX NPV IN PROGRESS;
2) BEGIN LH2 NPV;
3) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM ALONG THE LOCAL HORIZONTAL, NOSE LEADING, POSITION 1 DOWN;
4) END LOX NPV;
5) END LH2 NPV;
6) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM NOSE THREE DEGREES ABOVE THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;
7) INITIATE A MANEUVER TO POSITION THE S-IVB/CSM FOR SEPARATION;
8) BEGIN LH2 NPV;
9) BEGIN INERTIAL ATTITUDE HOLD;
10) END LH2 NPV;

TABLE II-1 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC2)	PITCH ANGLE OF ATTACK (DEG)	AXIAL FORCE (N)	NORMAL FORCE (N)
11)	4440.20	16843.	0.	7.	.000	-116.862	3.	6.
	4600.00	16843.	0.	8.	.000	-127.808	4.	6.
	4800.00	16843.	0.	8.	.000	-141.517	6.	5.
	5000.00	16843.	0.	7.	.000	-155.232	6.	3.
12)	5040.20	29725.	0.	8.	.000	-157.989	7.	3.
	5200.00	29725.	0.	6.	.000	-168.950	6.	1.
	5400.00	29725.	0.	5.	.000	177.331	5.	0.
	5600.00	29725.	0.	6.	.000	143.615	6.	2.
	5800.00	29725.	0.	8.	.000	149.905	6.	4.
	6000.00	29725.	0.	8.	.000	136.199	6.	6.
	6200.00	29725.	0.	9.	.000	122.499	4.	8.
13)	6293.38	29725.	0.	9.	.000	116.103	4.	8.
	6400.00	29701.	0.	9.	.000	108.802	3.	9.
	6600.00	29655.	0.	9.	.000	95.107	1.	9.
14)	6773.38	29615.	0.	9.	-.000	83.234	-1.	9.
	6800.00	29615.	0.	9.	-.000	81.411	-1.	9.
	7000.00	29615.	0.	9.	-.000	67.714	-3.	9.
	7200.00	29615.	0.	9.	-.000	54.015	-5.	7.
	7400.00	29615.	0.	8.	-.000	40.315	-6.	5.
	7600.00	29615.	0.	6.	-.000	26.616	-5.	3.
	7800.00	29615.	0.	4.	-.000	12.919	-4.	1.
	8000.00	29615.	0.	3.	-.000	-.772	-3.	0.
	8200.00	29615.	0.	4.	-.000	-14.458	-4.	1.
	8400.00	29615.	0.	5.	-.000	-28.138	-4.	2.
15)	8513.38	29615.	0.	5.	-.000	-35.891	-4.	3.
	8600.00	29615.	0.	3.	-.000	-15.772	-3.	1.
	8800.00	29615.	0.	4.	-.000	30.497	-4.	2.
16)	8942.38	29615.	0.	6.	-.000	9.342	-3.	5.
	9000.00	29615.	0.	6.	-.000	55.402	-3.	5.
	9200.00	29615.	0.	6.	-.000	41.724	-4.	4.
17)	9240.20	14695.	0.	4.	-.000	38.974	-3.	3.
	9400.00	14695.	0.	4.	-.000	28.039	-3.	2.
	9600.00	14695.	0.	4.	-.000	14.346	-3.	1.
	9800.00	14695.	0.	3.	-.000	.642	-3.	0.

11) CSM SEPARATION; SLA PANEL JETTISON;
12) CSM DOCKING;
13) BEGIN LH2 NPV;
14) END LH2 NPV;
15) INITIATE A MANEUVER TO POSITION THE VEHICLE FOR DOCKING MODULE EXTRACTION;
16) BEGIN INERTIAL ATTITUDE HOLD;
17) DOCKING MODULE EXTRACTION;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 11-1 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC2)	PITCH ANGLE OF ATTACK (DEG)	AXIAL FORCE (N)	NORMAL FORCE (N)
18)	9893.38	14695.	0.	4.	-.000	-5.759	-4.	0.
	10000.00	14695.	0.	8.	-.000	-44.916	-6.	6.
	10200.00	14695.	0.	11.	.000	-118.735	5.	10.
	10400.00	14695.	0.	5.	.000	179.948	5.	0.
	10600.00	14695.	0.	5.	.000	179.955	5.	0.
	10800.00	14695.	0.	5.	.000	179.966	5.	0.
	11000.00	14695.	0.	4.	.000	179.982	4.	0.
	11200.00	14695.	0.	4.	.000	-179.998	4.	0.
	11400.00	14695.	0.	3.	.000	-179.976	3.	0.
	11600.00	14695.	0.	3.	.000	-179.953	3.	0.
	11800.00	14695.	0.	3.	.000	-179.934	3.	0.
	12000.00	14695.	0.	3.	.000	-179.919	3.	0.
	12200.00	14695.	0.	3.	.000	-179.912	3.	0.
	12400.00	14695.	0.	3.	.000	-179.913	3.	0.
	12600.00	14695.	0.	3.	.000	-179.922	3.	0.
	12800.00	14695.	0.	3.	.000	-179.938	3.	0.
	13000.00	14695.	0.	3.	.000	-179.959	3.	0.
	13200.00	14695.	0.	3.	.000	-179.982	3.	0.
	13400.00	14695.	0.	3.	.000	179.996	3.	0.
	13600.00	14695.	0.	2.	.000	179.977	2.	0.
	13800.00	14695.	0.	2.	.000	179.962	2.	0.
	14000.00	14695.	0.	2.	.000	179.952	2.	0.
	14200.00	14695.	0.	2.	.000	179.947	2.	0.
	14400.00	14695.	0.	2.	.000	179.944	2.	0.
	14600.00	14695.	0.	2.	.000	179.944	2.	0.
	14800.00	14695.	0.	3.	.000	179.945	3.	0.
	15000.00	14695.	0.	4.	.000	179.945	4.	0.
	15200.00	14695.	0.	4.	.000	179.945	4.	0.
	15400.00	14695.	0.	5.	.000	179.946	5.	0.
	15600.00	14695.	0.	6.	.000	179.948	6.	0.
	15800.00	14695.	0.	6.	.000	179.954	6.	0.
	16000.00	14695.	0.	5.	.000	179.963	5.	0.
	16200.00	14695.	0.	5.	.000	179.977	5.	0.
	16400.00	14695.	0.	4.	.000	179.995	4.	0.
	16600.00	14695.	0.	4.	.000	-179.983	4.	0.
	16800.00	14695.	0.	3.	.000	-179.961	3.	0.
	17000.00	14695.	0.	3.	.000	-179.941	3.	0.
	17200.00	14695.	0.	3.	.000	-179.925	3.	0.
	17400.00	14695.	0.	3.	.000	-179.916	3.	0.
	17600.00	14695.	0.	3.	.000	-179.915	3.	0.

18) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/IU ALONG THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;

TABLE II-1 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC2)	PITCH ANGLE OF ATTACK (DEG)	AXIAL FORCE (N)	NORMAL FORCE (N)
17800.00	14695.	0.	4.	.000	-179.922	4.	0.
18000.00	14695.	0.	4.	.000	-179.936	4.	0.
18200.00	14695.	0.	3.	.000	-179.956	3.	0.
18400.00	14695.	0.	3.	.000	-179.977	3.	0.
18600.00	14695.	0.	3.	.000	-179.999	3.	0.
18800.00	14695.	0.	3.	.000	179.981	3.	0.
19000.00	14695.	0.	2.	.000	179.966	2.	0.
19200.00	14695.	0.	2.	.000	179.956	2.	0.
19400.00	14695.	0.	2.	.000	179.950	2.	0.
19600.00	14695.	0.	2.	.000	179.947	2.	0.
19800.00	14695.	0.	3.	.000	179.947	3.	0.
20000.00	14695.	0.	3.	.000	179.947	3.	0.
20200.00	14695.	0.	4.	.000	179.948	4.	0.
20400.00	14695.	0.	4.	.000	179.948	4.	0.
20600.00	14695.	0.	5.	.000	179.948	5.	0.
20800.00	14695.	0.	6.	.000	179.949	6.	0.
21000.00	14695.	0.	6.	.000	179.953	6.	0.
21200.00	14695.	0.	6.	.000	179.960	6.	0.
21400.00	14695.	0.	5.	.000	179.972	5.	0.
21600.00	14695.	0.	5.	.000	179.989	5.	0.
21800.00	14695.	0.	4.	.000	-179.991	4.	0.
22000.00	14695.	0.	4.	.000	-179.969	4.	0.
22200.00	14695.	0.	3.	.000	-179.949	3.	0.
22400.00	14695.	0.	3.	.000	-179.932	3.	0.
22600.00	14695.	0.	4.	.000	-179.921	4.	0.
22800.00	14695.	0.	4.	.000	-179.918	4.	0.
23000.00	14695.	0.	4.	.000	-179.923	4.	0.
23200.00	14695.	0.	4.	.000	-179.935	4.	0.
23400.00	14695.	0.	4.	.000	-179.953	4.	0.
23600.00	14695.	0.	4.	.000	-179.974	4.	0.
23800.00	14695.	0.	3.	.000	-179.995	3.	0.
24000.00	14695.	0.	3.	.000	179.986	3.	0.
24200.00	14695.	0.	3.	.000	179.970	3.	0.
24400.00	14695.	0.	2.	.000	179.959	2.	0.
24600.00	14695.	0.	2.	.000	179.953	2.	0.
24800.00	14695.	0.	2.	.000	179.950	2.	0.
25000.00	14695.	0.	3.	.000	179.950	3.	0.
25200.00	14695.	0.	3.	.000	179.950	3.	0.
25400.00	14695.	0.	4.	.000	179.951	4.	0.
25600.00	14695.	0.	5.	.000	179.950	5.	0.
25800.00	14695.	0.	6.	.000	179.950	6.	0.
26000.00	14695.	0.	7.	.000	179.950	7.	0.
26200.00	14695.	0.	7.	.000	179.953	7.	0.
26400.00	14695.	0.	7.	.000	179.958	7.	0.

TABLE 11-1 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC2)	PITCH ANGLE OF ATTACK (DEG)	AXIAL FORCE (N)	NORMAL FORCE (N)
	26600.00	14695.	0.	6.	.000	179.969	6.	0.
	26800.00	14695.	0.	5.	.000	179.983	5.	0.
19)	27000.00	14695.	0.	5.	.000	-179.998	5.	0.

19) END OF IU BATTERY LIFETIME.

TABLE II-2

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	SPACE FIXED RADIUS (M)	SPACE FIXED VELOCITY (M/S)	SPACE FIXED PATH ANGLE (DEG)	SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	593.18	6528178.	7818.46	90.001	6204978.	108557.	2025727.	-2421.37	-249.83	7429.87
2)	593.78	6528178.	7818.46	90.001	6203523.	108407.	2030185.	-2426.70	-249.91	7428.12
	600.00	6528177.	7818.40	90.000	6188265.	106850.	2076310.	-2481.85	-250.80	7409.79
3)	603.38	6528177.	7818.37	90.000	6179818.	106001.	2101359.	-2511.80	-251.27	7399.64
4)	643.98	6528170.	7818.02	89.996	6070588.	95688.	2399180.	-2867.91	-256.65	7268.47
	800.00	6528462.	7816.56	89.979	5520300.	54368.	3484846.	-4165.67	-271.47	6608.49
	1000.00	6529351.	7814.61	89.956	4837919.	-687.	4694648.	-5611.12	-276.43	5432.04
	1200.00	6530832.	7812.76	89.936	3297220.	-55151.	5637114.	-6736.66	-265.60	3947.92
5)	1264.78	6531426.	7812.21	89.930	2851349.	-72146.	5875724.	-7021.56	-258.82	3414.86
6)	1283.38	6531606.	7812.05	89.928	2720053.	-76939.	5937783.	-7095.66	-256.58	3257.91
	1400.00	6532820.	7811.12	89.919	1868846.	-105927.	6258908.	-7479.04	-239.77	2240.57
	1600.00	6535165.	7809.67	89.910	333988.	-150164.	6524898.	-7796.49	-200.55	406.77
	1800.00	6537664.	7808.39	89.908	-1220178.	-185413.	6420112.	-7671.19	-150.33	-1449.57
	2000.00	6540089.	7807.16	89.915	-2705387.	-209758.	5950601.	-7110.19	-92.06	-3223.11
	2200.00	6542224.	7805.84	89.929	-4037280.	-221926.	5143133.	-6145.34	-29.15	-4813.01
	2400.00	6543887.	7804.38	89.949	-5140224.	-221352.	4043706.	-4831.67	34.75	-6128.79
	2600.00	6544958.	7802.79	89.972	-5951666.	-208203.	2714922.	-3244.28	95.99	-7095.70
	2800.00	6545387.	7801.20	89.996	-6425709.	-183367.	1232371.	-1473.82	151.08	-7659.23
7)	2993.38	6545215.	7799.87	90.017	-6538005.	-149685.	-268194.	317.39	195.63	-7790.95
	3000.00	6545200.	7799.83	90.017	-6535701.	-148386.	-319738.	378.90	196.97	-7788.13
	3200.00	6544478.	7798.91	90.035	-6275662.	-105361.	-1853420.	2208.98	231.16	-7475.95
	3400.00	6543343.	7798.68	90.048	-5660506.	-56822.	-3281886.	3913.34	251.87	-6741.05
8)	3533.38	6542422.	7799.03	90.053	-5069325.	-22769.	-4135784.	4932.43	257.64	-6035.70
9)	3580.38	6542074.	7799.25	90.055	-4829666.	-10646.	-4412817.	5263.16	258.11	-5749.86
	3600.00	6541927.	7799.36	90.056	-4725106.	-5583.	-4524395.	5396.39	258.06	-5625.16
	3800.00	6540352.	7801.01	90.059	-3522286.	45422.	-5510685.	6574.96	249.56	-4190.87
	4000.00	6538713.	7803.56	90.061	-2119899.	93302.	-6184827.	7382.56	226.98	-2518.29
	4200.00	6537069.	7806.79	90.060	-597130.	135366.	-6508332.	7772.90	191.70	-700.96
	4400.00	6535448.	7810.39	90.059	959826.	169275.	-6462365.	7722.55	145.84	1158.94
10)	4433.38	6535180.	7811.00	90.059	1216799.	174002.	-6418544.	7670.94	137.33	1466.10

1) ORBIT INSERTION; INERTIAL ATTITUDE HOLD AND LOX NPV IN PROGRESS;
2) BEGIN LH2 NPV;
3) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM ALONG THE LOCAL HORIZONTAL, NOSE LEADING, POSITION 1 DOWN;
4) END LOX NPV;
5) END LH2 NPV;
6) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM NOSE THREE DEGREES ABOVE THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;
7) INITIATE A MANEUVER TO POSITION THE S-IVB/CSM FOR SEPARATION;
8) BEGIN LH2 NPV;
9) BEGIN INERTIAL ATTITUDE HOLD;
10) END LH2 NPV;

TABLE II-2 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	--- SPACE FIXED --- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
11)	4440.20	6535126.	7811.12	90.059	1269052.	174932.	-3408336.	7658.90	135.57	1528.57
	4600.00	6533856.	7813.93	90.058	2462532.	193172.	-6048958.	7232.69	92.07	2955.89
	4800.00	6532294.	7817.05	90.057	3825304.	205705.	-5291084.	6329.67	33.54	4586.99
	5000.00	6530781.	7819.43	90.054	4970174.	206499.	-4231527.	5064.00	-26.33	5958.08
12)	5040.20	6530486.	7819.80	90.053	5167914.	205201.	-3987206.	4771.88	-38.22	6194.92
	5200.00	6529363.	7820.90	90.049	5831498.	195394.	-2930534.	3507.81	-84.08	6989.61
	5400.00	6528124.	7821.38	90.041	6359866.	173230.	-1462362.	1750.52	-136.38	7621.75
	5600.00	6527178.	7820.92	90.028	6525038.	141402.	87056.	-106.59	-180.27	7918.12
	5800.00	6526098.	7819.74	90.010	6317701.	101898.	1635059.	-1956.66	-213.30	7567.98
	6000.00	6526694.	7818.09	89.990	5749920.	56924.	3087436.	-3693.79	-233.73	6886.50
	6200.00	6527236.	7816.26	89.967	4854331.	9264.	4363505.	-5219.10	-240.55	5813.46
13)	6293.38	6527719.	7815.41	89.957	4337705.	-13150.	4878038.	-5833.78	-238.99	5195.01
	6400.00	6528430.	7814.47	89.946	3682159.	-38374.	5390792.	-6446.54	-233.55	4410.61
	6600.00	6530172.	7812.87	89.928	2300235.	-83273.	6111065.	-7306.79	-213.31	2757.96
14)	6773.38	6532022.	7811.96	89.917	993087.	-118014.	6455011.	-7717.41	-186.04	1195.39
	6800.00	6532327.	7811.49	89.916	797200.	-122901.	6483556.	-7751.47	-181.14	949.31
	7000.00	6534708.	7810.26	89.911	-770921.	-155062.	6487222.	-7755.50	-139.00	-912.76
	7200.00	6537096.	7809.09	89.915	-2285547.	-178006.	6121945.	-7318.58	-89.43	-2722.54
	7400.00	6539267.	7807.84	89.927	-3670557.	-190532.	5408579.	-6465.50	-35.33	-4377.03
	7600.00	6541027.	7806.45	89.945	-4847200.	-192048.	4387802.	-5244.91	20.13	-5781.96
	7800.00	6542238.	7804.90	89.967	-5748637.	-182604.	3117806.	-3726.63	73.76	-6857.35
	8000.00	6542831.	7803.30	89.990	-6323770.	-162873.	1670942.	-1997.52	122.50	-7542.31
	8200.00	6542810.	7801.83	90.011	-6540153.	-134111.	129520.	-156.25	163.64	-7798.55
	8400.00	6542243.	7800.72	90.030	-6385763.	-98074.	-1418928.	1692.61	194.93	-7612.38
15)	8513.38	6541721.	7800.36	90.039	-6136115.	-75215.	-2266397.	2704.27	207.64	-7313.65
	8600.00	6541242.	7800.25	90.043	-5869576.	-56906.	-2886641.	3444.66	214.73	-6995.15
	8800.00	6539938.	7800.63	90.052	-5020943.	-13015.	-4190555.	5001.43	222.07	-5982.16
16)	8942.38	6538894.	7801.47	90.056	-4239991.	18499.	-4977877.	5942.01	219.52	-5050.47
	9000.00	6538454.	7801.94	90.056	-3887883.	31070.	-5256880.	6275.55	216.68	-4630.43
	9200.00	6536892.	7804.19	90.058	-2534394.	72838.	-6025156.	7195.26	199.03	-3015.62
17)	9240.20	6536575.	7804.74	90.058	-2242334.	80741.	-6139400.	7332.32	194.08	-2667.08
	9400.00	6535316.	7807.18	90.058	-1036952.	109936.	-6451589.	7708.11	170.23	-1228.06
	9600.00	6533758.	7810.64	90.057	519660.	140300.	-6511549.	7783.92	132.02	631.80
	9800.00	6532227.	7814.19	90.056	2047032.	162269.	-6201074.	7416.81	86.69	2458.64

11) CSM SEPARATION; SLA PANEL JETTISON;
12) CSM DOCKING;
13) BEGIN LH2 NPV;
14) END LH2 NPV;
15) INITIATE A MANEUVER TO POSITION THE VEHICLE FOR DOCKING MODULE EXTRACTION;
16) BEGIN INERTIAL ATTITUDE HOLD;
17) DOCKING MODULE EXTRACTION;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE II-2 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	SPACE FIXED RADIUS (M)	SPACE FIXED VELOCITY (M/S)	SPACE FIXED PATH ANGLE (DEG)	SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
18)	9893.38	6531518.	7815.76	90.055	2725466.	169302.	-5933287.	7098.21	63.81	3270.70
	10000.00	6530717.	7817.41	90.055	3458085.	174676.	-5537273.	6626.05	36.88	4148.01
	10200.00	6529244.	7819.89	90.053	4672084.	176919.	-4557561.	5455.55	-14.46	5602.45
	10400.00	6527836.	7821.53	90.050	5619387.	168988.	-3317615.	3971.89	-64.36	6737.67
	10600.00	6526561.	7822.21	90.043	6245613.	151463.	-1888221.	2260.27	-109.93	7487.73
	10800.00	6525522.	7821.96	90.032	6514859.	125477.	-351147.	419.37	-148.58	7809.30
	11000.00	6524840.	7820.96	90.017	6411811.	92636.	1205668.	-1444.73	-178.16	7684.30
	11200.00	6524630.	7819.47	89.998	5942562.	54922.	2693275.	-3225.08	-197.10	7120.69
	11400.00	6524977.	7817.77	89.976	5134154.	14568.	4028857.	-4820.17	-204.47	6151.56
	11600.00	6525915.	7816.10	89.955	4032906.	-26076.	5130551.	-6139.60	-200.01	4832.87
	11800.00	6527411.	7814.59	89.936	2701700.	-64675.	5941694.	-7108.89	-184.16	3240.00
	12000.00	6529358.	7813.31	89.922	1216387.	-99049.	6414290.	-7673.39	-157.98	1463.52
	12200.00	6531592.	7812.21	89.915	-338489.	-127286.	6521574.	-7801.21	-123.11	-395.74
	12400.00	6533906.	7811.16	89.916	-1874438.	-147852.	6257520.	-7484.99	-81.66	-2232.15
	12600.00	6536083.	7810.05	89.925	-3304022.	-159675.	5637226.	-6742.63	-36.10	-3941.12
	12800.00	6537921.	7808.75	89.941	-4545852.	-162197.	4696097.	-5616.44	10.89	-5425.14
	13000.00	6539269.	7807.25	89.961	-5529265.	-155406.	3487652.	-4170.88	56.58	-6599.53
	13200.00	6540039.	7805.62	89.983	-6198406.	-139825.	2081425.	-2488.80	98.37	-7397.56
	13400.00	6540216.	7804.03	90.004	-6515417.	-116477.	556965.	-666.43	133.89	-7774.37
	13600.00	6539848.	7802.71	90.022	-6462543.	-86815.	-998811.	1192.44	161.22	-7709.37
	13800.00	6539034.	7801.95	90.037	-6043037.	-52630.	-2497580.	2982.54	176.93	-7207.14
	14000.00	6537897.	7801.96	90.046	-5280856.	-15944.	-3854400.	4603.04	186.15	-6296.67
	14200.00	6536558.	7802.91	90.051	-4219228.	21111.	-4992421.	5962.92	182.62	-5029.48
	14400.00	6535124.	7804.80	90.054	-2918206.	56412.	-5847114.	6985.65	168.71	-3476.66
	14600.00	6533660.	7807.51	90.054	-1451365.	87964.	-6369813.	7613.14	145.33	-1725.14
	14800.00	6532201.	7810.77	90.053	98216.	114010.	-6530468.	7808.91	113.94	126.69
	15000.00	6530756.	7814.23	90.053	1642523.	133131.	-6319428.	7560.37	76.42	1974.12
	15200.00	6529317.	7817.49	90.053	3093523.	144318.	-5746154.	6880.05	35.00	3711.71
	15400.00	6527890.	7820.18	90.052	4368208.	147036.	-4848762.	5805.49	-7.86	5239.42
	15600.00	6526497.	7822.04	90.050	5393447.	141247.	-3672321.	4397.52	-49.65	6468.67
	15800.00	6525201.	7822.94	90.045	6110337.	127410.	-2285999.	2736.89	-87.95	7328.04
	16000.00	6524095.	7822.90	90.036	6477724.	106448.	-769138.	919.39	-120.57	7767.75
	16200.00	6523296.	7822.08	90.022	6474622.	79684.	791399.	-950.11	-145.70	7762.80
	16400.00	6522924.	7820.73	90.005	6101387.	48758.	2306345.	-2764.15	-162.00	7314.17
	16600.00	6523075.	7819.11	89.984	5379594.	15524.	3689205.	-4417.05	-166.70	6448.41
	16800.00	6523802.	7817.48	89.963	4350676.	-18063.	4861202.	-5820.82	-165.55	5215.71
	17000.00	6525090.	7816.01	89.943	3073468.	-50063.	5755700.	-6890.19	-152.93	3686.71
	17200.00	6526857.	7814.77	89.928	1620831.	-78659.	6321912.	-7566.81	-131.70	1948.49
	17400.00	6528953.	7813.73	89.919	75532.	-102259.	6527715.	-7812.41	-103.23	99.78
	17600.00	6531186.	7812.78	89.918	-1474405.	-119586.	6361464.	-7612.95	-69.28	-1754.32

18) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/IU ALONG THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;

TABLE 11-2 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
17800.00	6533341.	7811.78	89.925	-2940669.	-129743.	5832682.	-6979.65	-31.90	-3508.19
18000.00	6535216.	7810.61	89.939	-4239693.	-132264.	4971575.	-5948.54	0.70	-5061.66
18200.00	6536644.	7809.21	89.957	-5297457.	-127132.	3827336.	-4578.67	44.26	-6325.95
18400.00	6537525.	7807.64	89.978	-6053780.	-114776.	2465323.	-2948.61	78.60	-7229.02
18600.00	6537027.	7806.03	89.999	-6465763.	-96036.	963262.	-1151.79	107.80	-7719.84
18800.00	6537586.	7808.62	90.018	-6510213.	-72106.	-593261.	709.18	130.27	-7771.24
19000.00	6536888.	7803.97	90.033	-6184864.	-44458.	-2115748.	2528.65	144.82	-7381.21
19200.00	6535852.	7803.43	90.043	-5508370.	-14752.	-3517783.	4203.67	150.79	-6572.54
19400.00	6534603.	7805.08	90.048	-4519246.	15266.	-4719875.	5640.61	147.95	-5391.23
19600.00	6533245.	7805.67	90.051	-3273475.	43863.	-5653824.	6756.02	136.65	-3903.72
19800.00	6531853.	7806.12	90.051	-1841595.	69415.	-6266483.	7492.78	117.67	-2193.41
20000.00	6530464.	7817.19	90.051	-304749.	90499.	-6522722.	7802.51	92.21	-356.35
20200.00	6529087.	7818.55	90.050	1249755.	105971.	-6407485.	7645.26	61.84	1503.68
20400.00	6527716.	7817.81	90.050	2733305.	115029.	-5926794.	7096.09	28.39	3280.67
20600.00	6526341.	7820.60	90.050	4061028.	117255.	-5107585.	6117.26	-6.13	4872.45
20800.00	6524981.	7822.62	90.049	5156735.	112640.	-3996344.	4707.00	-39.69	6186.79
21000.00	6523681.	7823.71	90.046	5957439.	101575.	-2656505.	3181.47	-70.32	7147.29
21200.00	6522528.	7823.87	90.038	6417121.	84826.	-1164739.	1393.29	-96.27	7698.21
21400.00	6521634.	7823.22	90.027	6509453.	63478.	393308.	-474.27	-116.09	7807.97
21600.00	6521116.	7822.00	90.011	6229296.	38867.	1928551.	-2313.65	-128.76	7470.88
21800.00	6521085.	7820.47	89.991	5592913.	12493.	3353164.	-4019.49	-133.67	6707.13
22000.00	6521606.	7818.90	89.971	4636906.	-14073.	4585875.	-5494.69	-130.69	5561.16
22200.00	6522684.	7817.47	89.951	3416023.	-39281.	5556496.	-6655.69	-120.18	4098.82
22400.00	6524258.	7816.28	89.935	2000001.	-61691.	6209841.	-7436.84	-102.88	2403.54
22600.00	6526200.	7815.31	89.924	469608.	-80057.	6508790.	-7793.96	-79.95	571.72
22800.00	6528328.	7814.45	89.921	-1087897.	-93389.	6436367.	-7706.65	-52.82	-1292.46
23000.00	6530433.	7813.58	89.926	-2583686.	-101014.	5996742.	-7179.71	-23.16	-3082.73
23200.00	6532313.	7812.54	89.937	-3932415.	-102604.	5215045.	-6243.08	7.23	-4696.78
23400.00	6533795.	7811.27	89.955	-5057131.	-98192.	4135973.	-4950.35	36.56	-6042.24
23600.00	6534764.	7809.78	89.975	-5893729.	-88163.	2821228.	-3375.77	63.13	-7042.22
23800.00	6535172.	7808.19	89.995	-6394649.	-73227.	1345951.	-1609.72	85.42	-7639.98
24000.00	6535044.	7806.71	90.014	-6531581.	-54363.	-205668.	246.70	102.42	-7802.14
24200.00	6534456.	7805.60	90.029	-6296994.	-32761.	-1745253.	2087.79	112.69	-7520.36
24400.00	6533519.	7805.14	90.039	-5704450.	-9744.	-3185284.	3809.33	116.33	-6811.44
24600.00	6532356.	7805.51	90.045	-4787727.	13313.	-4444005.	5314.29	113.11	-5715.90
24800.00	6531078.	7806.81	90.048	-3598858.	35062.	-5449952.	6517.93	103.34	-4295.60
25000.00	6529764.	7808.99	90.048	-2205227.	54260.	-6145881.	7352.16	87.74	-2630.28
25200.00	6528453.	7811.85	90.048	-685867.	69838.	-6491949.	7769.08	67.33	-813.51
25400.00	6527152.	7815.08	90.047	872871.	80959.	-6468018.	7743.81	43.41	1052.12
25600.00	6525857.	7818.30	90.048	2382114.	87065.	-6074929.	7276.23	17.45	2860.41
25800.00	6524549.	7821.14	90.048	3755507.	87906.	-5334620.	6391.61	-6.98	4507.50
26000.00	6523237.	7823.28	90.048	4914218.	83550.	-4289067.	5139.63	-34.27	5898.03
26200.00	6521952.	7824.54	90.046	5791601.	74373.	-2997946.	3591.88	-56.94	6951.16
26400.00	6520771.	7824.87	90.040	6337175.	61035.	-1535231.	1837.62	-75.69	7605.66

TABLE II-2 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
	26600.00	6519798.	7824.39	90.030	6519629.	44429.	15174.	-21.74	-89.47	7823.85
	26800.00	6519155.	7823.30	90.016	6328625.	25624.	1564361.	-1878.94	-97.60	7593.69
19)	27000.00	6518954.	7821.88	89.998	5775321.	5792.	3023638.	-3627.37	-99.71	6929.21

19) END OF IU BATTERY LIFETIME.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE II-3

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	593.18	1868556.	7527.12	90.001	-113370.	-34557.	1864794.	-2135.32	-244.55	7213.75
2)	593.78	1872956.	7527.11	90.001	-114653.	-34704.	1869122.	-2140.30	-244.10	7212.28
	600.00	1918539.	7526.99	90.000	-128120.	-36207.	1913914.	-2191.88	-239.39	7196.80
3)	603.38	1943334.	7526.93	90.000	-135582.	-37012.	1938245.	-2219.90	-236.82	7188.22
4)	643.78	2240448.	7526.14	89.995	-232497.	-45988.	2227878.	-2553.35	-205.11	7076.80
	800.00	3370556.	7523.23	89.978	-727533.	-67791.	3290401.	-3775.14	-71.67	6807.09
	1000.00	4778862.	7520.12	89.955	-1629632.	-63583.	4493779.	-5155.64	115.35	5473.42
	1200.00	6123557.	7518.13	89.933	-2771428.	-21674.	5660464.	-6261.24	302.00	4150.66
5)	1264.78	6542455.	7517.75	89.927	-3186610.	-248.	5713951.	-6550.43	359.05	3671.45
6)	1283.38	6661059.	7517.67	89.925	-3309162.	6578.	5780927.	-6626.77	374.94	3529.97
	1400.00	7386632.	7517.37	89.916	-4106943.	55862.	6139400.	-7034.67	468.36	2608.64
	1600.00	8551405.	7517.64	89.906	-5560459.	163070.	6494709.	-7436.22	595.83	928.69
	1800.00	9602588.	7518.49	89.905	-7055253.	290544.	6507588.	-7445.79	668.71	-800.48
	2000.00	10526445.	7519.32	89.912	-8512627.	426134.	6177350.	-7063.83	675.48	-2487.21
	2200.00	11310971.	7519.53	89.927	-9856051.	555901.	5521529.	-6311.52	609.92	-4041.77
	2400.00	11946070.	7518.68	89.947	-11015233.	665247.	4575006.	-5229.75	471.74	-5381.24
	2600.00	12423719.	7516.67	89.971	-11929849.	740133.	3388170.	-3876.89	266.87	-6434.19
	2800.00	12738080.	7513.69	89.996	-12552728.	768324.	2024197.	-2325.44	7.12	-7144.78
7)	2993.38	12883377.	7510.38	90.017	-12847733.	742341.	505066.	-713.97	-280.25	-7471.12
	3000.00	12885568.	7510.27	90.018	-12852272.	740453.	555613.	-657.85	-290.49	-7475.76
	3200.00	12864961.	7507.10	90.036	-12813974.	651004.	-939632.	1038.16	-604.88	-7410.33
	3400.00	12676871.	7504.94	90.050	-12441006.	498958.	-2382324.	2674.34	-912.38	-6952.67
8)	3533.38	12459955.	7504.38	90.056	-12015691.	364457.	-3277316.	3690.32	-1101.44	-6440.82
9)	3560.38	12366366.	7504.38	90.057	-11834252.	311223.	-3575002.	4028.61	-1163.35	-6223.56
	3600.00	12324690.	7504.42	90.058	-11753867.	288155.	-3696153.	4166.36	-1188.34	-6127.44
	3800.00	11813527.	7505.89	90.062	-10789187.	27326.	-4811666.	5437.88	-1408.82	-4978.25
	4000.00	11150670.	7509.33	90.063	-9597773.	-270230.	-5669848.	6424.01	-1552.31	-3565.44
	4200.00	10345465.	7514.34	90.062	-8242007.	-587294.	-6225195.	7074.34	-1601.42	-1963.27
	4400.00	9409364.	7520.21	90.061	-6792692.	-903702.	-6448162.	7355.47	-1544.32	-256.41
10)	4413.38	9241295.	7521.21	90.061	-6546954.	-954925.	-6451903.	7365.13	-1523.98	32.32

1) ORBIT INSERTION; INERTIAL ATTITUDE HOLD AND LOX NPV IN PROGRESS;
2) BEGIN LH2 NPV;
3) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM ALONG THE LOCAL HORIZONTAL, NOSE LEADING, POSITION 1 DOWN;
4) END LOX NPV;
5) END LH2 NPV;
6) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM NOSE THREE DEGREES ABOVE THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;
7) INITIATE A MANEUVER TO POSITION THE S-IVB/CSM FOR SEPARATION;
8) BEGIN LH2 NPV;
9) BEGIN INERTIAL ATTITUDE HOLD;
10) END LH2 NPV;

TABLE II-3 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	EARTH FIXED POSITION (M)	EARTH FIXED VELOCITY (M/S)	EARTH FIXED PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
11)	4440.20	9206578.	7521.42	90.061	-6496743.	-965299.	-6451481.	7365.78	-1519.44	91.30
	4600.00	8356051.	7526.04	90.060	-5325445.	-1197589.	-6326847.	7252.89	-1375.99	1464.08
	4800.00	7201784.	7530.95	90.059	-3916789.	-1446840.	-5867803.	6772.19	-1099.07	3105.58
	5000.00	5966308.	7534.23	90.056	-2640101.	-1630667.	-5095843.	5939.14	-724.18	4578.96
12)	5040.20	5710302.	7534.66	90.055	-2405454.	-1658067.	-4906338.	5732.82	-638.49	4847.49
	5200.00	4675585.	7535.54	90.051	-1561673.	-1731185.	-4052810.	4798.53	-269.62	5803.94
	5400.00	3371476.	7534.83	90.042	-737133.	-1734862.	-2795307.	3411.69	239.56	6713.91
	5600.00	2156144.	7532.44	90.029	-208476.	-1633729.	-1391554.	1852.94	773.08	7259.93
	5800.00	1428628.	7529.01	90.011	-1900.	-1426245.	82457.	205.16	1297.32	7413.56
	6000.00	1912915.	7525.31	89.989	-126567.	-1117739.	1547218.	-1444.99	1777.54	7168.17
	6200.00	3065800.	7522.08	89.966	-574329.	-720413.	2924087.	-3011.83	2180.14	6538.92
13)	6293.38	3661804.	7520.89	89.955	-887648.	-509500.	3515864.	-3691.96	2332.84	6123.00
	6400.00	4352365.	7519.86	89.943	-1320372.	-252886.	4139535.	-4415.06	2474.87	5561.52
	6600.00	5637310.	7518.87	89.925	-2324680.	260668.	5129052.	-5583.60	2636.82	4289.99
14)	6773.38	6711958.	7518.94	89.913	-3363600.	721191.	5763373.	-6361.04	2655.81	3003.04
	6800.00	6872368.	7519.01	89.912	-3534228.	791786.	5840526.	-6458.89	2648.22	2793.77
	7000.00	8030242.	7519.85	89.908	-4885763.	1309283.	6236978.	-6997.64	2499.86	1154.07
	7200.00	9091088.	7520.82	89.912	-6309079.	1781085.	6298503.	-7173.92	2192.16	-540.30
	7400.00	10038887.	7521.29	89.924	-7730645.	2176203.	6023332.	-6980.53	1735.61	-2197.63
	7600.00	10860308.	7520.78	89.943	-9077404.	2466744.	5427909.	-6429.45	1150.59	-3728.34
	7800.00	11544345.	7519.10	89.965	-10280576.	2629817.	4545955.	-5551.21	466.51	-5050.08
	8000.00	12082210.	7516.35	89.989	-11279203.	2649190.	3426542.	-4393.15	-279.76	-6092.41
	8200.00	12467322.	7512.97	90.012	-12023250.	2516574.	2131297.	-3016.63	-1046.02	-6800.78
	8400.00	12695285.	7509.63	90.031	-12476064.	2232448.	730931.	-1493.47	-1787.27	-7139.31
15)	8513.38	12753789.	7508.04	90.039	-12594570.	2007334.	80905.	-594.46	-2179.15	-7160.20
	8600.00	12763874.	7507.08	90.045	-12616078.	1806349.	-698689.	97.99	-2458.35	-7092.47
	8800.00	12672992.	7506.02	90.054	-12437701.	1256637.	-2080666.	1676.98	-3016.64	-6665.43
16)	8942.38	12512130.	7506.41	90.058	-12121847.	804234.	-2994565.	2749.62	-3324.36	-6142.83
	9000.00	12424630.	7506.86	90.059	-11951417.	609738.	-3341150.	3164.17	-3424.51	-5883.35
	9200.00	12022846.	7509.72	90.060	-11183120.	-101096.	-4413211.	4485.32	-3651.64	-4789.91
17)	9240.20	11924076.	7510.51	90.060	-10997964.	-248357.	-4600727.	4724.81	-3673.43	-4537.60
	9400.00	11473780.	7514.27	90.060	-10172774.	-837443.	-5240323.	5574.54	-3677.01	-3445.05
	9600.00	10785717.	7519.91	90.059	-8972426.	-1557749.	-5779333.	6377.39	-3490.54	-1922.04
	9800.00	9969226.	7525.79	90.058	-7643639.	-2219644.	-6002786.	6853.51	-3094.29	-303.89

11) CSM SEPARATION; SLA PANEL JETTISON;
12) CSM DOCKING;
13) BEGIN LH2 NPV;
14) END LH2 NPV;
15) INITIATE A MANEUVER TO POSITION THE VEHICLE FOR DOCKING MODULE EXTRACTION;
16) BEGIN INERTIAL ATTITUDE HOLD;
17) DOCKING MODULE EXTRACTION;

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE II-3 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	---- EARTH FIXED ---- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
18)	9893.38	9547601.	7528.36	90.057	-6998226.	-2497099.	-5995500.	6956.52	-2841.11	459.38
	10000.00	9037435.	7530.97	90.057	-6254441.	-2782434.	-5900446.	6978.95	-2503.01	1320.89
	10200.00	8006602.	7534.63	90.055	-4875880.	-3209637.	-5479937.	6745.70	-1743.95	2863.20
	10400.00	6897301.	7536.39	90.052	-3578328.	-3471382.	-4766324.	6172.53	-855.72	4238.49
	10600.00	5737336.	7536.14	90.045	-2427781.	-3546494.	-3800695.	5284.21	113.76	5371.93
	10800.00	4569423.	7534.12	90.033	-1482411.	-3424076.	-2637761.	4129.84	1110.13	6202.82
	11000.00	3473317.	7530.91	90.018	-789558.	-3104406.	-1342646.	2770.10	2075.83	6686.20
	11200.00	2627755.	7527.27	89.998	-383363.	-2599608.	12702.	1275.66	2953.68	6805.02
	11400.00	2376856.	7523.97	89.976	-283164.	-1932445.	1354592.	-276.79	3090.29	6550.97
	11600.00	2888596.	7521.59	89.953	-492695.	-1136027.	2609728.	-1808.55	4239.21	5944.12
	11800.00	3851768.	7520.43	89.930	-1000067.	-251753.	3711146.	-3242.74	4563.65	5021.92
	12000.00	4978241.	7520.47	89.919	-1778503.	672779.	4600781.	-4507.90	4638.73	3836.46
	12200.00	6137523.	7521.33	89.912	-2787749.	1586327.	5238706.	-5541.27	4453.14	2456.48
	12400.00	7268704.	7522.46	89.913	-3976122.	2436846.	5575900.	-6291.76	4210.24	958.74
	12600.00	8336911.	7523.22	89.922	-5283098.	3174461.	5613889.	-6722.47	3328.39	-573.64
	12800.00	9318905.	7523.06	89.939	-6642373.	3754425.	5349378.	-6812.71	2440.33	-2056.27
	13000.00	10195255.	7521.70	89.959	-7985222.	4139864.	4800102.	-6559.13	1391.70	-3408.36
	13200.00	10953266.	7519.17	89.982	-9244013.	4304120.	3999602.	-5975.92	238.55	-4557.34
	13400.00	11581108.	7515.83	90.004	-10385637.	4232526.	2994757.	-5093.90	-955.86	-5442.99
	13600.00	12069916.	7512.31	90.023	-11264664.	3923477.	1842972.	-3958.66	-2124.77	-6020.73
	13800.00	12413094.	7509.38	90.038	-11926047.	3388753.	608828.	-2627.93	-3201.77	-6263.66
	14000.00	12606192.	7507.75	90.048	-12307242.	2653073.	-639582.	-1168.49	-4124.47	-6163.58
	14200.00	12646822.	7507.95	90.053	-12389687.	1752937.	-1834388.	347.18	-4837.96	-5730.87
	14400.00	12534627.	7510.17	90.056	-12169617.	734830.	-2911586.	1844.17	-5297.76	-4993.53
	14600.00	12271252.	7514.22	90.056	-11658198.	-347122.	-3814387.	3248.56	-5472.36	-3995.44
	14800.00	11860390.	7619.54	90.056	-10881035.	-1433966.	-4496184.	4490.52	-5345.27	-2794.06
	15000.00	11307848.	7525.34	90.055	-9876998.	-2465078.	-4922981.	5507.70	-4916.47	-1457.48
	15200.00	10621671.	7530.69	90.055	-8696422.	-3381545.	-5075165.	6248.32	-4203.11	-60.84
	15400.00	9812340.	7534.79	90.054	-7398693.	-4129586.	-4948521.	6674.12	-3239.23	1317.80
	15600.00	8893103.	7537.05	90.052	-6049295.	-4663810.	-4554359.	6762.69	-2074.37	2601.96
	15800.00	7880667.	7537.27	90.046	-4716473.	-4950075.	-3918744.	6509.03	-770.94	3721.38
	16000.00	6796648.	7535.64	90.037	-3467683.	-4967717.	-3080809.	5925.95	599.35	4616.25
	16200.00	5671083.	7532.68	90.023	-2366098.	-4710984.	-2090308.	5043.31	1959.88	5240.72
	16400.00	4551337.	7529.11	90.005	-1467353.	-4189560.	-1004555.	3906.20	3233.64	5565.30
	16600.00	3526010.	7525.71	89.983	-816754.	-3428183.	114989.	2572.35	4347.65	5578.13
	16800.00	2780839.	7523.13	89.961	-447063.	-2465385.	1206265.	1108.94	5237.97	5285.02
	17000.00	2617826.	7521.75	89.941	-376933.	-1351482.	2210075.	-410.72	5851.27	4708.57
	17200.00	3136644.	7521.60	89.925	-610040.	-145906.	3073287.	-1910.75	6149.71	3886.47
	17400.00	4067186.	7522.41	89.916	-1134912.	1085960.	3751622.	-3316.13	6112.14	2869.11
	17600.00	5160349.	7523.63	89.915	-1925457.	2276316.	4211912.	-4556.27	5735.71	1716.70

18) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/IU ALONG THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;

TABLE 11-3 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
17800.00	6292480.	7524.63	89.922	-2942198.	3358684.	4433736.	-5568.46	5036.50	495.89
18000.00	7401992.	7524.61	89.936	-4134172.	4271663.	4410329.	-6301.10	4049.03	-724.07
18200.00	8452649.	7523.82	89.956	-5441458.	4962467.	4148702.	-6716.59	2824.61	-1875.32
18400.00	9419628.	7521.60	89.977	-6798191.	5390059.	3668970.	-6793.39	1428.68	-2895.35
18600.00	10284177.	7518.42	89.999	-8135916.	5527543.	3002904.	-6527.25	-63.02	-3730.64
18800.00	11031436.	7514.87	90.019	-9387047.	5363899.	2191836.	-5931.29	-1568.84	-4339.57
19000.00	11649470.	7511.70	90.034	-10488307.	4904603.	1284048.	-5035.15	-3005.86	-4694.44
19200.00	12128796.	7509.65	90.044	-11384044.	4171462.	331881.	-3883.20	-4294.54	-4782.52
19400.00	12462152.	7509.31	90.050	-12028381.	3201501.	-611299.	-2532.28	-5362.87	-4606.17
19600.00	12644365.	7510.96	90.053	-12388116.	2045084.	-1494047.	-1048.95	-6150.11	-4182.15
19800.00	12672304.	7514.51	90.053	-12444015.	763323.	-2269609.	493.46	-6609.91	-3540.26
20000.00	12544879.	7519.51	90.053	-12191919.	-575054.	-2898346.	2018.07	-6712.93	-2721.58
20200.00	12263071.	7525.18	90.052	-11643116.	-1897322.	-3349768.	3447.87	-6448.73	-1776.03
20400.00	11830009.	7530.63	90.052	-10823999.	-3130667.	-3604035.	4709.49	-5827.01	-759.72
20600.00	11251027.	7535.02	90.052	-9774951.	-4206239.	-3652873.	5737.00	-4877.64	268.35
20800.00	10533770.	7537.70	90.051	-8548479.	-5063108.	-3499819.	6475.76	-3649.62	1249.68
21000.00	9688280.	7538.37	90.047	-7206608.	-5651858.	-3159759.	6885.69	-2208.59	2129.88
21200.00	8727196.	7537.13	90.040	-5817698.	-5937559.	-2657768.	6943.83	-633.07	2861.94
21400.00	7666193.	7534.43	90.028	-4452869.	-5901895.	-2027340.	6645.70	990.22	3409.06
21600.00	6525107.	7530.96	90.011	-3182260.	-5544276.	-1308149.	6005.51	2571.54	3776.53
21800.00	5330966.	7527.52	89.991	-2071376.	-4881926.	-543505.	5055.17	4023.39	3862.78
22000.00	4126807.	7524.77	89.969	-1177713.	-3948938.	222300.	3842.45	5265.36	3759.49
22200.00	3000811.	7523.18	89.949	-547842.	-2794410.	946575.	2428.39	6228.40	3450.83
22400.00	2183151.	7622.87	89.932	-215039.	-1479821.	1590609.	884.33	6858.37	2962.14
22600.00	2132247.	7523.60	89.921	-197568.	-75738.	2121723.	-711.51	7118.88	2328.07
22800.00	2893663.	7524.89	89.918	-497665.	1341947.	2514914.	-2277.71	6993.35	1590.32
23000.00	4008295.	7526.10	89.923	-1101287.	2696109.	2754013.	-3733.60	6486.16	795.07
23200.00	5219742.	7526.61	89.935	-1978683.	3912617.	2832306.	-5003.44	5622.75	-9.77
23400.00	6430317.	7525.98	89.953	-3085784.	4924447.	2752588.	-6020.52	4448.51	-777.51
23600.00	7593438.	7524.08	89.974	-4366410.	5675463.	2526635.	-6730.92	3026.38	-1465.46
23800.00	8680246.	7521.12	89.996	-5755131.	6123578.	2174149.	-7096.59	1433.25	-2037.48
24000.00	9669607.	7517.60	90.014	-7180683.	6243112.	1721235.	-7097.44	-244.52	-2465.94
24200.00	10544692.	7514.25	90.030	-8569660.	6026187.	1198550.	-6732.22	-1916.09	-2733.08
24400.00	11291661.	7511.83	90.041	-9850295.	5463121.	639271.	-6018.45	-3491.17	-2831.54
24600.00	11899112.	7510.99	90.047	-10956107.	4641836.	77004.	-4991.25	-4664.80	-2764.27
24800.00	12357843.	7512.10	90.050	-11829266.	3546357.	-456204.	-3701.59	-6021.55	-2543.77
25000.00	12660752.	7515.15	90.050	-12423518.	2254520.	-931665.	-2213.88	-6839.31	-2190.90
25200.00	12802814.	7519.77	90.050	-12706601.	834988.	-1325570.	-603.13	-7292.39	-1733.29
25400.00	12781124.	7525.26	90.049	-12662043.	-636294.	-1620185.	1048.39	-7354.04	-1203.55
25600.00	12594965.	7530.75	90.049	-12290239.	-2080091.	-1804544.	2655.02	-7018.34	-637.16
25800.00	12245854.	7535.36	90.050	-11608687.	-3418143.	-1875002.	4132.00	-6301.02	-70.30
26000.00	11737618.	7538.39	90.050	-10651350.	-4577486.	-1834946.	5400.44	-5239.15	462.48
26200.00	11076369.	7539.47	90.047	-9467037.	-5494576.	-1694344.	6371.42	-3889.43	930.45
26400.00	10270494.	7538.61	90.042	-8116934.	-6118917.	-1468770.	7050.70	-2325.02	1308.62

TABLE 11-3 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
	26600.00	9330546.	7536.18	90.031	-6671347.	-6415944.	-1178085.	7341.77	-631.24	1579.24
	26800.00	8269160.	7532.85	90.017	-5205933.	-6308941.	-844903.	7247.94	1099.68	1732.68
19)	27000.00	7101005.	7529.39	89.998	-3797619.	-5979915.	-492931.	6773.12	2773.47	1767.62

19) END OF IU BATTERY LIFETIME.

TABLE II-4
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	INERTIAL RANGE ANGLE (DEG)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	593.18	158.718	18.212	53.386	51.720	-65.673	39.576	39.765
2)	593.78	158.727	18.254	53.414	51.749	-65.633	39.601	39.790
	600.00	158.819	18.679	53.699	52.052	-65.213	39.854	40.044
3)	603.38	158.870	18.910	53.856	52.219	-64.983	39.991	40.181
4)	643.98	159.475	21.690	55.826	54.303	-62.144	41.596	41.787
	800.00	161.729	32.379	64.943	63.894	-49.794	46.914	47.106
	1000.00	164.157	46.087	80.132	79.742	-30.631	51.085	51.273
	1200.00	165.747	59.792	97.372	97.663	-9.489	51.389	51.576
5)	1264.78	166.058	64.231	102.782	103.291	-2.811	50.610	50.799
6)	1283.38	166.129	65.505	104.285	104.857	-.942	50.312	50.501
	1400.00	166.395	73.493	113.036	113.992	10.127	47.749	47.936
	1600.00	166.250	87.187	124.869	126.435	26.087	41.054	41.244
	1800.00	165.665	100.874	132.883	134.971	38.548	32.415	32.590
	2000.00	165.106	114.553	137.928	140.418	48.536	22.640	22.777
	2200.00	165.025	128.224	140.749	143.501	57.029	12.242	12.322
	2400.00	165.738	141.887	141.792	144.649	64.795	1.558	1.568
	2600.00	167.337	155.538	141.222	144.023	72.470	-9.157	-9.217
	2800.00	169.653	169.156	138.954	141.540	80.671	-19.655	-19.779
7)	2993.38	172.198	177.262	134.813	137.051	89.771	-29.322	-29.486
	3000.00	172.284	176.854	134.631	136.855	90.112	-29.640	-29.805
	3200.00	174.683	163.414	127.600	129.336	101.703	-38.660	-38.848
	3400.00	176.274	149.780	117.001	118.149	116.494	-46.014	-46.206
8)	3533.38	176.644	140.677	107.681	108.399	128.481	-49.494	-49.684
9)	3580.38	176.619	137.469	104.003	104.565	133.083	-50.371	-50.560
	3600.00	176.583	136.129	102.417	102.913	135.053	-50.677	-50.866
	3800.00	175.350	122.470	85.328	85.144	156.030	-51.615	-51.802
	4000.00	172.591	108.802	69.236	68.383	176.046	-48.561	-48.752
	4200.00	168.612	95.125	56.762	55.288	-167.397	-42.290	-42.482
	4400.00	163.959	81.438	48.185	46.176	-154.436	-33.903	-34.081
10)	4433.38	163.164	79.152	47.080	44.992	-152.559	-32.362	-32.536

1) ORBIT INSERTION; INERTIAL ATTITUDE HOLD AND LOX NPV IN PROGRESS;
2) BEGIN LH2 NPV;
3) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM ALONG THE LOCAL HORIZONTAL, NOSE LEADING, POSITION 1 DOWN;
4) END LOX NPV;
5) END LH2 NPV;
6) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM NOSE THREE DEGREES ABOVE THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;
7) INITIATE A MANEUVER TO POSITION THE S-IVB/CSM FOR SEPARATION;
8) BEGIN LH2 NPV;
9) BEGIN INERTIAL ATTITUDE HOLD;
10) END LH2 NPV;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 11-4 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	INERTIAL RANGE ANGLE (DEG)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
11)	4440.20	163.801	78.686	46.865	44.761	-152.184	-32.044	-32.217
	4600.00	159.015	67.741	42.715	40.284	-144.110	-24.256	-24.403
	4800.00	155.371	54.037	39.571	36.858	-135.413	-13.909	-13.999
	5000.00	152.683	40.325	38.263	35.423	-127.548	-3.216	-3.238
12)	5040.20	152.023	37.568	38.199	35.353	-126.000	-1.049	-1.056
	5200.00	151.569	26.611	38.589	35.783	-119.861	7.555	7.605
	5400.00	152.045	12.911	40.601	37.989	-111.734	18.155	18.270
	5600.00	153.834	1.439	44.620	42.350	-102.466	28.289	28.450
	5800.00	156.842	14.644	51.266	49.469	-91.166	37.526	37.712
	6000.00	159.268	28.350	61.404	60.182	-76.770	45.191	45.383
	6200.00	161.746	42.066	75.578	75.001	-58.578	50.283	50.472
13)	6293.38	162.660	48.470	83.344	83.082	-48.980	51.458	51.646
	6400.00	163.466	55.781	92.594	92.696	-37.650	51.719	51.906
	6600.00	164.251	69.491	109.038	109.813	-17.278	49.107	49.297
14)	6773.38	164.234	81.371	120.522	121.847	-2.280	44.086	44.279
	6800.00	164.186	83.195	122.010	123.414	-.239	43.140	43.332
	7000.00	163.580	96.892	131.008	132.961	13.105	34.939	35.120
	7200.00	162.884	110.582	136.787	139.179	23.674	25.409	25.559
	7400.00	162.567	124.264	140.164	142.858	32.498	15.137	15.235
	7600.00	162.994	137.939	141.668	144.511	40.402	4.498	4.529
	7800.00	164.327	151.606	141.538	144.369	48.048	-6.237	-6.279
	8000.00	166.466	165.256	139.756	142.414	56.046	-16.828	-16.935
	8200.00	169.068	178.529	136.043	138.377	65.074	-26.995	-27.150
	8400.00	171.611	167.337	129.826	131.705	75.984	-36.339	-36.523
15)	8513.38	172.803	159.607	124.876	126.446	83.400	-41.048	-41.238
	8600.00	173.511	153.696	120.270	121.585	89.819	-44.238	-44.431
	8800.00	174.253	140.037	106.719	107.396	107.393	-49.747	-49.936
16)	8942.38	173.884	130.309	94.991	95.188	121.904	-51.593	-51.780
	9000.00	173.507	126.371	90.003	90.003	128.012	-51.765	-51.952
	9200.00	171.207	112.697	73.279	72.603	148.640	-49.746	-49.936
17)	9240.20	170.572	109.947	70.236	69.427	152.479	-48.885	-49.075
	9400.00	167.580	99.014	59.712	58.399	166.237	-44.228	-44.420
	9600.00	163.114	85.322	50.145	48.270	-179.905	-36.307	-36.490
	9800.00	158.465	71.620	43.925	41.596	-168.973	-26.930	-27.085

11) CSM SEPARATION; SLA PANEL JETTISON;
12) CSM DOCKING;
13) BEGIN LH2 NPV;
14) END LH2 NPV;
15) INITIATE A MANEUVER TO POSITION THE VEHICLE FOR DOCKING MODULE EXTRACTION;
16) BEGIN INERTIAL ATTITUDE HOLD;
17) DOCKING MODULE EXTRACTION;

TABLE II-4 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	INERTIAL RANGE ANGLE (DEG)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
18)	9893.38	156.429	65.220	41.923	39.426	-164.570	-22.239	-22.374
	10000.00	154.331	57.910	40.217	37.567	-159.922	-16.723	-16.830
	10200.00	151.321	44.193	38.449	35.628	-151.898	-6.089	-6.130
	10400.00	149.815	30.470	38.344	35.514	-144.220	4.689	4.721
	10600.00	149.904	16.750	39.888	37.210	-136.270	15.365	15.464
	10800.00	151.384	3.131	43.327	40.953	-127.380	25.661	25.812
	11000.00	153.802	10.786	49.200	47.266	-116.714	35.194	35.375
	11200.00	156.572	24.497	58.330	56.948	-103.236	43.363	43.556
	11400.00	159.110	38.222	71.456	70.703	-86.039	49.251	49.442
	11600.00	160.958	51.946	87.994	87.915	-65.571	51.737	51.924
	11800.00	161.879	65.665	104.964	105.564	-44.687	50.164	50.353
	12000.00	161.800	79.379	118.998	120.242	-26.632	44.970	45.163
	12200.00	161.287	93.087	128.995	130.012	-12.374	37.251	37.436
	12400.00	160.471	106.788	135.534	137.822	-1.176	27.996	28.156
	12600.00	159.940	120.482	139.478	142.105	8.022	17.869	17.982
	12800.00	160.102	134.169	141.438	144.256	16.104	7.290	7.339
	13000.00	161.182	147.849	141.726	144.573	23.764	-3.451	-3.474
	13200.00	163.151	161.520	140.387	143.103	31.616	-14.110	-14.202
	13400.00	165.723	175.143	137.215	139.645	40.310	-24.425	-24.570
	13600.00	168.405	171.077	131.713	133.719	50.648	-34.036	-34.215
	13800.00	170.414	157.429	123.098	124.565	63.635	-42.390	-42.581
	14000.00	171.798	143.761	110.577	111.422	80.234	-48.623	-48.814
	14200.00	171.561	130.087	94.443	94.618	100.291	-51.629	-51.816
	14400.00	169.765	116.407	77.347	76.842	121.283	-50.634	-50.822
	14600.00	166.552	102.719	62.790	61.634	139.828	-45.909	-46.101
	14800.00	162.346	89.023	52.230	50.490	154.600	-38.495	-38.683
	15000.00	157.768	75.317	45.240	43.015	166.180	-29.414	-29.579
	15200.00	153.515	61.603	40.958	38.577	175.623	-19.370	-19.490
	15400.00	150.229	47.880	38.734	35.943	-176.159	-8.810	-8.869
	15600.00	148.357	34.152	38.219	35.377	-168.448	1.959	1.973
	15800.00	148.073	20.421	39.333	36.603	-160.623	12.689	12.772
	16000.00	149.239	6.707	42.255	39.792	-152.037	23.115	23.254
	16200.00	151.458	7.107	47.448	45.393	-141.907	32.890	33.065
	16400.00	154.165	20.823	55.674	54.145	-129.235	[illegible]	41.670
	16600.00	156.763	34.555	67.772	66.856	-113.009	48.347	48.239
	16800.00	158.753	48.287	83.649	83.399	-93.177	51.485	51.673
	17000.00	159.840	62.014	100.884	101.315	-72.033	50.934	51.122
	17200.00	159.988	75.736	115.865	116.952	-53.068	46.552	46.744
	17400.00	159.412	89.453	126.857	128.539	-37.886	39.355	39.544
	17600.00	158.518	103.163	134.178	136.358	-26.020	30.405	30.573

18) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/IU ALONG THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE II-4 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (KM)	INERTIAL RANGE ANGLE (DEG)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
17800.00	157.796	116.867	128.701	141.255	-16.409	20.444	20.570
18000.00	157.691	130.564	141.115	143.898	-8.116	9.941	10.007
18200.00	158.483	144.255	141.803	144.657	-.405	-.789	-.794
18400.00	160.814	157.939	140.876	143.637	7.347	-11.497	-11.573
18600.00	162.658	171.609	138.188	140.701	15.772	-21.931	-22.065
18800.00	165.367	174.654	133.320	135.441	25.625	-31.763	-31.936
19000.00	167.766	160.999	125.549	127.156	37.869	-40.497	-40.697
19200.00	169.282	147.323	114.021	115.024	53.536	-47.352	-47.543
19400.00	169.469	133.641	98.614	98.955	72.895	-51.248	-51.436
19600.00	168.110	119.955	81.393	81.053	94.009	-51.249	-51.437
19800.00	165.281	106.261	65.974	64.972	113.384	-47.350	-47.541
20000.00	161.337	92.559	54.433	52.827	129.073	-40.481	-40.672
20200.00	156.856	78.849	46.654	44.537	141.337	-31.723	-31.896
20400.00	152.528	65.130	41.786	39.279	151.210	-21.859	-21.992
20600.00	149.013	51.403	39.106	36.352	159.657	-11.388	-11.463
20800.00	146.818	37.669	38.195	35.352	167.434	-.641	-.645
21000.00	146.181	23.930	38.911	36.141	175.179	10.125	10.191
21200.00	147.036	10.193	41.369	38.830	-176.479	20.655	20.782
21400.00	149.039	3.599	45.960	43.796	-166.797	30.630	30.799
21600.00	151.653	17.317	53.380	51.717	-154.829	39.569	39.758
21800.00	154.278	31.058	64.503	63.435	-139.514	46.718	46.910
22000.00	156.383	44.797	79.604	79.193	-120.426	51.008	51.196
22200.00	157.618	58.533	96.863	97.133	-99.257	51.438	51.625
22400.00	157.888	72.264	112.646	113.581	-79.516	47.892	48.083
22600.00	157.359	85.989	124.612	126.160	-63.419	41.255	41.446
22800.00	156.404	99.708	132.730	134.801	-50.853	32.636	32.811
23000.00	155.508	113.422	137.843	140.321	-40.796	22.858	22.996
23200.00	155.146	127.129	140.711	143.453	-32.259	12.444	12.526
23400.00	155.650	140.831	141.786	144.636	-24.464	1.738	1.750
23600.00	157.125	154.527	141.241	144.037	-16.771	-9.004	-9.063
23800.00	159.408	168.216	138.991	141.573	-8.559	-19.534	-19.655
24000.00	162.099	178.049	134.682	136.904	.890	-29.548	-29.714
24200.00	164.639	164.394	127.660	129.395	12.489	-38.601	-38.789
24400.00	166.839	150.708	117.058	118.207	27.296	-45.984	-46.176
24600.00	167.010	137.018	102.454	102.951	45.887	-50.669	-50.858
24800.00	166.076	123.323	85.331	85.147	66.909	-51.614	-51.801
25000.00	163.638	109.623	69.208	68.355	86.965	-48.551	-48.741
25200.00	159.984	95.915	56.722	55.248	103.546	-42.259	-42.451
25400.00	155.644	82.200	48.146	46.137	116.518	-33.848	-34.026
25600.00	151.295	68.475	42.684	40.255	126.851	-24.180	-24.324
25800.00	147.608	54.743	39.551	36.842	135.554	-13.809	-13.898
26000.00	145.135	41.003	38.259	35.423	143.429	-3.096	-3.116
26200.00	144.172	27.258	38.605	35.805	151.132	7.692	7.743
26400.00	144.725	13.510	40.645	38.040	159.283	18.305	18.420

TABLE II-4 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	INERTIAL RANGE ANGLE (DEG)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
	26600.00	146.503	.370	44.704	42.445	168.591	28.444	28.605
	26800.00	149.003	13.999	51.413	49.628	179.954	37.675	37.862
19)	27000.00	151.625	27.748	61.639	60.431	-165.559	45.315	45.508

19) END OF IU BATTERY LIFETIME.

TABLE 11-5
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	RELATIVE VEHICLE ATTITUDE PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	593.18	-99.767	-6.366	.293	.000	.000	.000	8.181	-4.690	-.918
2)	593.78	-99.767	-6.366	.293	.000	.000	.000	8.223	-4.690	-.918
	600.00	-99.767	-6.366	.293	.000	.000	.000	8.649	-4.690	-.918
3)	603.38	-99.767	-6.366	.293	.000	.000	.000	8.881	-4.691	-.918
4)	643.98	-111.537	-1.881	.840	.000	.000	.000	.000	.000	-.000
	800.00	-122.247	-1.990	.477	-.069	-.000	-.002	.000	.000	-.000
	1000.00	-135.973	-2.027	-.006	-.069	.000	-.002	.000	.000	.000
	1200.00	-149.693	-1.948	-.484	-.069	.001	-.002	.000	.000	.000
5)	1264.78	-154.135	-1.898	-.633	.000	.000	.000	.000	.000	.000
6)	1283.38	-155.410	-1.881	-.675	-.069	.001	-.002	.000	.000	.000
	1400.00	-120.425	1.707	-58.984	.300	-.001	-.500	42.988	3.626	-59.503
	1600.00	-60.425	1.399	-158.984	.300	-.002	-.500	116.717	1.915	-160.889
	1800.00	-13.792	1.014	-178.319	-.068	-.002	.001	177.000	-.000	-180.000
	2000.00	-27.469	.576	-178.129	-.068	-.002	.001	177.000	-.000	-180.000
	2200.00	-41.137	.110	-178.048	-.068	-.002	.000	177.000	-.000	-180.000
	2400.00	-54.798	-.358	-178.078	-.068	-.002	-.000	177.000	.000	180.000
	2600.00	-68.456	-.800	-178.216	-.068	-.002	-.001	177.000	.000	-180.000
	2800.00	-82.112	-1.192	-178.455	-.068	-.002	-.001	177.000	.000	-180.000
7)	2993.38	-95.316	-1.503	-178.766	-.068	-.001	-.002	177.000	.000	-180.000
	3000.00	-97.302	-.335	178.085	-.300	.053	-.452	175.492	1.210	176.903
	3200.00	-157.302	.117	178.071	-.300	.002	.000	129.126	1.905	178.806
	3400.00	142.698	.556	178.167	-.300	.002	.001	82.772	.820	-179.935
8)	3533.38	108.807	.834	178.289	.000	.000	.000	58.000	-.000	180.000
9)	3580.38	105.597	.926	178.342	-.068	.002	.001	58.000	-.000	180.000
	3600.00	105.597	.926	178.342	.000	.000	.000	59.340	.001	179.998
	3800.00	105.597	.926	178.342	.000	.000	.000	73.005	.009	179.980
	4000.00	105.597	.926	178.342	.000	.000	.000	86.676	.013	179.960
	4200.00	105.597	.926	178.342	.000	.000	.000	100.357	.012	179.941
	4400.00	105.597	.926	178.342	.000	.000	.000	114.046	.007	179.926
10)	4433.38	105.597	.926	178.342	.000	.000	.000	116.332	.006	179.924

1) ORBIT INSERTION; INERTIAL ATTITUDE HOLD AND LOX NPV IN PROGRESS;
2) BEGIN LH2 NPV;
3) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM ALONG THE LOCAL HORIZONTAL, NOSE LEADING, POSITION 1 DOWN;
4) END LOX NPV;
5) END LH2 NPV;
6) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM NOSE THREE DEGREES ABOVE THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;
7) INITIATE A MANEUVER TO POSITION THE S-IVB/CSM FOR SEPARATION;
8) BEGIN LH2 NPV;
9) BEGIN INERTIAL ATTITUDE HOLD;
10) END LH2 NPV;

TABLE II-5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	RELATIVE VEHICLE ATTITUDE PITCH (DEG)	YAW (DEG)	ROLL (DEG)
11)	4440.20	105.597	.926	178.342	.000	.000	.000	116.799	.006	179.923
	4600.00	105.597	.926	178.342	.000	.000	.000	127.746	.001	179.915
	4800.00	105.597	.926	178.342	.000	.000	.000	141.454	-.005	179.909
	5000.00	105.597	.926	178.342	.000	.000	.000	155.171	-.009	179.906
12)	5040.20	105.597	.926	178.342	.000	.000	.000	157.929	-.009	179.906
	5200.00	105.597	.926	178.342	.000	.000	.000	168.894	-.008	179.907
	5400.00	105.597	.926	178.342	.000	.000	.000	-177.378	-.002	179.907
	5600.00	105.597	.926	178.342	.000	.000	.000	-163.648	.009	179.905
	5800.00	105.597	.926	178.342	.000	.000	.000	-149.918	.022	179.900
	6000.00	105.597	.926	178.342	.000	.000	.000	-136.189	.035	179.889
	6200.00	105.597	.926	178.342	.000	.000	.000	-122.465	.048	179.874
13)	6293.36	105.597	.926	178.342	.000	.000	.000	-116.058	.052	179.866
	6400.00	105.597	.926	178.342	.000	.000	.000	-108.746	.057	179.856
	6600.00	105.597	.926	178.342	.000	.000	.000	-95.032	.061	179.836
14)	6773.38	105.597	.926	178.342	.000	.000	.000	-83.149	.061	179.819
	6800.00	105.597	.926	178.342	.000	.000	.000	-81.326	.060	179.817
	7000.00	105.597	.926	178.342	.000	.000	.000	-67.626	.056	179.801
	7200.00	105.597	.926	178.342	.000	.000	.000	-53.934	.050	179.790
	7400.00	105.597	.926	178.342	.000	.000	.000	-40.248	.043	179.783
	7600.00	105.597	.926	178.342	.000	.000	.000	-26.569	.040	179.780
	7800.00	105.597	.926	178.342	.000	.000	.000	-12.896	.040	179.780
	8000.00	105.597	.926	178.342	.000	.000	.000	.773	.045	179.781
	8200.00	105.597	.926	178.342	.000	.000	.000	14.438	.055	179.779
	8400.00	105.597	.926	178.342	.000	.000	.000	28.102	.068	179.774
15)	8513.38	105.597	.926	178.342	.000	.000	.000	35.848	.076	179.769
	8600.00	79.612	1.232	-178.896	-.300	-.001	.001	15.785	-.150	-177.987
	8800.00	19.612	.928	-178.654	-.300	-.002	.001	-30.538	-.534	-179.385
16)	8942.38	-18.988	.681	-178.529	-.068	-.002	.001	-59.400	-.000	-180.000
	9000.00	-18.988	.681	-178.529	.000	.000	.000	-55.461	.003	-179.995
	9200.00	-18.988	.681	-178.529	.000	.000	.000	-41.784	.017	-179.980
17)	9240.20	-18.988	.681	-178.529	.000	.000	.000	-39.034	.020	-179.977
	9400.00	-18.988	.681	-178.529	.000	.000	.000	-28.097	.032	-179.969
	9600.00	-18.988	.681	-178.529	.000	.000	.000	-14.405	.048	-179.962
	9800.00	-18.988	.681	-178.529	.000	.000	.000	-.702	.062	-179.961

11) CSM SEPARATION; SLA PANEL JETTISON;
12) CSM DOCKING;
13) BEGIN LH2 NPV;
14) END LH2 NPV;
15) INITIATE A MANEUVER TO POSITION THE VEHICLE FOR DOCKING MODULE EXTRACTION;
16) BEGIN INERTIAL ATTITUDE HOLD;
17) DOCKING MODULE EXTRACTION;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE II-5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	RELATIVE VEHICLE ATTITUDE PITCH (DEG)	YAW (DEG)	ROLL (DEG)
18)	9893.38	-18.988	.681	-178.529	.000	.000	.000	5.699	.067	-179.961
	10000.00	12.997	-.272	178.467	.300	.002	-.000	44.972	-1.547	177.575
	10200.00	72.997	.105	178.447	.300	.002	.000	118.714	-1.308	179.102
	10400.00	120.549	.470	178.517	-.069	.002	.001	180.000	-.000	180.000
	10600.00	106.840	.804	178.670	-.069	.002	.001	180.000	-.000	180.000
	10800.00	93.106	1.088	178.898	-.069	.001	.001	180.000	-.000	180.000
	11000.00	79.369	1.305	179.186	-.069	.001	.002	180.000	-.000	180.000
	11200.00	65.631	1.444	179.518	-.069	.000	.002	180.000	-.000	180.000
	11400.00	51.895	1.499	179.872	-.069	.000	.002	180.000	-.000	180.000
	11600.00	38.164	1.466	-179.771	-.069	-.000	.002	180.000	-.000	-180.000
	11800.00	24.438	1.350	-179.432	-.069	-.001	.002	180.000	-.000	-180.000
	12000.00	10.720	1.157	-179.131	-.069	-.001	.001	180.000	-.000	-180.000
	12200.00	-2.989	.901	-178.893	-.069	-.001	.001	180.000	-.000	180.000
	12400.00	-16.689	.597	-178.703	-.068	-.002	.001	-180.000	-.000	180.000
	12600.00	-30.381	.263	-178.600	-.068	-.002	.000	180.000	-.000	-180.000
	12800.00	-44.067	-.081	-178.578	-.068	-.002	-.000	-180.000	.000	-180.000
	13000.00	-57.746	-.416	-178.638	-.068	-.002	-.000	-180.000	.000	-180.000
	13200.00	-71.422	-.722	-178.775	-.068	-.001	-.001	-180.000	.000	-180.000
	13400.00	-85.096	-.983	-178.979	-.068	-.001	-.001	-180.000	.000	-180.000
	13600.00	-98.770	-1.184	-179.239	-.068	-.001	-.001	-180.000	.000	-180.000
	13800.00	-112.445	-1.314	-179.539	-.068	-.000	-.002	-180.000	.000	-180.000
	14000.00	-126.122	-1.367	-179.860	-.068	-.000	-.002	-180.000	.000	-180.000
	14200.00	-139.802	-1.341	179.815	-.068	.000	-.002	-180.000	.000	180.000
	14400.00	-153.488	-1.239	179.505	-.068	.001	-.001	-180.000	.000	180.000
	14600.00	-167.179	-1.067	179.228	-.068	.001	-.001	-180.000	.000	180.000
	14800.00	179.124	-.837	179.000	-.069	.001	-.001	180.000	.000	180.000
	15000.00	165.419	-.561	178.832	-.069	.001	-.001	180.000	.000	180.000
	15200.00	151.706	-.258	178.733	-.069	.002	-.000	180.000	.000	180.000
	15400.00	137.986	.056	178.709	-.069	.002	.000	180.000	-.000	180.000
	15600.00	124.258	.363	178.760	-.069	.001	.000	180.000	-.000	180.000
	15800.00	110.524	.643	178.881	-.069	.001	.001	180.000	-.000	180.000
	16000.00	96.786	.883	179.065	-.069	.001	.001	180.000	-.000	180.000
	16200.00	83.044	1.067	179.300	-.069	.001	.001	180.000	-.000	180.000
	16400.00	69.302	1.187	179.572	-.069	.000	.001	180.000	-.000	180.000
	16600.00	55.561	1.236	179.864	-.069	.000	.001	180.000	-.000	180.000
	16800.00	41.825	1.213	-179.841	-.069	-.000	.001	180.000	-.000	-180.000
	17000.00	28.093	1.121	-179.560	-.069	-.001	.001	180.000	-.000	-180.000
	17200.00	14.368	.965	-179.309	-.069	-.001	.001	180.000	-.000	-180.000
	17400.00	.651	.756	-179.102	-.069	-.001	.001	180.000	-.000	-180.000
	17600.00	-13.058	.507	-178.951	-.069	-.001	.001	-180.000	-.000	-180.000

18) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/IU ALONG THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;

TABLE 11-5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	RELATIVE VEHICLE ATTITUDE PITCH (DEG)	YAW (DEG)	ROLL (DEG)
17800.00	-26.761	.232	-178.862	-.068	-.001	.000	180.000	-.000	-180.000
18000.00	-40.456	-.050	-178.840	-.068	-.001	-.000	-180.000	.000	-180.000
18200.00	-54.146	-.326	-178.886	-.068	-.001	-.000	-180.000	.000	-180.000
18400.00	-67.832	-.577	-178.994	-.068	-.001	-.001	-180.000	.000	-180.000
18600.00	-81.515	-.791	-179.158	-.068	-.001	-.001	-180.000	.000	-180.000
18800.00	-95.196	-.956	-179.368	-.068	-.001	-.001	-180.000	.000	-180.000
19000.00	-108.878	-1.063	-179.610	-.068	-.000	-.001	-180.000	.000	-180.000
19200.00	-122.561	-1.107	-179.871	-.068	-.000	-.001	-180.000	.000	180.000
19400.00	-136.247	-1.086	179.866	-.068	.000	-.001	-180.000	.000	180.000
19600.00	-149.937	-1.003	179.615	-.068	.001	-.001	-180.000	.000	180.000
19800.00	-163.632	-.864	179.391	-.068	.001	-.001	-180.000	.000	180.000
20000.00	-177.334	-.677	179.206	-.069	.001	-.001	-180.000	.000	180.000
20200.00	168.956	-.454	179.070	-.069	.001	-.001	180.000	.000	180.000
20400.00	155.238	-.209	178.990	-.069	.001	-.000	180.000	.000	180.000
20600.00	141.513	.044	178.971	-.069	.001	.000	180.000	-.000	180.000
20800.00	127.780	.290	179.011	-.069	.001	.000	180.000	-.000	180.000
21000.00	114.041	.514	179.108	-.069	.001	.001	180.000	-.000	180.000
21200.00	100.297	.704	179.255	-.069	.001	.001	180.000	-.000	180.000
21400.00	86.551	.850	179.442	-.069	.001	.001	180.000	-.000	180.000
21600.00	72.803	.943	179.658	-.069	.000	.001	180.000	-.000	180.000
21800.00	59.058	.979	179.890	-.069	.000	.001	180.000	-.000	180.000
22000.00	45.315	.958	-179.876	-.069	-.000	.001	180.000	-.000	-180.000
22200.00	31.577	.881	-179.655	-.069	-.001	.001	180.000	.000	180.000
22400.00	17.845	.754	-179.458	-.069	-.001	.001	180.000	-.000	-180.000
22600.00	4.120	.585	-179.297	-.069	-.001	.001	180.000	-.000	-180.000
22800.00	-9.599	.386	-179.180	-.069	-.001	.000	-180.000	-.000	180.000
23000.00	-23.311	.169	-179.114	-.069	-.001	.000	-180.000	-.000	-180.000
23200.00	-37.017	-.054	-179.100	-.069	-.001	-.000	-180.000	.000	180.000
23400.00	-50.718	-.269	-179.139	-.068	-.001	-.000	-180.000	.000	180.000
23600.00	-64.414	-.463	-179.227	-.068	-.001	-.001	-180.000	.000	-180.000
23800.00	-78.107	-.627	-179.358	-.068	-.001	-.001	180.000	.000	-180.000
24000.00	-91.797	-.750	-179.523	-.068	-.001	-.001	-180.000	.000	-180.000
24200.00	-105.487	-.827	-179.713	-.068	-.000	-.001	180.000	.000	-180.000
24400.00	-119.177	-.854	-179.915	-.068	-.000	-.001	-180.000	.000	-180.000
24600.00	-132.869	-.830	179.883	-.068	.000	-.001	-180.000	.000	180.000
24800.00	-146.565	-.759	179.692	-.068	.000	-.001	-180.000	.000	180.000
25000.00	-160.267	-.644	179.524	-.069	.001	-.001	180.000	.000	180.000
25200.00	-173.974	-.494	179.387	-.069	.001	-.001	-180.000	.000	180.000
25400.00	172.310	-.319	179.289	-.069	.001	-.000	180.000	.000	180.000
25600.00	158.587	-.128	179.236	-.069	.001	-.000	180.000	.000	180.000
25800.00	144.856	.065	179.228	-.069	.001	.000	180.000	-.000	180.000
26000.00	131.117	.250	179.266	-.069	.001	.000	180.000	-.000	180.000
26200.00	117.372	.416	179.347	-.069	.001	.000	180.000	-.000	180.000
26400.00	103.623	.554	179.464	-.069	.001	.001	180.000	-.000	180.000

TABLE II-5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	RELATIVE VEHICLE ATTITUDE PITCH (DEG)	YAW (DEG)	ROLL (DEG)
	26600.00	89.871	.655	179.610	-.069	.000	.001	180.000	-.000	180.000
	26800.00	76.118	.715	179.775	-.069	.000	.001	180.000	-.000	180.000
19)	27000.00	62.367	.730	179.949	-.069	-.000	.001	180.000	-.000	180.000

19) END OF IU BATTERY LIFETIME.

FIGURE 1
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW REQUIREMENTS
ORBITAL INCLINATION = 51.78 DEG.

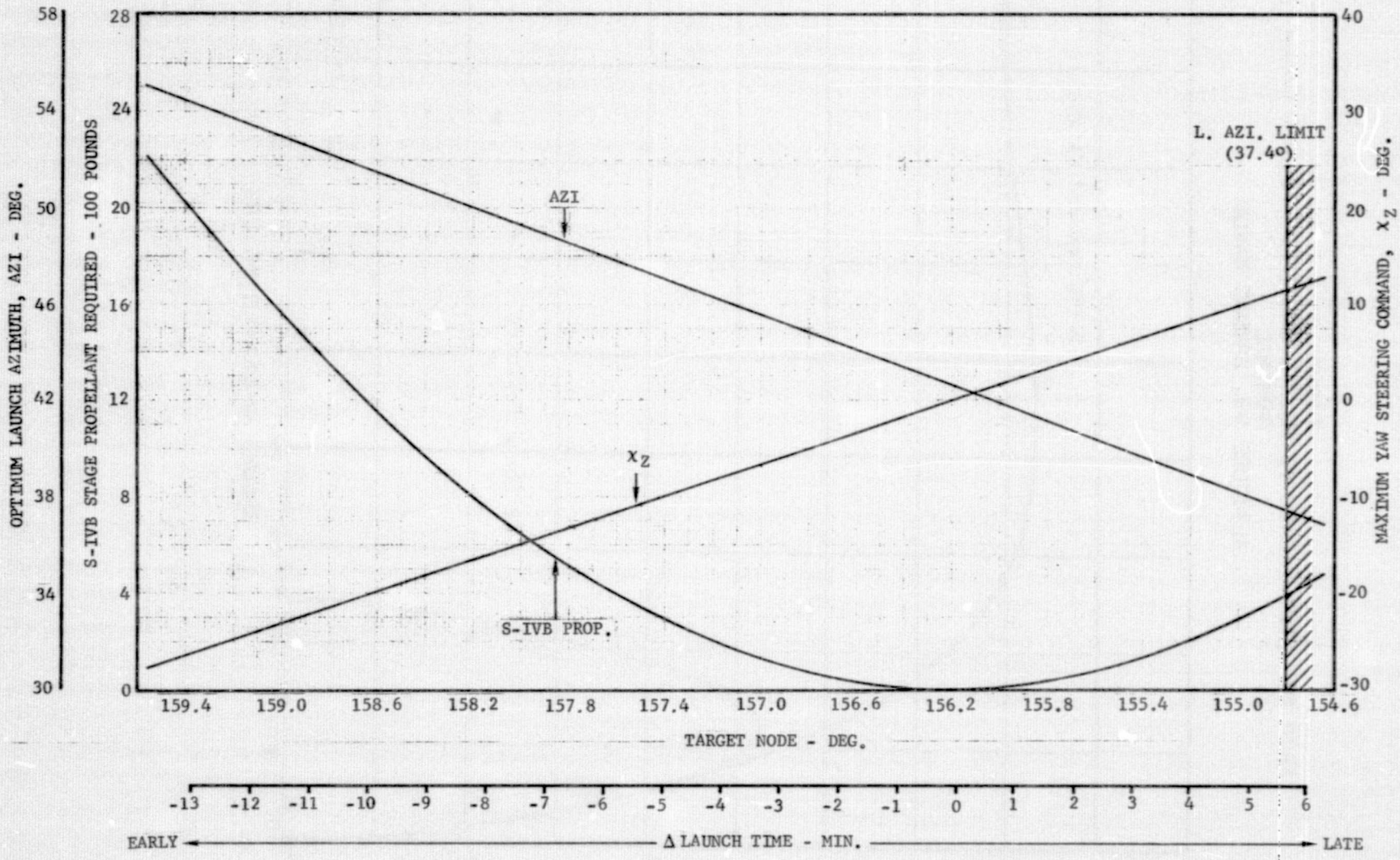


FIGURE 2
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ALTITUDE VS. GROUND RANGE

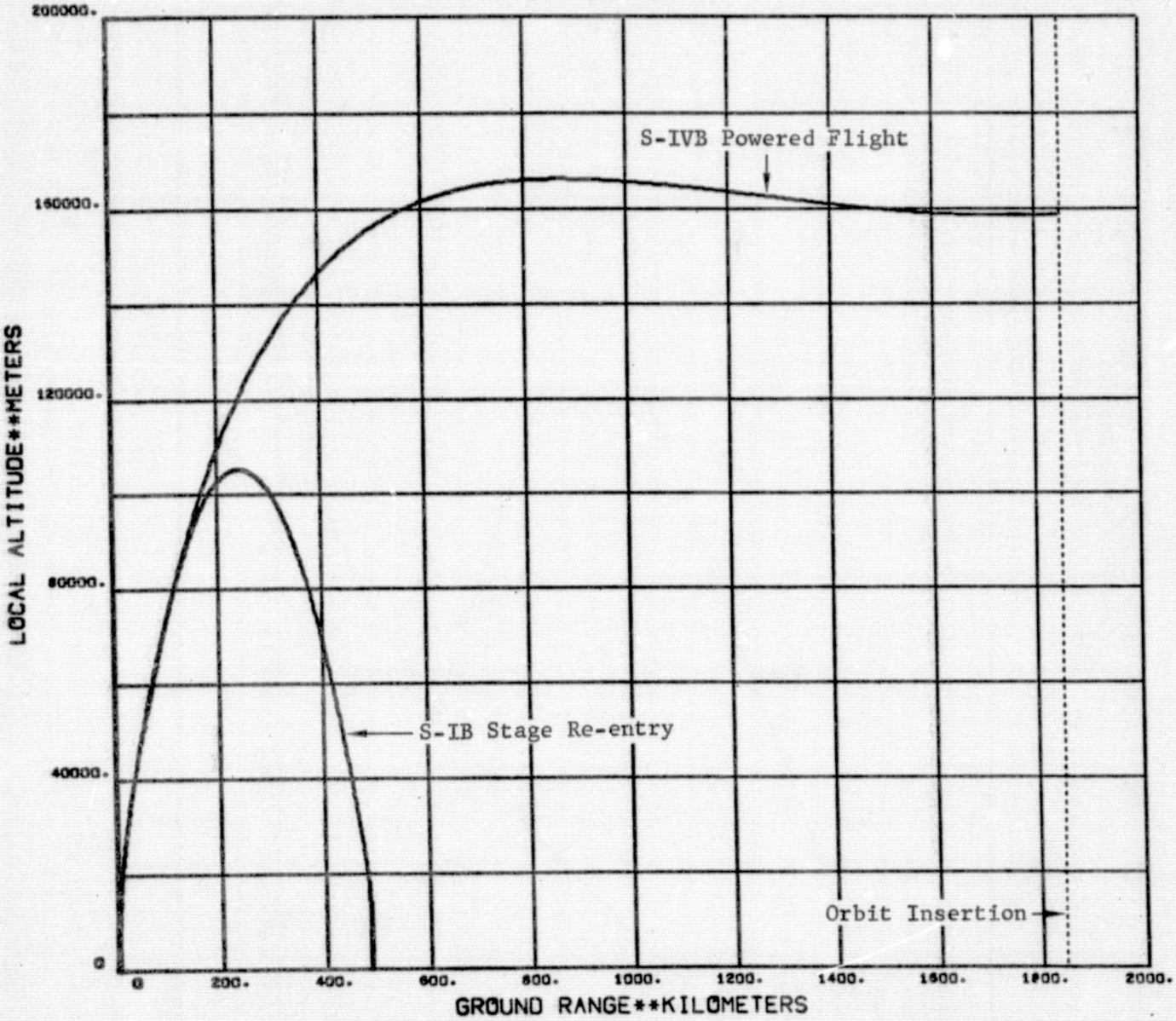


FIGURE 3
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ALTITUDE HISTORIES

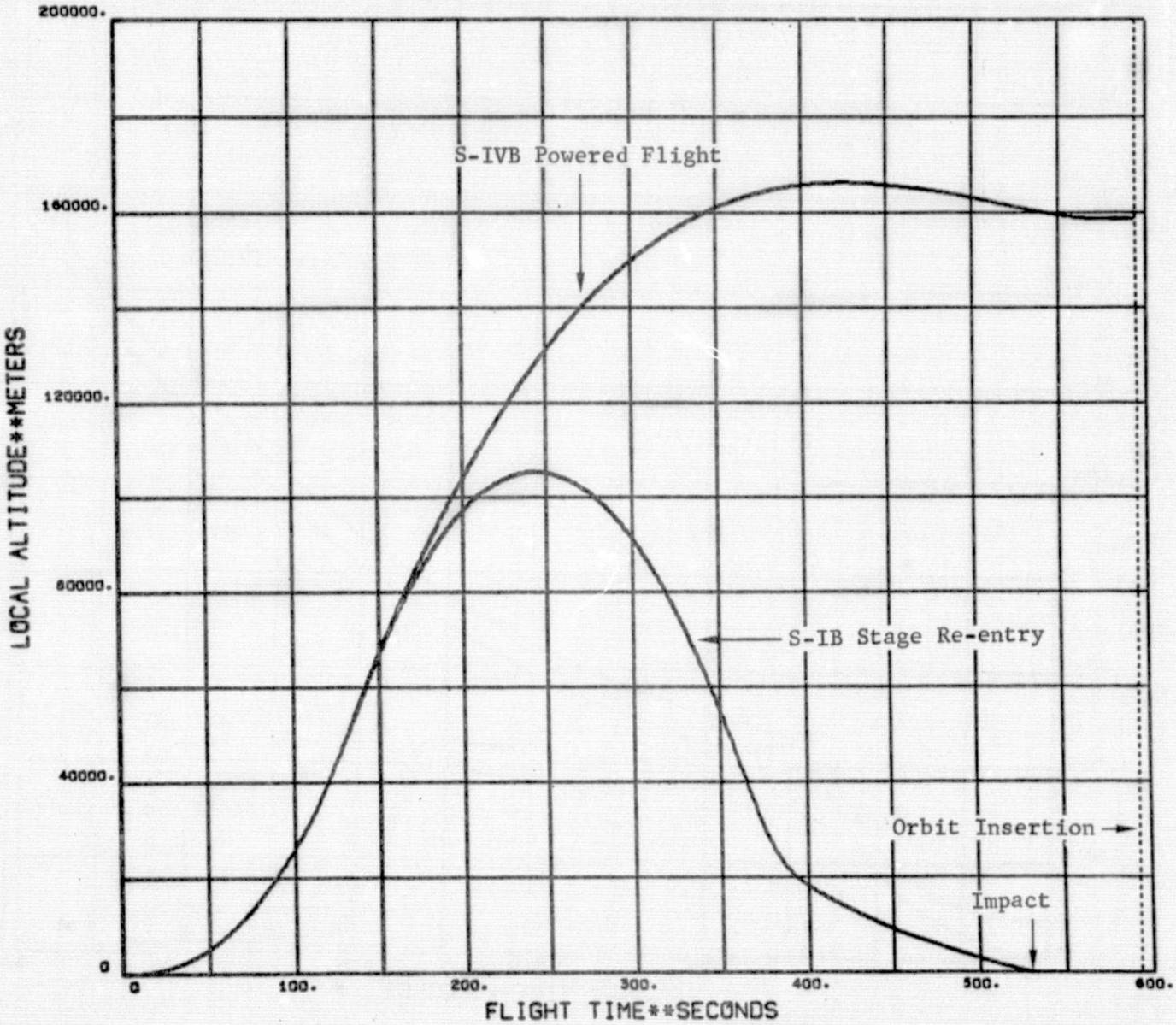


FIGURE 4
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
VELOCITY HISTORIES

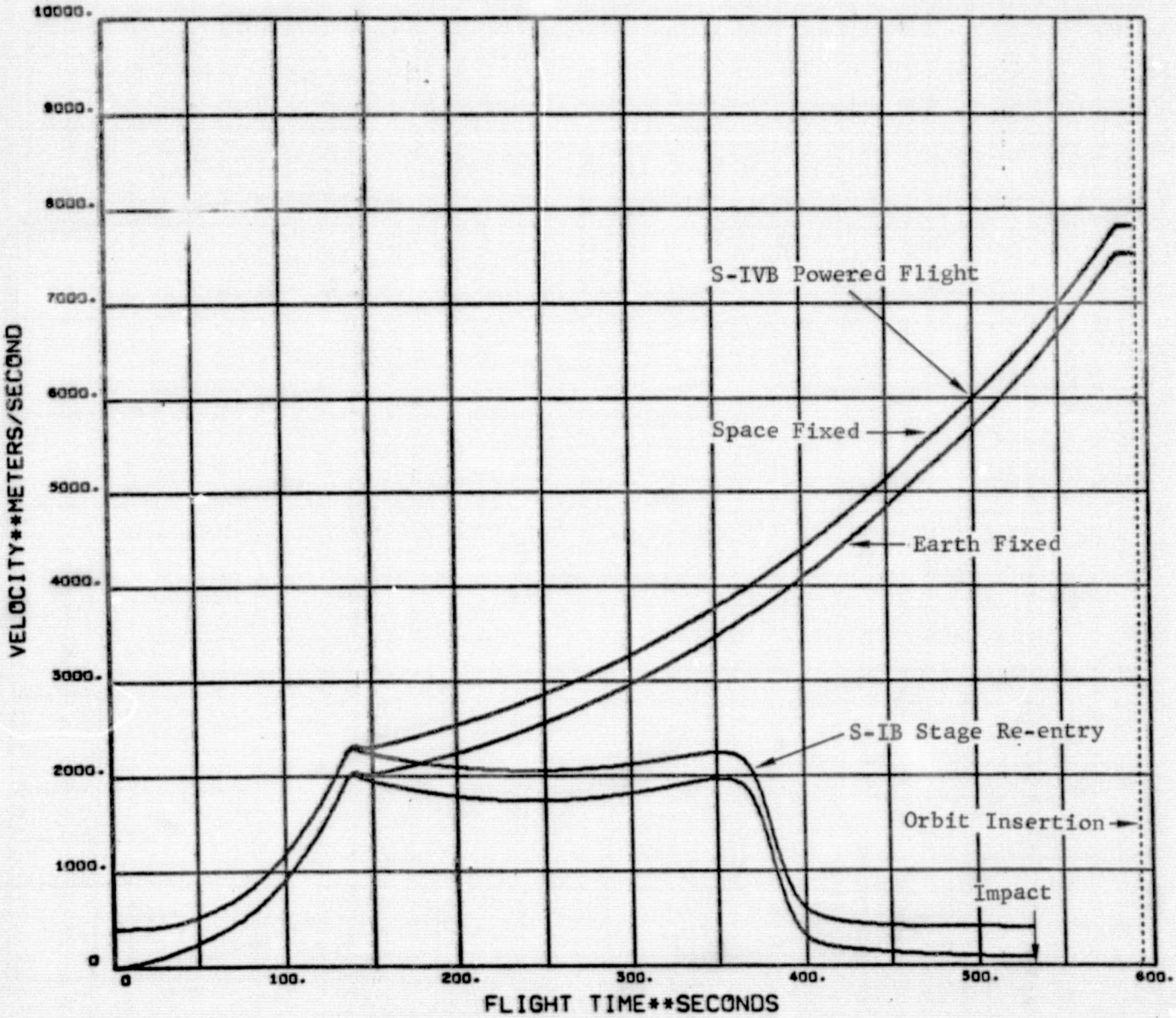


FIGURE 5
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
SPACE FIXED PATH ANGLE HISTORIES

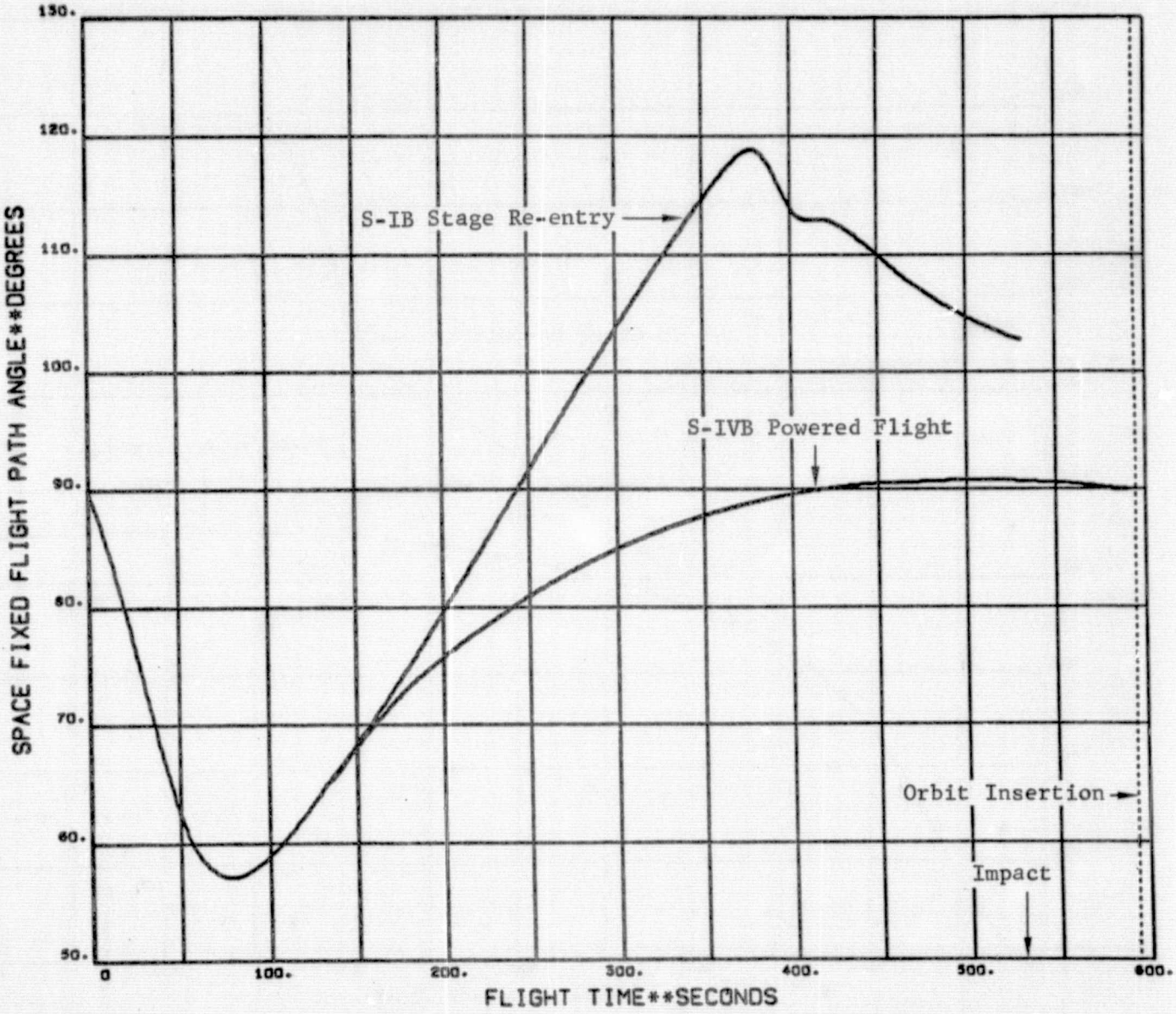


FIGURE 6
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
EARTH FIXED PATH ANGLE HISTORIES

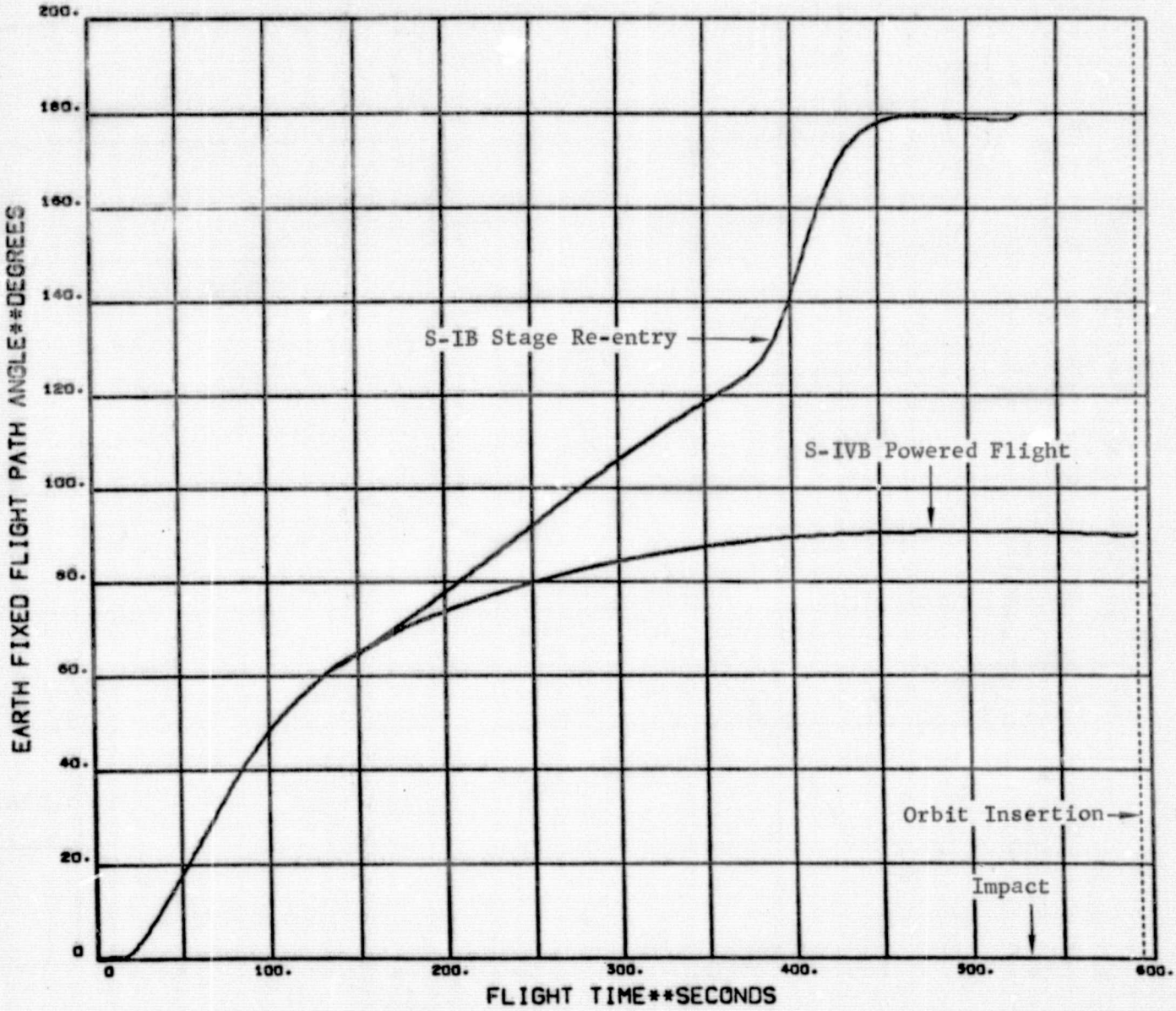


FIGURE 7
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
PITCH ANGLE OF ATTACK HISTORY

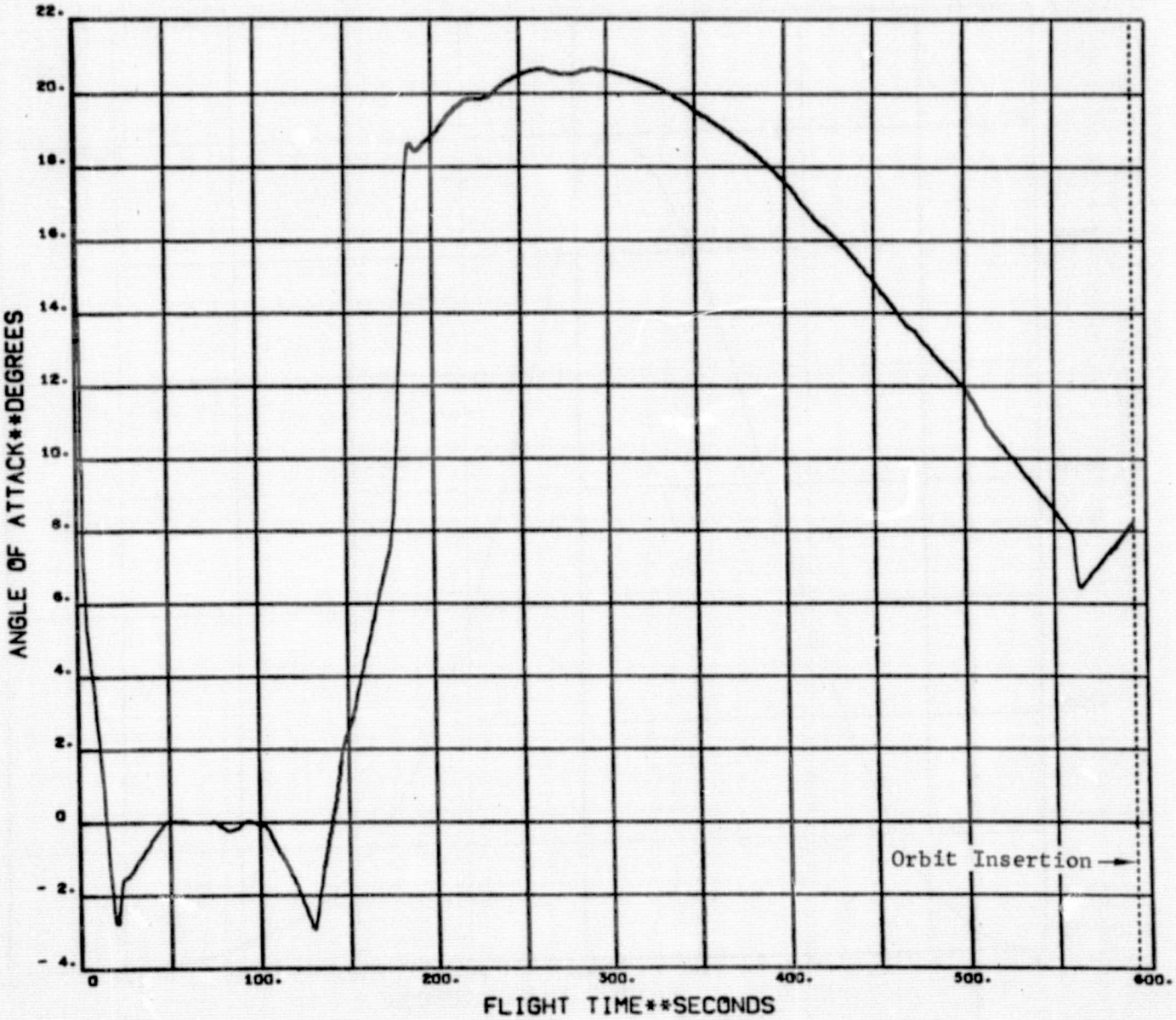


FIGURE 8
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
DYNAMIC PRESSURE HISTORY

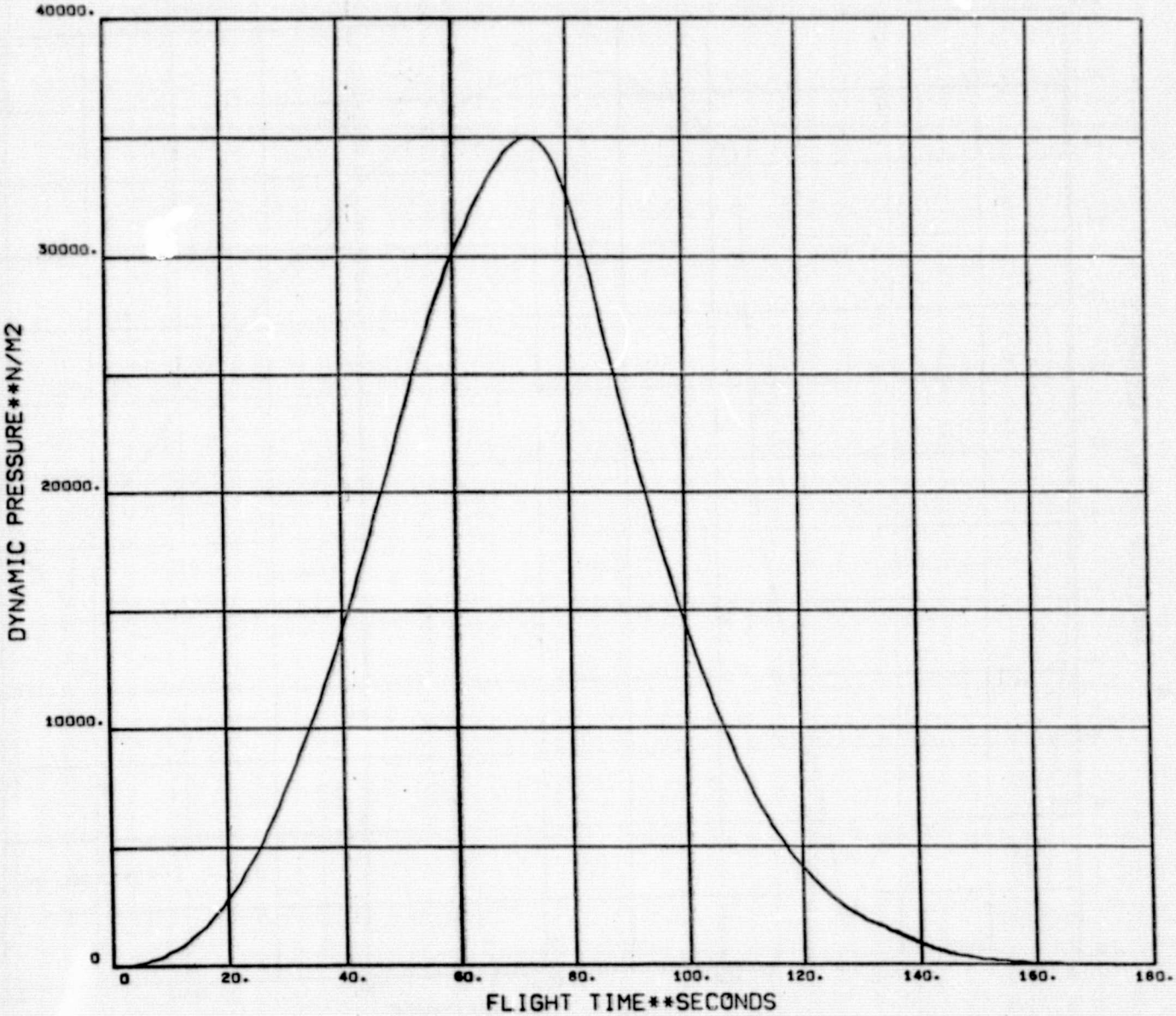


FIGURE 9
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
AERODYNAMIC LOAD INDICATOR HISTORY

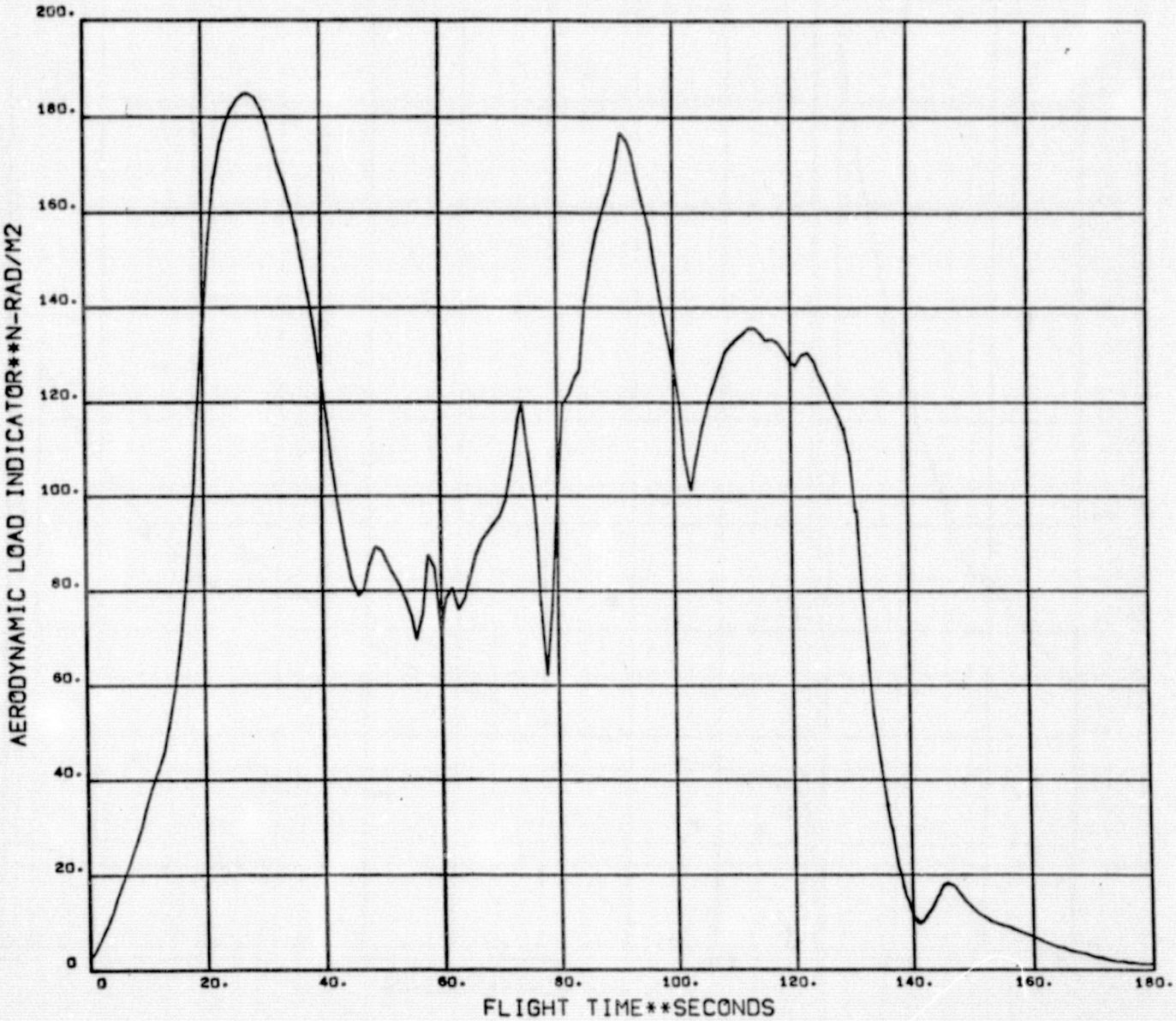


FIGURE 10
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
LONGITUDINAL ACCELERATION HISTORY

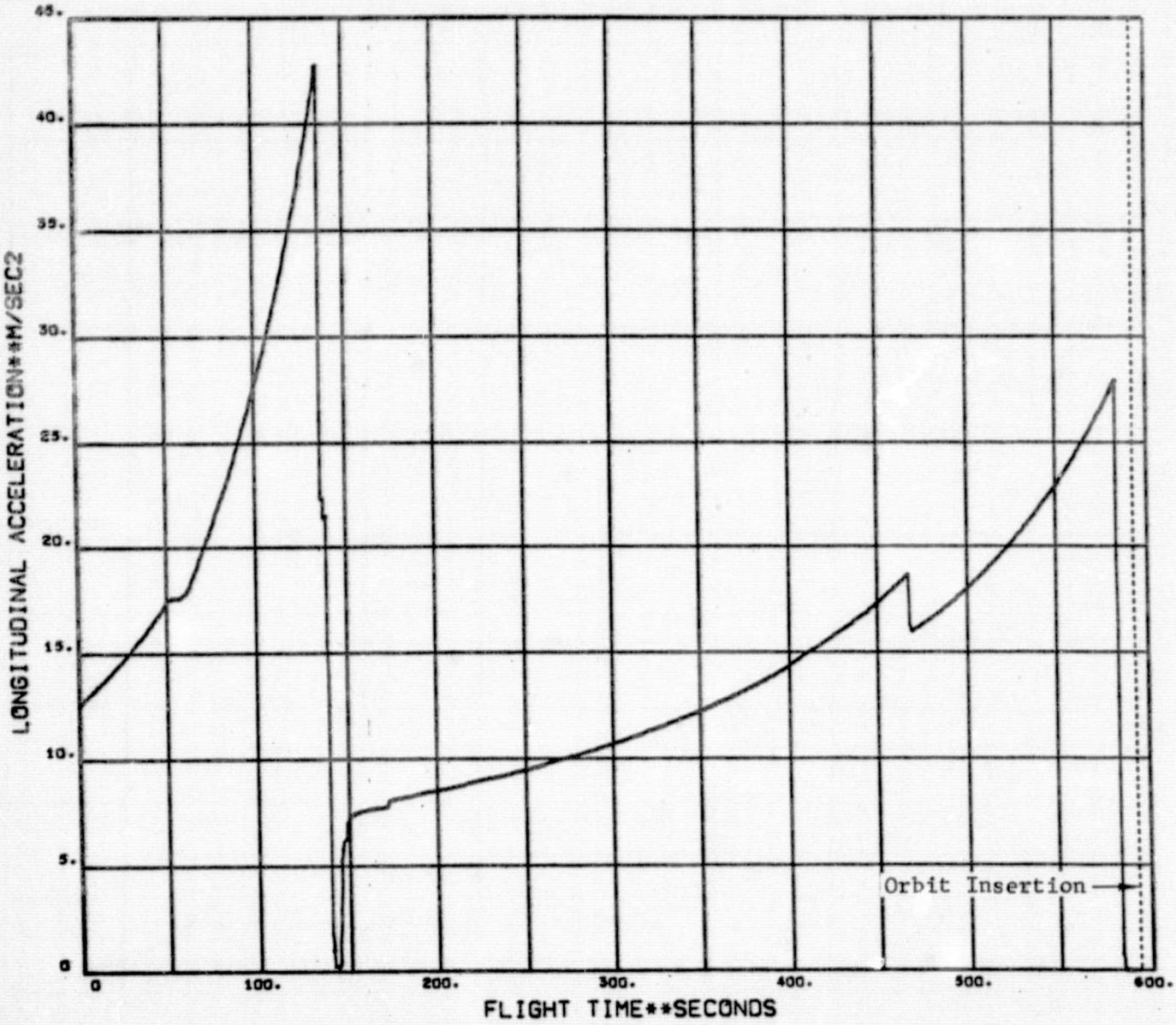


FIGURE 11
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
INERTIAL PITCH ATTITUDE AND PITCH ATTITUDE COMMAND HISTORIES

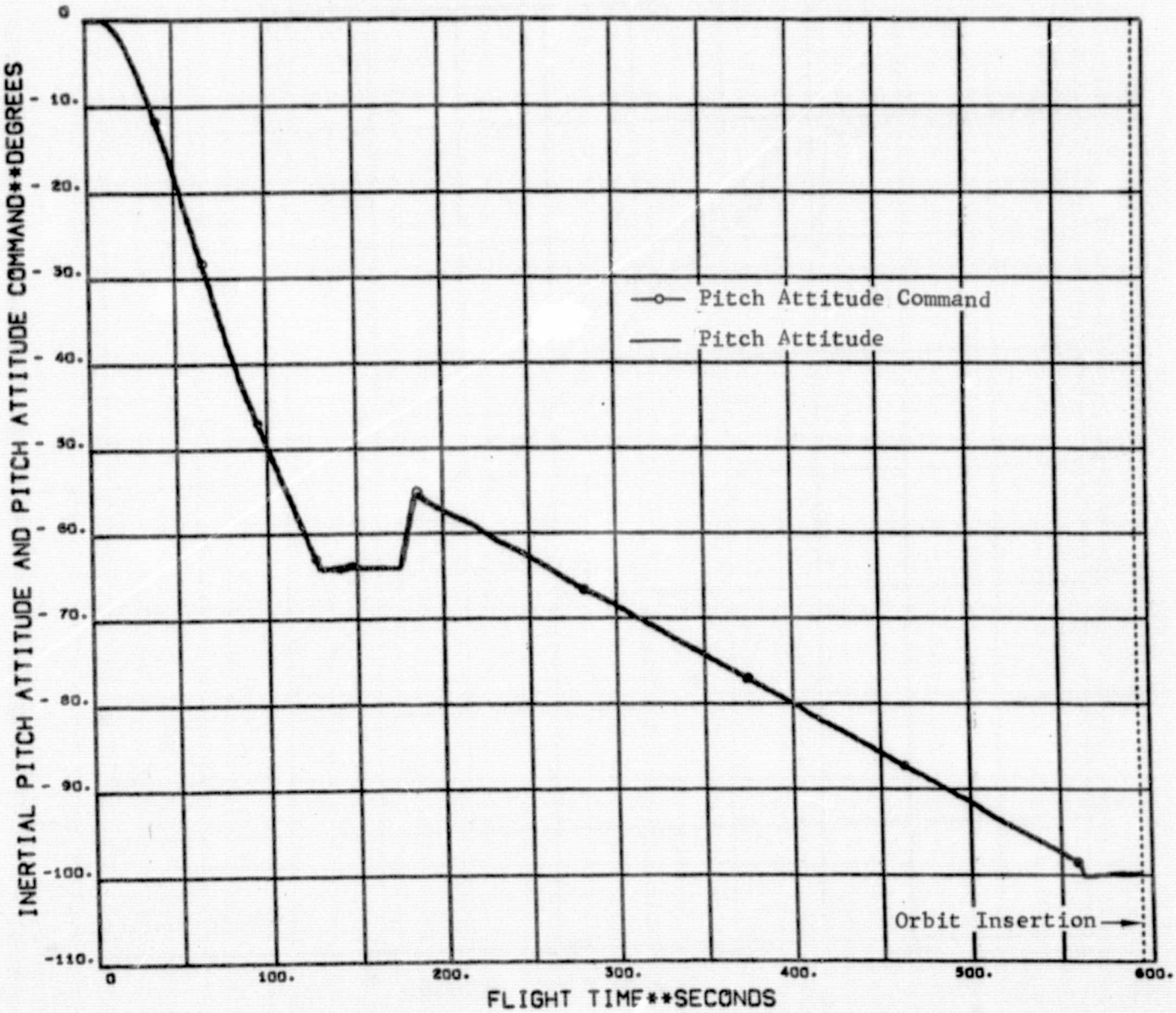


FIGURE 12
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
INERTIAL YAW ATTITUDE AND YAW ATTITUDE COMMAND HISTORIES

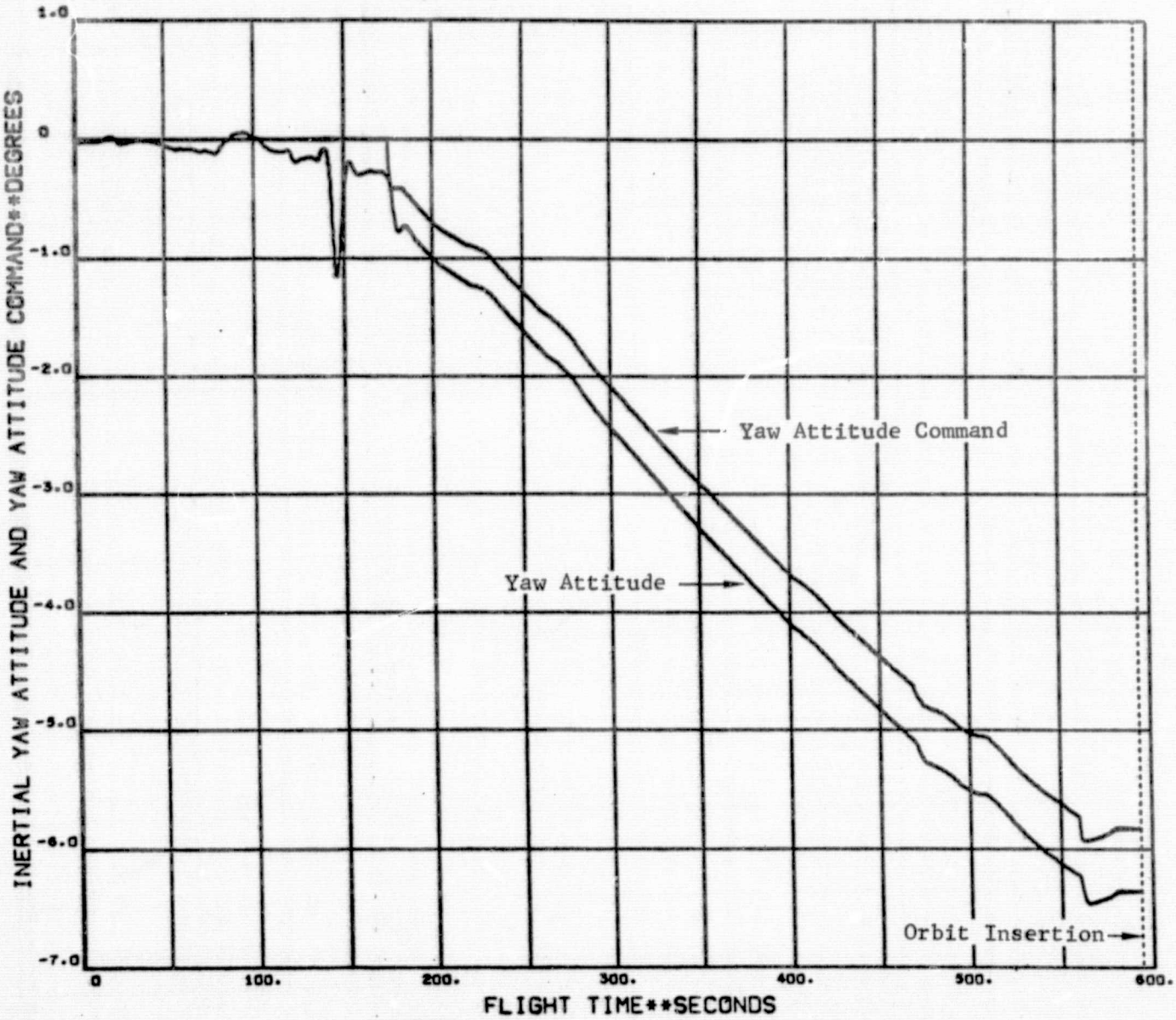


FIGURE 13
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
PITCH, YAW, AND ROLL BODY RATE HISTORIES

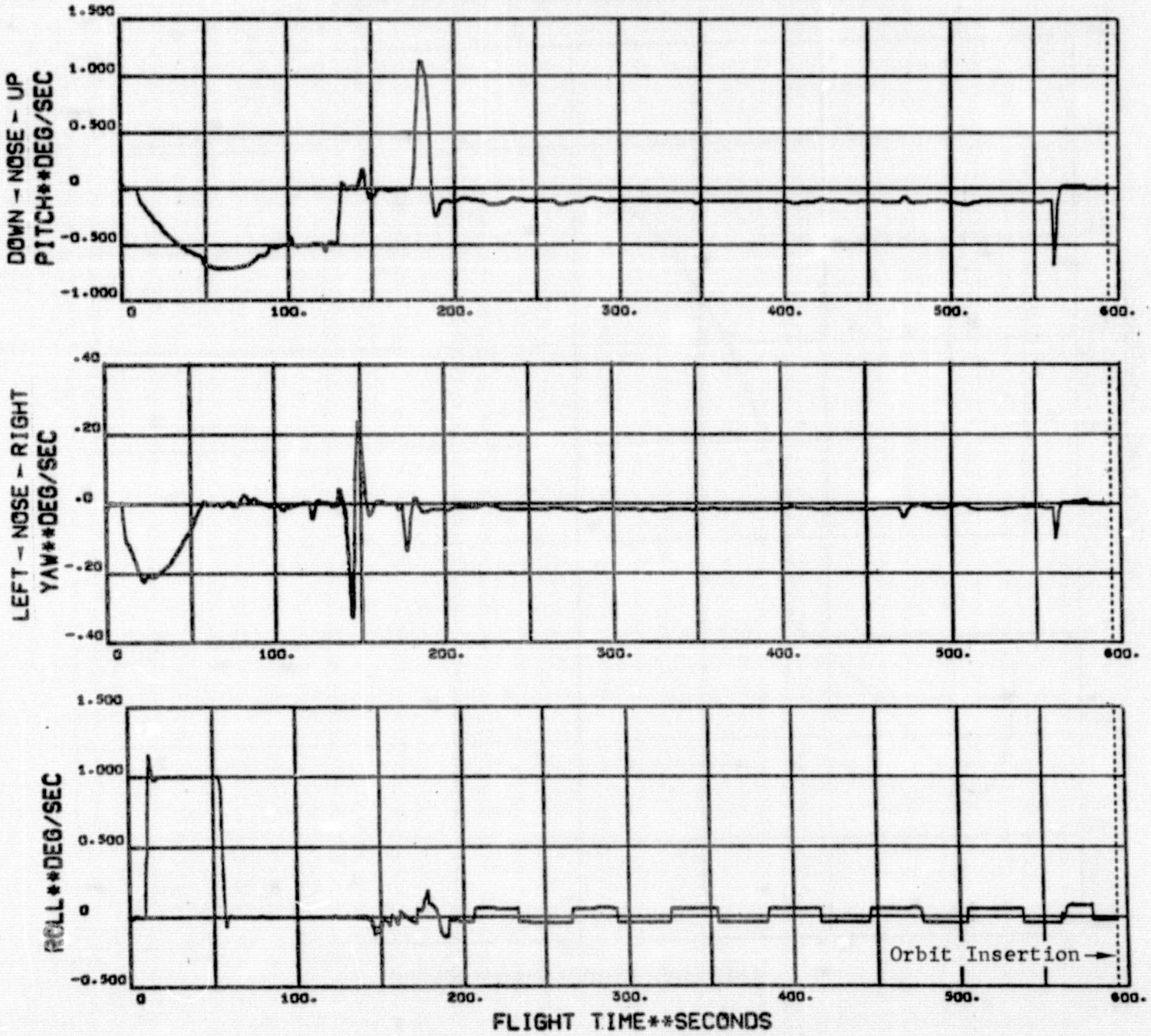


FIGURE 14
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
INERTIAL PATH ANGLE VS. INERTIAL VELOCITY

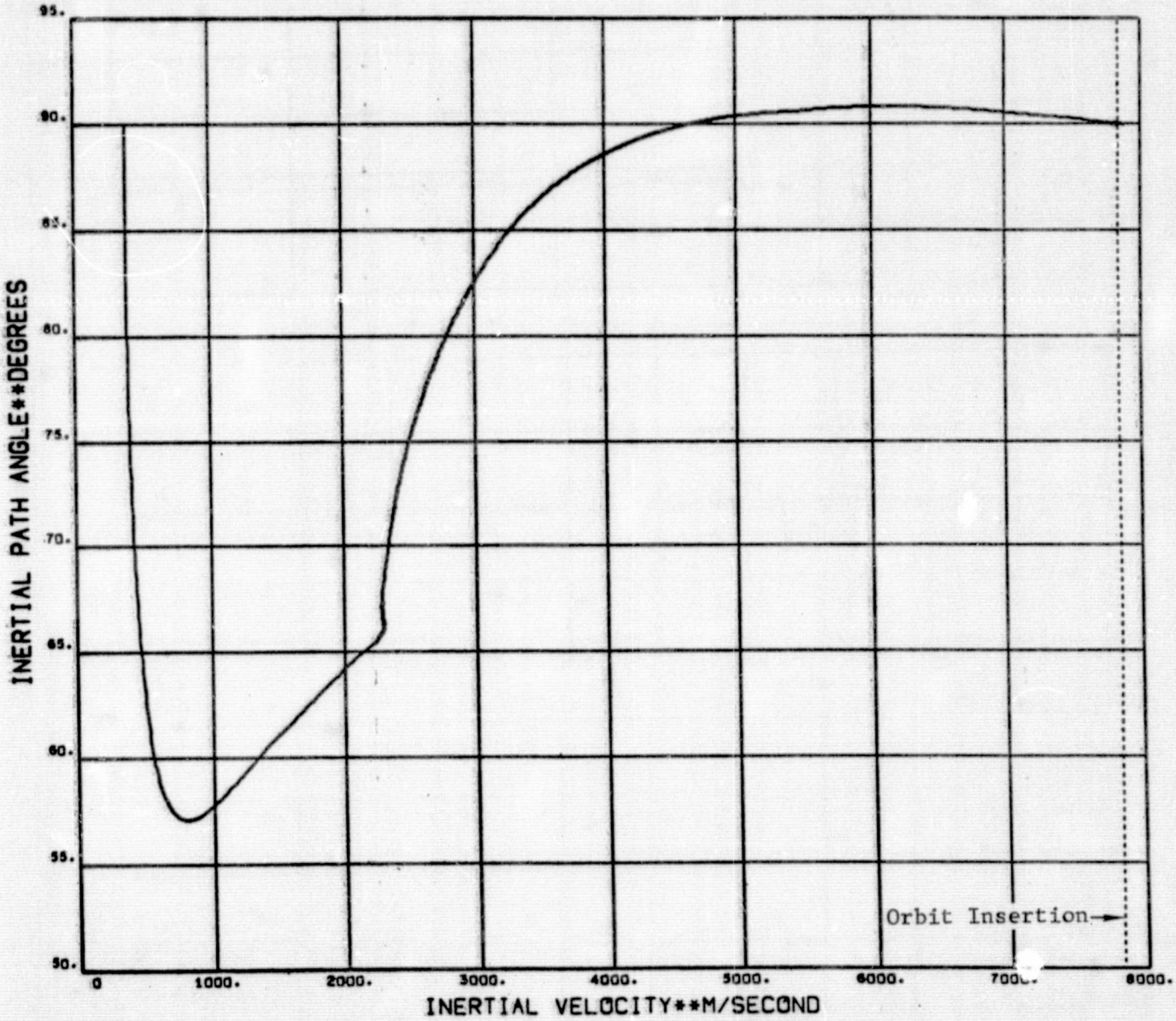


FIGURE 15
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ALTITUDE VS. INERTIAL VELOCITY

FIGURE 16

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
GROUND PROJECTION WITH TRACKING COVERAGE
ELEVATION ANGLES ABOVE 2 DEGREES
(WITHOUT TERRAIN LIMITATIONS)

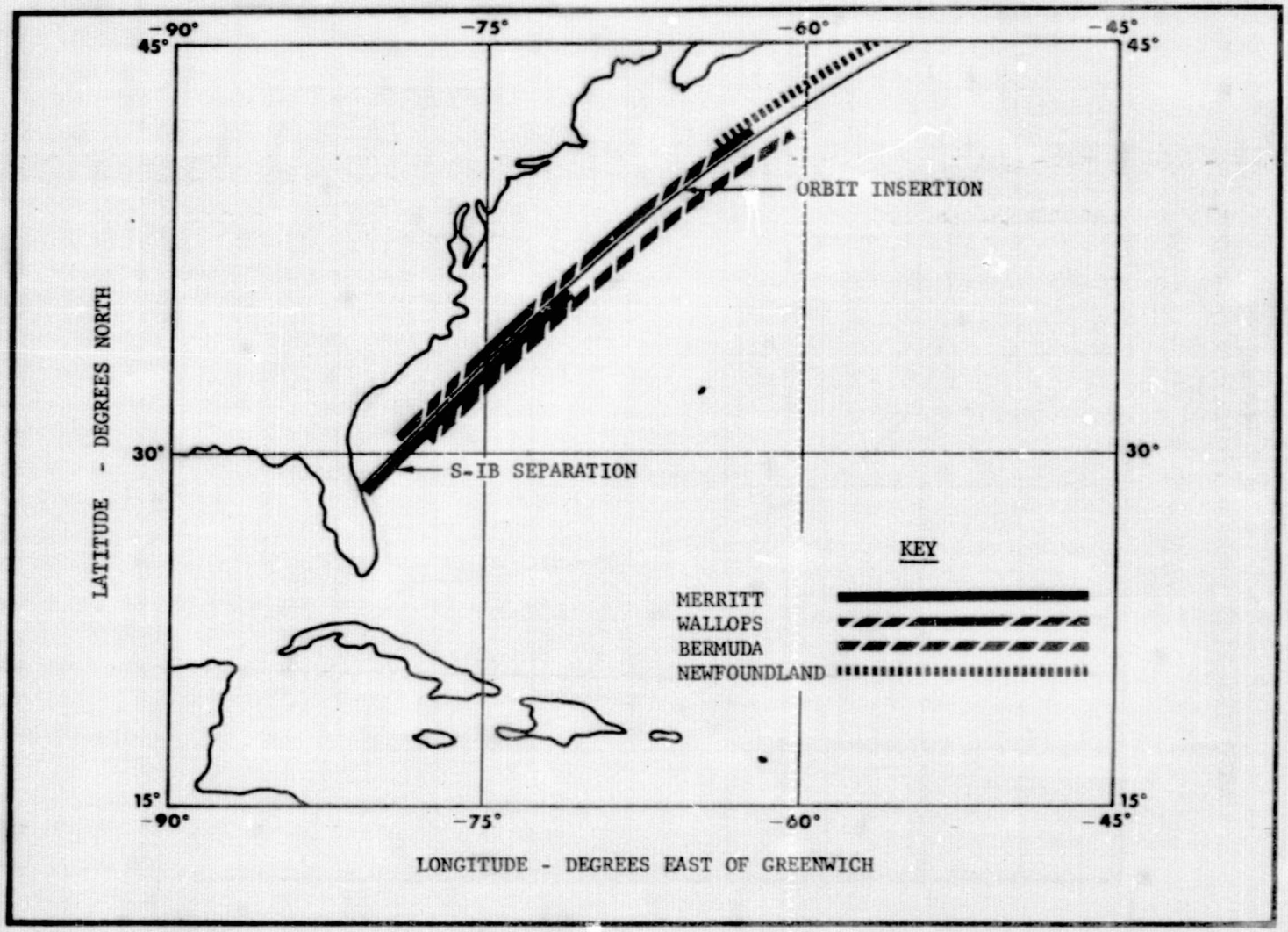


FIGURE 17
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL. ORBITAL PHASE
ALTITUDE HISTORY

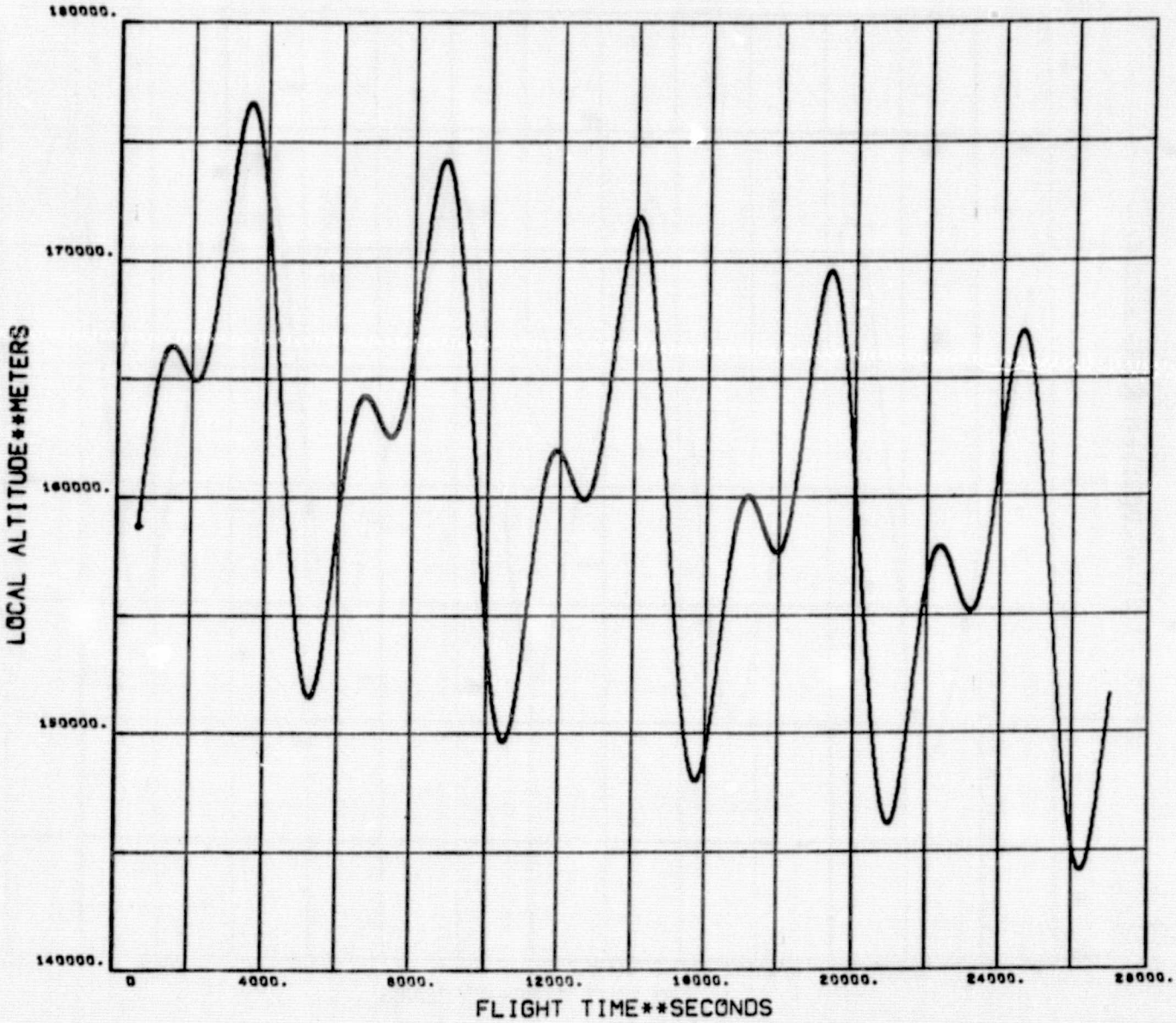


FIGURE 18
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL, ORBITAL PHASE
SPACE FIXED VELOCITY HISTORY

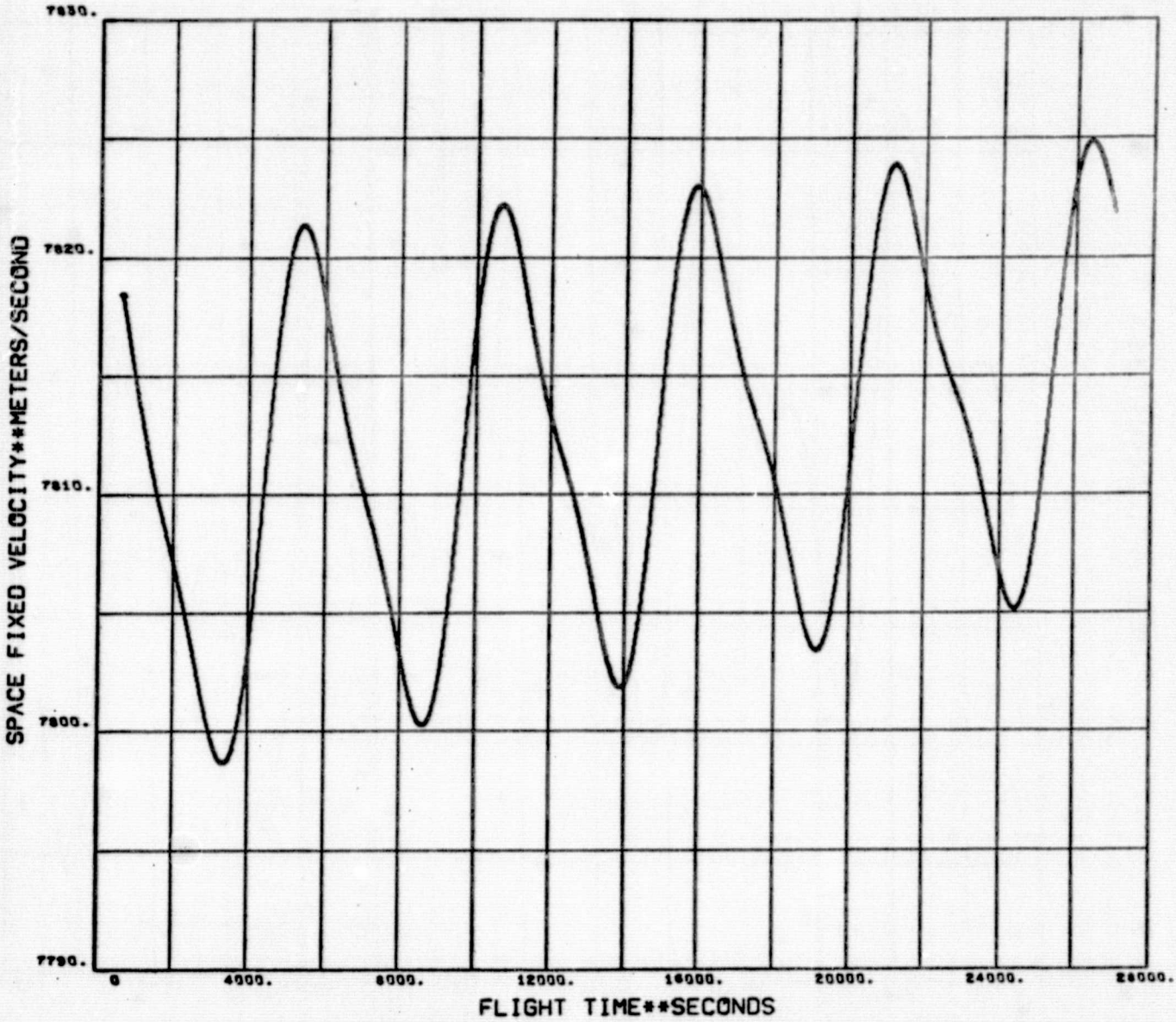


FIGURE 19
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL, ORBITAL PHASE
INERTIAL PITCH ATTITUDE HISTORY

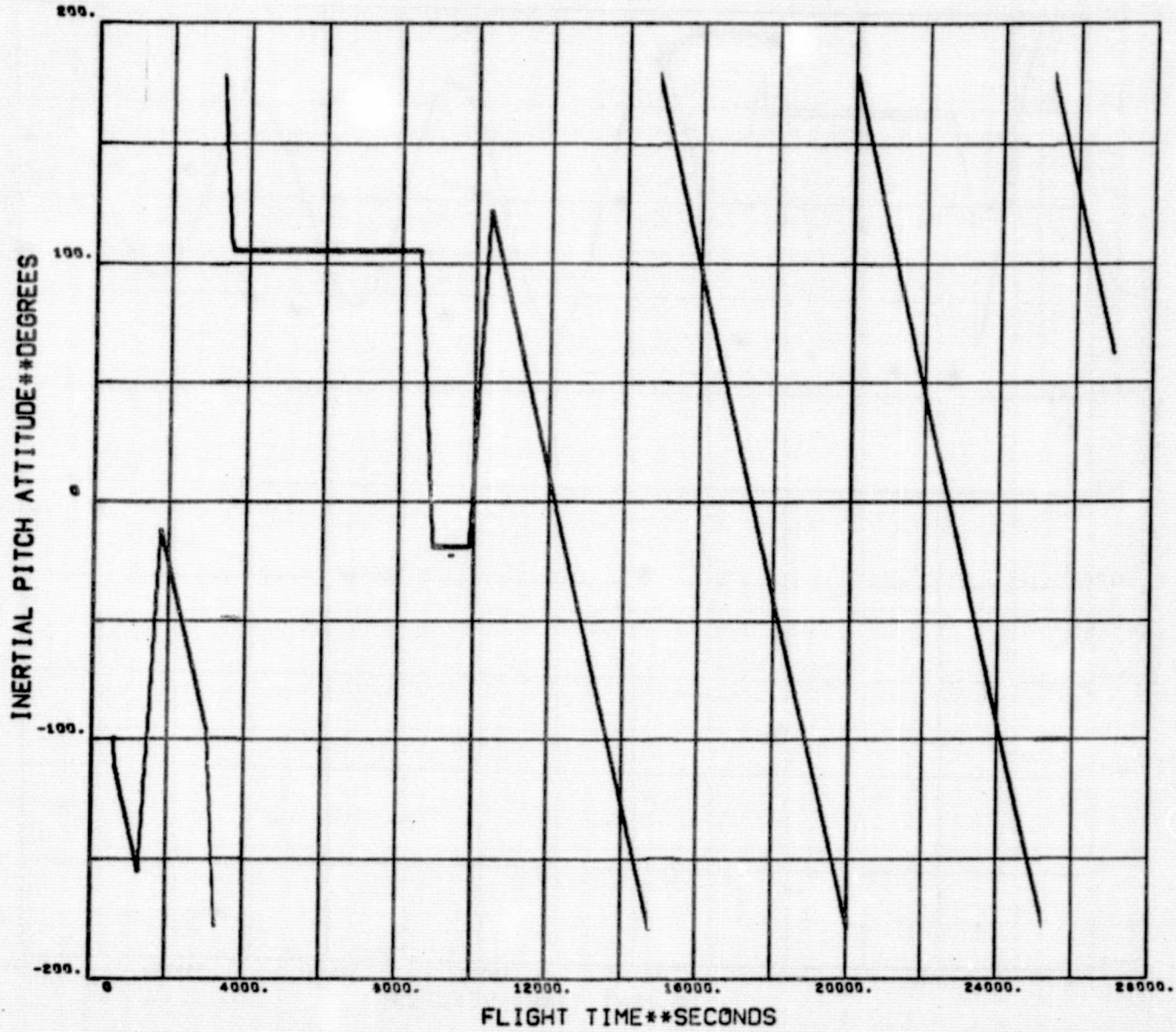


FIGURE 20
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL, ORBITAL PHASE
INERTIAL YAW ATTITUDE HISTORY

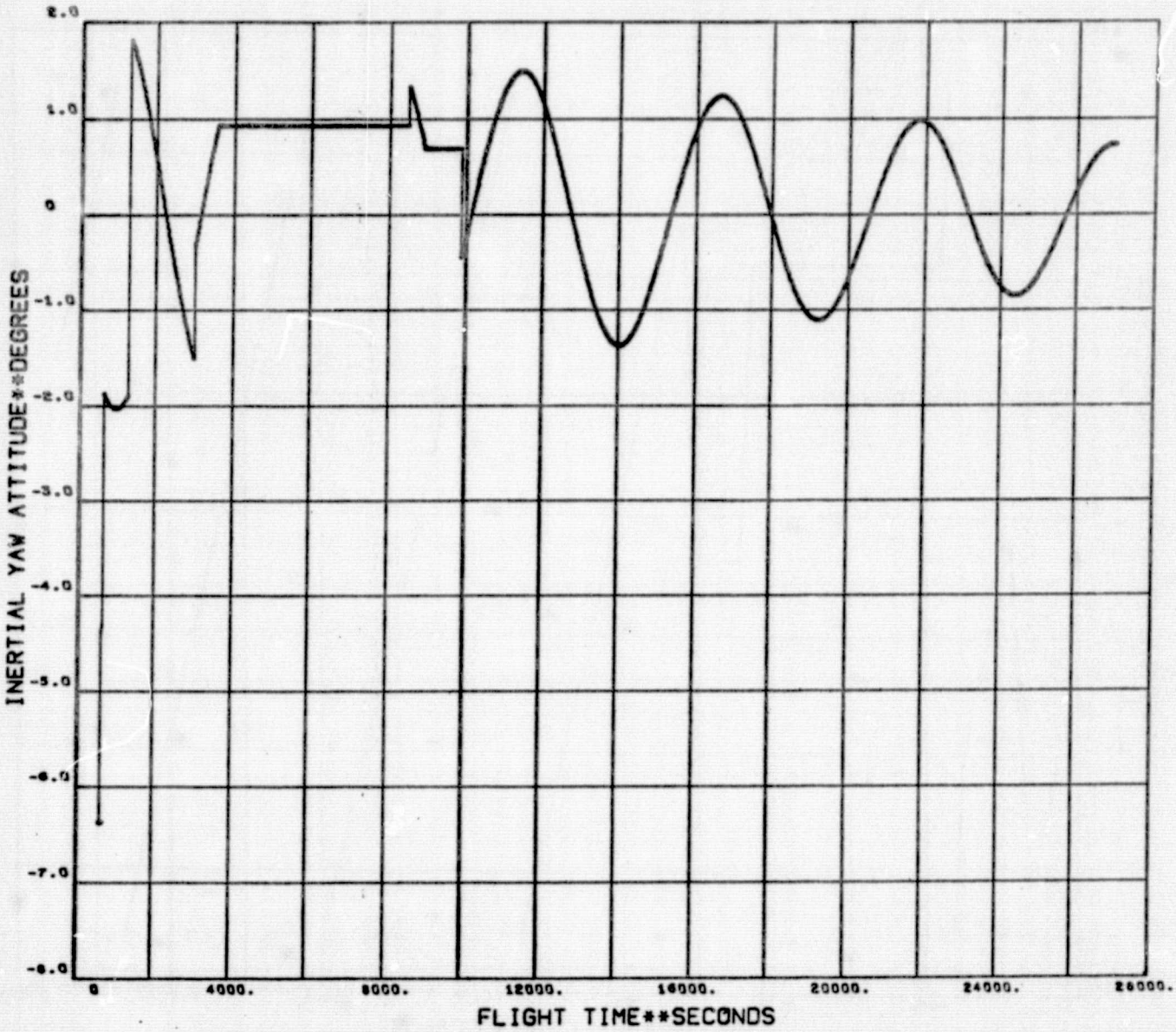


FIGURE 21
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL, ORBITAL PHASE
INERTIAL ROLL ATTITUDE HISTORY

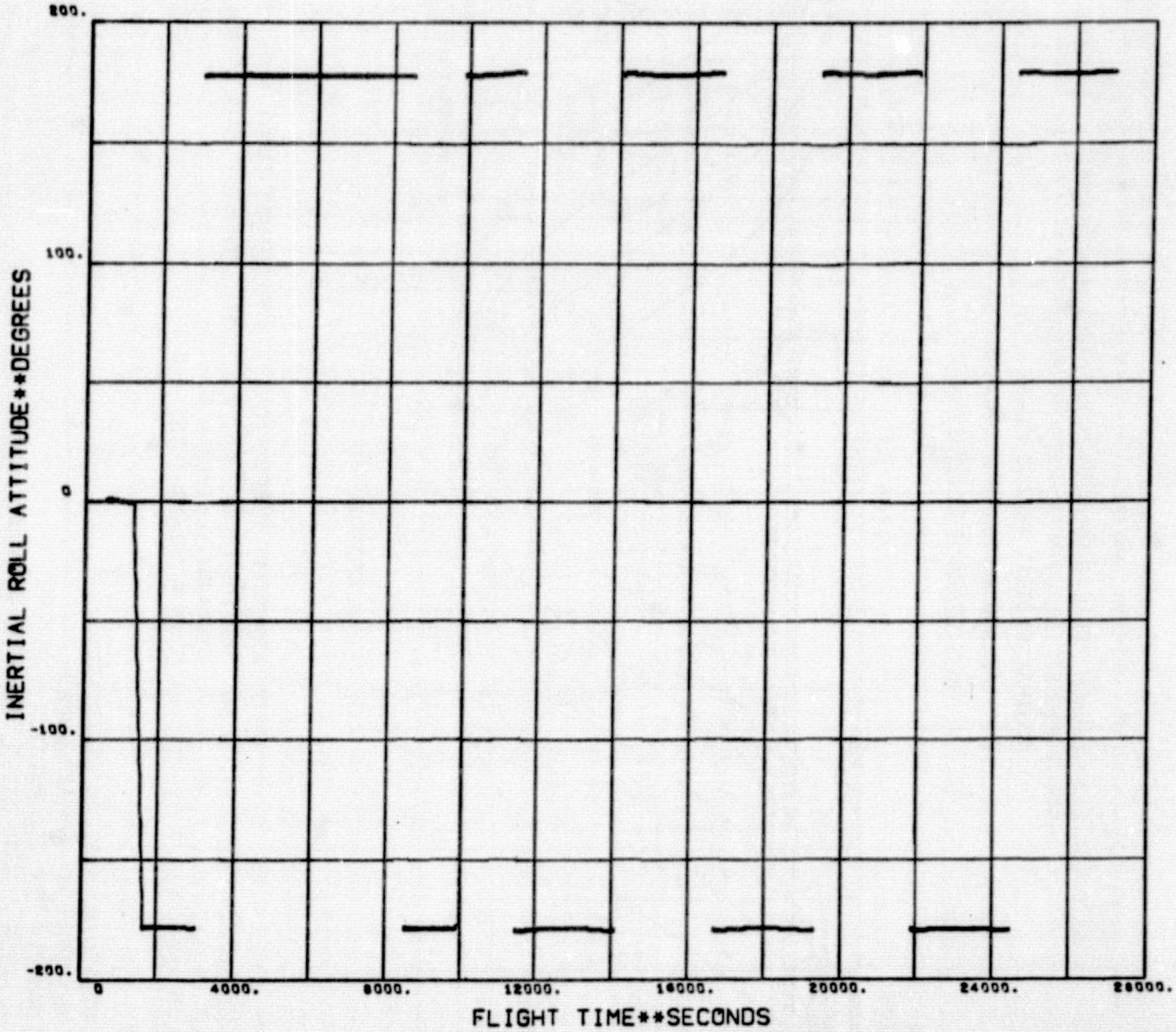
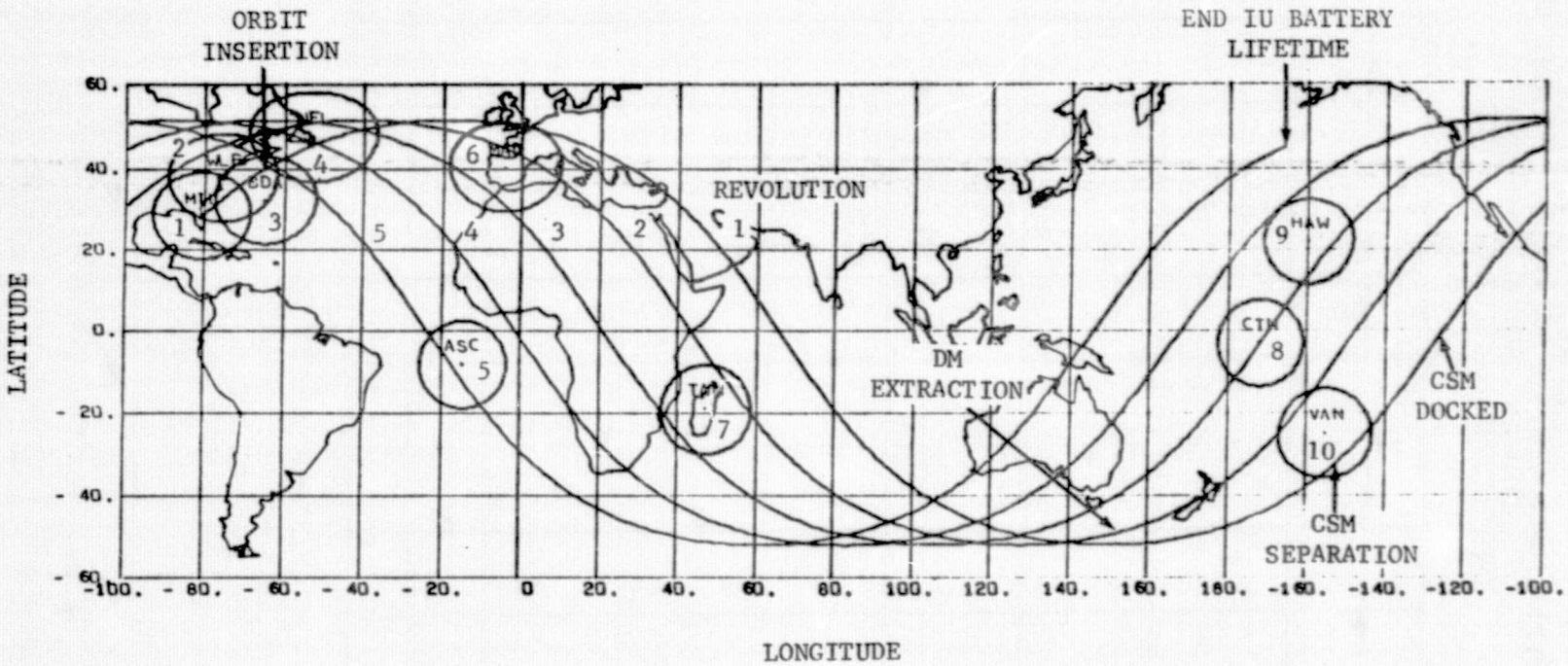


FIGURE 22

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
GROUND PROJECTION WITH TRACKING COVERAGE
NOMINAL ORBITAL FLIGHT PHASE
ELEVATION ANGLES ABOVE 2 DEGREES
(WITHOUT TERRAIN LIMITATIONS)



STATIONS

1. MERRITT (MIL) - CS, T, C
2. WALLOPS (WLP) - CS, C
3. BERMUDA (BDA) - CS, T, C
4. NEWFOUNDLAND (NFL) - CS, T
5. ASCENSION (ASC) - C
6. MADRID (MAD) - CS, T
7. TANANARIVE (TAN) - C
8. CANTON ISLAND (CTN) - C
9. HAWAII (HAW) - CS, T
10. VANGUARD SHIP (VAN) - CS, T

NOTES: REFLECTS TOTAL STATION CAPABILITY.
CS - DENOTES UHF COMMAND SYSTEM.
T - DENOTES VHF TELEMETRY.
C - DENOTES C-BAND RADAR.

APPENDIX A: "LAUNCH VEHICLE CHARACTERISTICS AND FLIGHT ENVIRONMENT"

TABLE 1A

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL VEHICLE WEIGHT BREAKDOWN
(POUNDS)

SLA, (Fixed Portion)	2,164	
Instrument Unit	4,099	
S-IVB Stage	26,134	
Weight at First Motion + 7.5 Hours		32,397
DM Extracted	4,492	
SLA Panels Jettisoned	2,343	
CSM Separated	28,401	
S-IVB Residuals Vented	1,111	
*Orbital Insertion Weight		68,744
LOX Vented	11	
J-2 Thrust Decay and Drain Propellant	121	
S-IVB Guidance Cutoff Weight		68,876
S-IVB Propellant Consumed	229,072	
S-IVB APS Propellant Consumed	6	
LES	9,151	
Ullage Cases	214	
S-IVB "90% Thrust" Weight		307,319
S-IVB GH2 Start Tank	4	
S-IVB Buildup Propellant Consumed	383	
Ullage Propellant Consumed	176	
S-IVB Weight at Separation		307,882
S-IVB Aft Frame Hardware	31	
S-IB/S-IVB Interstage	6,718	
S-IB Dry Weight	84,410	
S-IB Residuals and Reserves	10,200	
S-IVB Detonation Package	5	
S-IVB Frost Consumed	200	
S-IB Frost Consumed	1,000	
S-IB Seal Purge Consumed (N2)	6	
S-IB Fuel Additive Consumed (Oronite)	27	
S-IB Gearbox Consumption (RP-1)	699	
Inboard Engine Thrust Decay Prpt. Consumed	2,181	
Outboard Engine Thrust Decay Prpt. Consumed to Separation	1,529	
S-IB Mainstage Propellant Consumed	881,519	
Vehicle Weight at First Motion		1,296,407

* Contains 2612 pounds of excess available S-IVB stage propellant, which is composed of 1768 pounds of LOX and 844 pounds of LH_2. 3σ FPR estimate is 1173 pounds of LOX and 688 pounds of LH_2.

TABLE 2A

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
LAUNCH VEHICLE PERFORMANCE CHARACTERISTICS

S-IB STAGE

Average Longitudinal Sea Level Thrust (lbs):

	H-1 Engine	Turbine	Total
Engine #1	208083.	706.	208789.
Engine #2	209511.	741.	210252.
Engine #3	210038.	730.	210768.
Engine #4	208622.	738.	209360.
Engine #5	209517.	715.	210232.
Engine #6	211256.	711.	211967.
Engine #7	210143.	720.	210863.
Engine #8	209988.	705.	210693.

Total Average Longitudinal Sea Level Thrust (F): 1682924.

Flight Time Interval: 0.0 - 136.068 seconds (IECO)

$$\dot{W} = \left[Wt \ @ \ (t=0) - WT \ @ \ (t=136.068) - * \ Waux \right] / \ 136.068$$

$$= 6406.53 \ (lb/sec)$$

$$Isp = F/\dot{W}$$

$$= 262.69 \ (sec).$$

*Waux:

Frost	1200.	lbs
Seal Purge	6.	lbs
Fuel Additive	27.	lbs
TOTAL	1233.	lbs

S-IVB STAGE

High Thrust Level Flight Time Interval: 148.17 - 469.00 seconds.
Low Thrust Level Flight Time Interval: 469.00 - 583.18 seconds.

AVERAGE VALUES

	High Thrust Level	Low Thrust Level
Vacuum Thrust (lbs)	232,594.	196,536.
Flowrate (lb/sec)	546.85	458.81
Specific Impulse (sec)	425.33	428.36

TABLE 3A
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE MASS CHARACTERISTICS

	FLIGHT TIME (SEC)	MASS (KG)	CENTER OF GRAVITY X-AXIS (M)	CENTER OF GRAVITY Y-AXIS (M)	CENTER OF GRAVITY Z-AXIS (M)	MOMENT OF INERTIA X-AXIS (KG-M-S2)	MOMENT OF INERTIA Y-AXIS (KG-M-S2)	MOMENT OF INERTIA Z-AXIS (KG-M-S2)
1)	-17.20	594950.	---	---	---	---	---	---
2)	.00	588040.	16.3998	-.0053	.0000	216090.	7583675.	7583539.
	5.00	573697.	16.3280	-.0053	.0000	209630.	7564557.	7564415.
	10.00	559243.	16.2666	-.0056	.0000	203270.	7549829.	7549679.
	15.00	544737.	16.2164	-.0058	.0003	196991.	7538439.	7538285.
	20.00	530193.	16.1785	-.0058	.0003	190730.	7529633.	7529475.
	25.00	515622.	16.1557	-.0061	.0003	184465.	7522673.	7522515.
	30.00	501035.	16.1472	-.0063	.0003	178192.	7516720.	7516553.
	35.00	486433.	16.1557	-.0066	.0003	171922.	7510918.	7510756.
	40.00	471823.	16.1824	-.0069	.0003	165659.	7504382.	7504214.
	45.00	457190.	16.2288	-.0069	.0003	159374.	7495244.	7495082.
	50.00	442548.	16.2967	-.0071	.0003	153081.	7482919.	7482748.
	55.00	427908.	16.3893	-.0074	.0003	146782.	7465961.	7465799.
3)	57.74	419900.	16.4548	-.0075	.0003	143332.	7453185.	7453023.
	65.00	398598.	16.6609	-.0081	.0003	134179.	7410271.	7410095.
	70.00	383903.	16.8456	-.0084	.0003	127897.	7368138.	7367967.
4)	73.25	374354.	16.9865	-.0086	.0003	123825.	7334345.	7334184.
	80.00	354529.	17.3333	-.0091	.0005	115378.	7245061.	7244886.
	85.00	339855.	17.6453	-.0094	.0005	109135.	7158706.	7158540.
	90.00	325275.	18.0082	-.0099	.0005	102906.	7052881.	7052718.
	95.00	310703.	18.4312	-.0104	.0005	96670.	6922020.	6921853.
	100.00	296146.	18.9241	-.0109	.0005	90435.	6761449.	6761281.
	105.00	281610.	19.4972	-.0114	.0005	84207.	6565787.	6565619.
	110.00	267102.	20.1624	-.0119	.0005	77989.	6328263.	6328098.
	115.00	252621.	20.9353	-.0127	.0005	71782.	6040926.	6040754.
	120.00	238174.	21.8348	-.0135	.0005	65590.	5693875.	5693714.
	125.00	223765.	22.8852	-.0142	.0005	59415.	5274998.	5274832.
5)	129.00	212276.	23.8685	-.0150	.0005	54489.	4870363.	4870188.
6)	133.07	200631.	25.0024	-.0160	.0007	49494.	4393418.	4393248.
7)	136.07	192074.	25.9023	-.0165	.0008	45822.	4010021.	4009855.
8)	139.47	186324.	26.6008	-.0170	.0005	43398.	3698520.	3698350.
9)	140.57	185750.	26.6754	-.0172	.0005	43094.	3664368.	3664195.
10)	140.77	185646.	26.6889	-.0173	.0005	43039.	3658158.	3657985.
11)	140.85	185631.	26.6909	-.0173	.0005	43033.	3657078.	3656905.

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 4A
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE MASS CHARACTERISTICS

	FLIGHT TIME (SEC)	MASS (KG)	--- CENTER OF GRAVITY --- X-AXIS (M)	Y-AXIS (M)	Z-AXIS (M)	---- MOMENT OF INERTIA ---- X-AXIS (KG-M-S2)	Y-AXIS (KG-M-S2)	Z-AXIS (KG-M-S2)
1)	140.85	139653.	8.1209	-.0180	.0015	13982.	1108546.	1108334.
2)	142.17	139621.	8.1209	-.0180	.0015	13982.	1108546.	1108334.
3)	145.57	139397.	8.1236	-.0183	.0015	13918.	1108280.	1108068.
4)	148.57	138753.	8.1303	-.0183	.0015	13916.	1107877.	1107665.
5)	152.77	137783.	8.1414	-.0183	.0015	13914.	1107225.	1107013.
	160.00	135898.	8.1693	-.0185	.0015	13796.	1105570.	1105358.
6)	165.17	134613.	8.1875	-.0188	.0015	13796.	1104531.	1104319.
	170.00	133415.	8.2065	-.0190	.0015	13795.	1103429.	1103217.
7)	171.47	133049.	8.2119	-.0191	.0015	13795.	1103010.	1102802.
8)	175.00	128020.	7.3298	-.0198	.0010	13681.	765285.	765080.
	180.00	126774.	7.3422	-.0198	.0010	13680.	764543.	764335.
	190.00	124288.	7.3692	-.0203	.0010	13679.	762968.	762762.
	200.00	121796.	7.4013	-.0206	.0010	13678.	761292.	761083.
	210.00	119311.	7.4361	-.0211	.0010	13677.	759645.	759436.
	220.00	116825.	7.4741	-.0216	.0010	13675.	757954.	757745.
	230.00	114333.	7.5163	-.0218	.0010	13674.	756067.	755856.
	240.00	111847.	7.5622	-.0223	.0010	13673.	754032.	754631.
	250.00	109363.	7.6134	-.0228	.0010	13672.	751902.	751689.
	260.00	106879.	7.6667	-.0233	.0010	13671.	749695.	749481.
	270.00	104388.	7.7270	-.0238	.0010	13669.	747172.	746956.
	280.00	101897.	7.7904	-.0244	.0010	13668.	744628.	744413.
	290.00	99411.	7.8606	-.0249	.0010	13667.	741758.	741541.
	300.00	96925.	7.9356	-.0256	.0013	13665.	738730.	738512.
	310.00	94440.	8.0165	-.0261	.0013	13664.	735492.	735272.
	320.00	91955.	8.1046	-.0269	.0013	13663.	731957.	731737.
	330.00	89471.	8.1993	-.0276	.0013	13662.	728178.	727957.
	340.00	86987.	8.3024	-.0284	.0013	13660.	724019.	723797.
	350.00	84503.	8.4136	-.0292	.0013	13659.	719565.	719343.
	360.00	82019.	8.5327	-.0299	.0013	13658.	714859.	714634.
	370.00	79536.	8.6628	-.0309	.0013	13656.	709618.	709392.
	380.00	77053.	8.8035	-.0317	.0013	13655.	703988.	703761.
	390.00	74570.	8.9560	-.0327	.0015	13654.	697815.	697586.
	400.00	72088.	9.1230	-.0340	.0015	13652.	691048.	690817.
	410.00	69597.	9.3043	-.0350	.0015	13650.	683677.	683446.
	420.00	67107.	9.5016	-.0363	.0015	13649.	675589.	675355.
	430.00	64621.	9.7184	-.0375	.0015	13647.	666645.	666411.

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 4A (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE MASS CHARACTERISTICS

FLIGHT TIME (SEC)	MASS (KG)	--- CENTER OF GRAVITY --- X-AXIS (M)	Y-AXIS (M)	Z-AXIS (M)	--- MOMENT OF INERTIA --- X-AXIS (KG-M-S2)	Y-AXIS (KG-M-S2)	Z-AXIS (KG-M-S2)
440.00	62135.	9.9555	-.0390	.0015	13646.	656813.	656578.
450.00	59650.	10.2157	-.0406	.0017	13644.	645955.	645718.
460.00	57166.	10.5020	-.0423	.0018	13642.	633892.	633655.
9) 469.00	55004.	10.7762	-.0440	.0018	13641.	622296.	622055.
470.00	54777.	10.8058	-.0441	.0018	13641.	621045.	620804.
480.00	52682.	11.0957	-.0459	.0018	13639.	608781.	608541.
490.00	50604.	11.4111	-.0476	.0018	13638.	595324.	595082.
500.00	48525.	11.7561	-.0497	.0020	13636.	580504.	580259.
510.00	46447.	12.1364	-.0517	.0020	13635.	564094.	563848.
520.00	44369.	12.5573	-.0540	.0020	13633.	545832.	545584.
530.00	42291.	13.0241	-.0567	.0023	13631.	525403.	525155.
540.00	40213.	13.5446	-.0595	.0023	13629.	502523.	502273.
550.00	38135.	14.1286	-.0626	.0023	13627.	476737.	476485.
560.00	36057.	14.7865	-.0661	.0025	13626.	447297.	447044.
570.00	33979.	15.5340	-.0701	.0025	13624.	413512.	413257.
580.00	31902.	16.3899	-.0747	.0028	13621.	374419.	374162.
10) 583.18	31242.	16.6917	-.0763	.0028	13621.	360492.	360234.
11) 583.38	31225.	16.6917	-.0763	.0028	13621.	360492.	360234.
12) 583.98	31188.	16.6917	-.0763	.0028	13621.	360492.	360234.
13) 593.18	31182.	16.6917	-.0763	.0028	13621.	360492.	360234.

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 5A

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

S-IB STAGE AERODYNAMIC CHARACTERISTICS

	FLIGHT TIME (SEC)	MACH NO.	CENTER OF PRESSURE (M)	AXIAL FORCE COEFFICIENT	NORMAL FORCE COEFFICIENT
1)	-17.20	.00	20.8240	.0000	.0000
2)	.00	.01	20.8240	.7445	.0000
	5.00	.04	19.0613	.7055	.7756
	10.00	.09	19.5750	.6544	.3549
	15.00	.15	19.7823	.5966	.2437
	20.00	.21	19.6964	.5320	.2899
	25.00	.28	19.8080	.4601	.2299
	30.00	.35	19.9568	.4138	.1500
	35.00	.44	20.0623	.3790	.0933
	40.00	.54	20.0209	.3545	.0536
	45.00	.65	19.7249	.3547	.0274
	50.00	.77	19.1470	.3549	.0246
	55.00	.92	17.5310	.5514	.0192
3)	57.74	1.00	18.5707	.6941	.0204
	65.00	1.25	22.0070	.6721	.0155
	70.00	1.47	21.5086	.5558	.0167
4)	73.25	1.63	23.8408	.4995	.0193
	80.00	2.00	28.3244	.4246	.0164
	85.00	2.25	28.6943	.4011	.0264
	90.00	2.52	28.3701	.3775	.0373
	95.00	2.80	28.2659	.3523	.0432
	100.00	3.11	28.1871	.3282	.0436
	105.00	3.44	28.0800	.3095	.0513
	110.00	3.77	27.9250	.2784	.0793
	115.00	4.13	27.7936	.1992	.1102
	120.00	4.50	27.6840	.0860	.1482
	125.00	4.91	27.2764	-.0433	.2144
5)	129.00	5.26	26.8647	-.1567	.2696
6)	133.07	5.72	29.9026	-.3462	.2035
7)	136.07	6.13	34.7752	-.6104	.1350
8)	139.47	6.42	35.0721	-.8022	.0749
9)	140.57	6.46	35.1091	-.8248	.0661
10)	140.77	6.46	35.1109	-.8276	.0658
11)	140.85	6.46	35.1113	-.8287	.0658

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 6A
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE PROPULSION CHARACTERISTICS

	FLIGHT TIME (SEC)	ALTITUDE (KM)	LONG. ACCEL (M/S2)	H-1 ENGINE THRUST MAGNITUDES ENGINE 1 (N)	ENGINE 2 (N)	ENGINE 3 (N)	ENGINE 4 (N)	ENGINE 5 (N)	ENGINE 6 (N)	ENGINE 7 (N)	ENGINE 8 (N)
1)	-17.20	.09	.000	0.	0.	0.	0.	0.	0.	0.	0.
2)	.00	.09	12.354	901265.	907841.	910545.	903936.	903932.	911573.	906776.	906008.
	5.00	.13	12.963	923144.	929661.	932287.	925728.	925809.	933541.	928625.	927938.
	10.00	.24	13.370	929408.	935905.	938510.	931975.	932076.	939822.	934881.	934205.
	15.00	.44	13.783	935282.	941781.	944352.	937863.	937961.	945717.	940758.	940086.
	20.00	.75	14.213	941364.	947855.	950411.	943944.	944037.	951799.	946829.	946159.
	25.00	1.16	14.669	947635.	954120.	956664.	950216.	950315.	958110.	953101.	952462.
	30.00	1.70	15.153	954582.	961062.	963598.	957163.	957268.	965035.	960049.	959381.
	35.00	2.36	15.671	962129.	968606.	971136.	964712.	964821.	972589.	967600.	966931.
	40.00	3.17	16.226	970487.	976932.	979485.	973043.	973154.	980925.	975931.	975261.
	45.00	4.14	16.801	979557.	986028.	988545.	982141.	982288.	990059.	985061.	984392.
	50.00	5.26	17.408	988683.	995154.	997667.	991269.	991358.	999130.	994131.	993461.
	55.00	6.56	17.626	996495.	1002969.	1005486.	999085.	999295.	1007000.	1002070.	1001332.
3)	57.74	7.34	17.617	1000069.	1006472.	1009067.	1002589.	1002780.	1010479.	1005556.	1004814.
	65.00	9.65	18.613	1011198.	1017616.	1020198.	1013735.	1013943.	1021699.	1016718.	1016032.
	70.00	11.44	19.729	1018608.	1025151.	1027607.	1021270.	1021420.	1029176.	1024195.	1023507.
4)	73.25	12.70	20.476	1022697.	1029116.	1031697.	1025235.	1025401.	1033139.	1028175.	1027470.
	80.00	15.58	22.125	1029745.	1036103.	1038747.	1032221.	1032375.	1040061.	1035149.	1034393.
	85.00	17.93	23.428	1033465.	1039953.	1042470.	1036068.	1036224.	1043909.	1039000.	1038241.
	90.00	20.48	24.804	1036008.	1042496.	1045012.	1038610.	1038769.	1046515.	1041543.	1040847.
	95.00	23.24	26.233	1036971.	1043465.	1045984.	1039576.	1039735.	1047604.	1042512.	1041938.
	100.00	26.21	27.723	1036901.	1043529.	1045925.	1039637.	1039794.	1047402.	1042573.	1041740.
	105.00	29.40	29.281	1035739.	1042371.	1044774.	1038477.	1038632.	1046230.	1041413.	1040572.
	110.00	32.81	30.969	1034227.	1040744.	1043282.	1036847.	1036869.	1044714.	1039655.	1039060.
	115.00	36.44	32.830	1032372.	1038894.	1041441.	1034995.	1035141.	1042721.	1037928.	1037072.
	120.00	40.30	34.848	1029778.	1036312.	1038869.	1032409.	1032421.	1040244.	1035215.	1034601.
	125.00	44.37	37.044	1026422.	1033094.	1035538.	1029185.	1029066.	1036747.	1031863.	1031112.
5)	129.00	47.78	38.973	1023576.	1030006.	1032714.	1026094.	1026219.	1033888.	1029021.	1028258.
6)	133.07	51.40	41.100	1019229.	1025808.	1028398.	1021890.	1021771.	1029533.	1024579.	1023909.
7)	136.07	54.16	42.759	1014103.	1020636.	1023245.	1016740.	1016730.	1024372.	1019512.	1018696.
8)	139.47	57.36	15.547	713304.	717761.	719325.	715049.	0.	0.	0.	0.
9)	140.57	58.39	.973	39072.	39338.	39452.	39181.	0.	0.	0.	0.
10)	140.77	58.58	1.031	32084.	32304.	32396.	32174.	0.	0.	0.	0.
11)	140.85	58.65	.983	29600.	29801.	29888.	29681.	0.	0.	0.	0.

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 7A

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

S-IVB STAGE PROPULSION CHARACTERISTICS

	FLIGHT TIME (SEC)	ALTITUDE (KM)	LONGITUDINAL ACCELERATION (M/S2)	THRUST MAGNITUDE J-2 ENGINE (N)	APS IMPULSE (N-SEC)
1)	140.85	58.65	.263	0.	.000
2)	142.17	59.87	.266	0.	.000
3)	145.57	62.95	5.259	730014.	.000
4)	148.57	65.60	6.722	934345.	67.366
5)	152.77	69.22	7.428	1024475.	201.682
	160.00	75.22	7.609	1034592.	268.713
6)	165.17	79.34	7.669	1032592.	336.541
	170.00	83.07	7.756	1034917.	336.541
7)	171.47	84.18	7.782	1035492.	336.541
8)	175.00	86.80	8.094	1036335.	404.383
	180.00	90.40	8.182	1037282.	474.210
	190.00	97.29	8.341	1036754.	474.210
	200.00	103.81	8.498	1035066.	542.412
	210.00	109.95	8.670	1034398.	609.475
	220.00	115.74	8.880	1037443.	609.475
	230.00	121.17	9.057	1035546.	609.475
	240.00	126.25	9.256	1035230.	677.467
	250.00	130.98	9.463	1034881.	677.467
	260.00	135.38	9.709	1037645.	677.467
	270.00	139.45	9.949	1038526.	744.597
	280.00	143.19	10.168	1036118.	744.597
	290.00	146.61	10.422	1036101.	744.597
	300.00	149.72	10.690	1036088.	811.755
	310.00	152.53	10.970	1036058.	811.755
	320.00	155.05	11.267	1036020.	811.755
	330.00	157.28	11.579	1035957.	879.066
	340.00	159.23	11.909	1035893.	879.066
	350.00	160.92	12.258	1035824.	879.066
	360.00	162.35	12.628	1035750.	946.233
	370.00	163.53	13.021	1035633.	946.233
	380.00	164.48	13.439	1035502.	946.233
	390.00	165.20	13.885	1035393.	1013.447
	400.00	165.72	14.361	1035288.	1013.447
	410.00	166.05	14.932	1039200.	1013.447
	420.00	166.20	15.449	1036712.	1080.226
	430.00	166.18	16.042	1036641.	1080.226

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 7A
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE PROPULSION CHARACTERISTICS

	FLIGHT TIME (SEC)	ALTITUDE (KM)	LONGITUDINAL ACCELERATION (M/S2)	THRUST MAGNITUDE J-2 ENGINE (N)	APS IMPULSE (N-SEC)
	440.00	166.03	16.682	1036573.	1080.226
	450.00	165.75	17.361	1035595.	1147.430
	460.00	165.37	18.114	1035502.	1147.430
9)	469.00	164.97	15.979	878924.	1147.430
	470.00	164.92	16.034	878292.	1147.430
	480.00	164.37	16.605	874810.	1214.769
	490.00	163.74	17.277	874311.	1214.769
	500.00	163.03	18.019	874399.	1214.769
	510.00	162.29	18.825	874388.	1282.677
	520.00	161.52	19.706	874346.	1282.677
	530.00	160.78	20.673	874300.	1282.677
	540.00	160.08	21.739	874175.	1349.525
	550.00	159.46	22.917	873955.	1349.525
	560.00	158.98	24.230	873673.	1349.525
	570.00	158.66	25.698	873214.	1422.102
	580.00	158.54	27.351	872571.	1490.613
10)	583.18	158.57	27.920	872292.	1490.613
11)	583.38	158.57	19.555	610616.	1490.613
12)	583.98	158.58	.792	24715.	1490.613
13)	593.18	158.72	-.000	0.	1490.613

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

FIGURE 1A

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
VEHICLE PROFILE

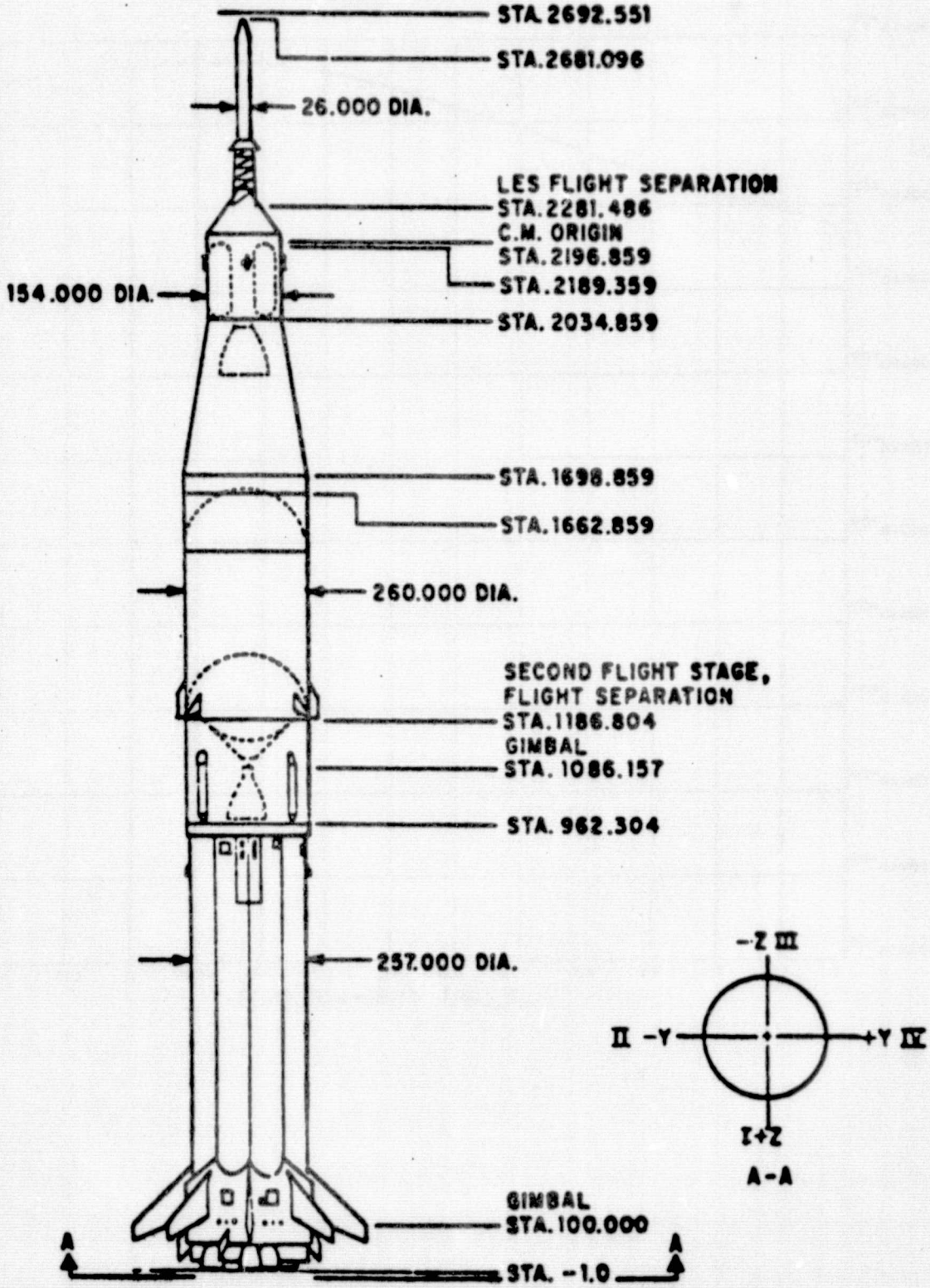


FIGURE 2A
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE THRUST HISTORY

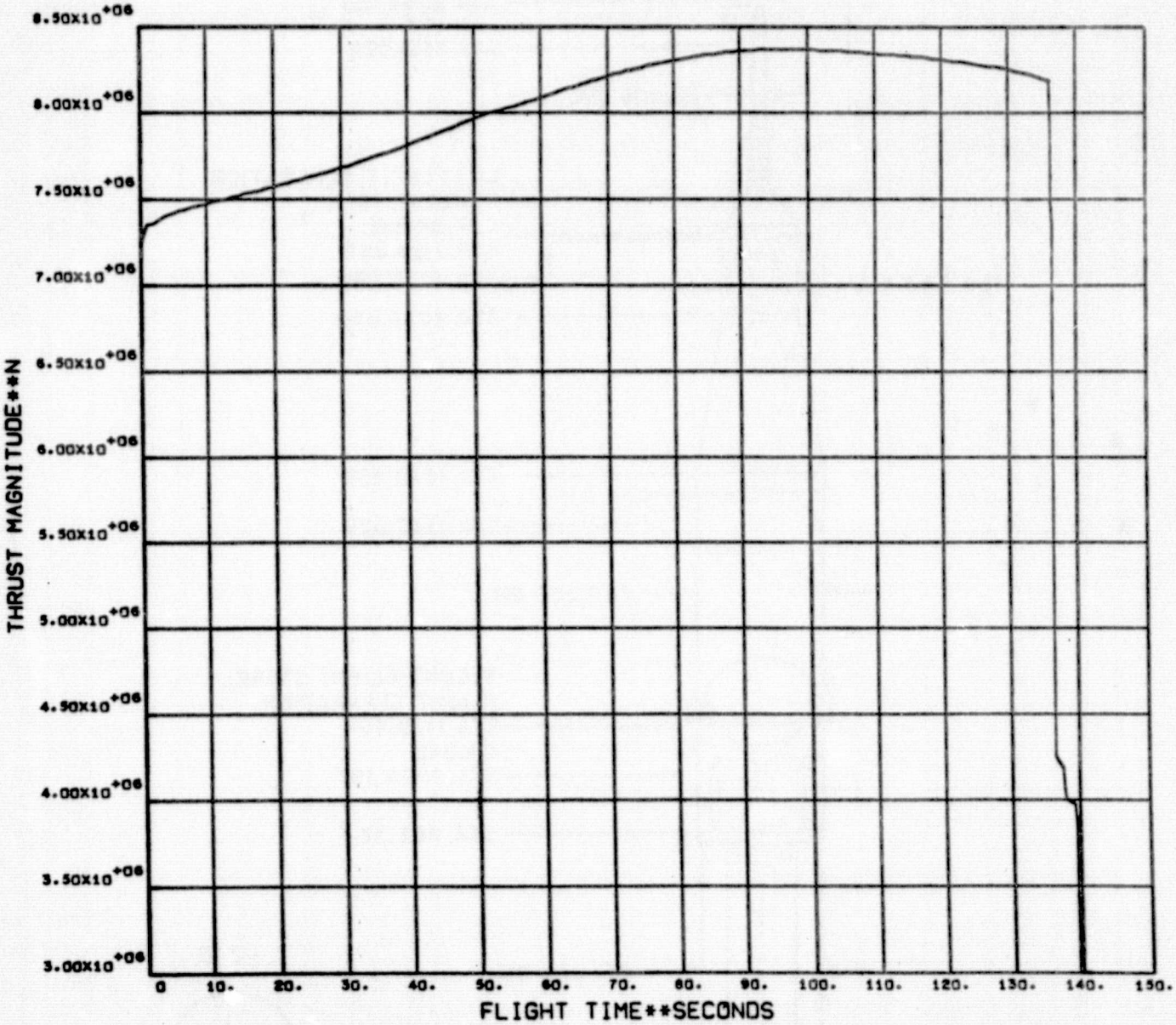


FIGURE 3A
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
H-1 ENGINE THRUST DECAY

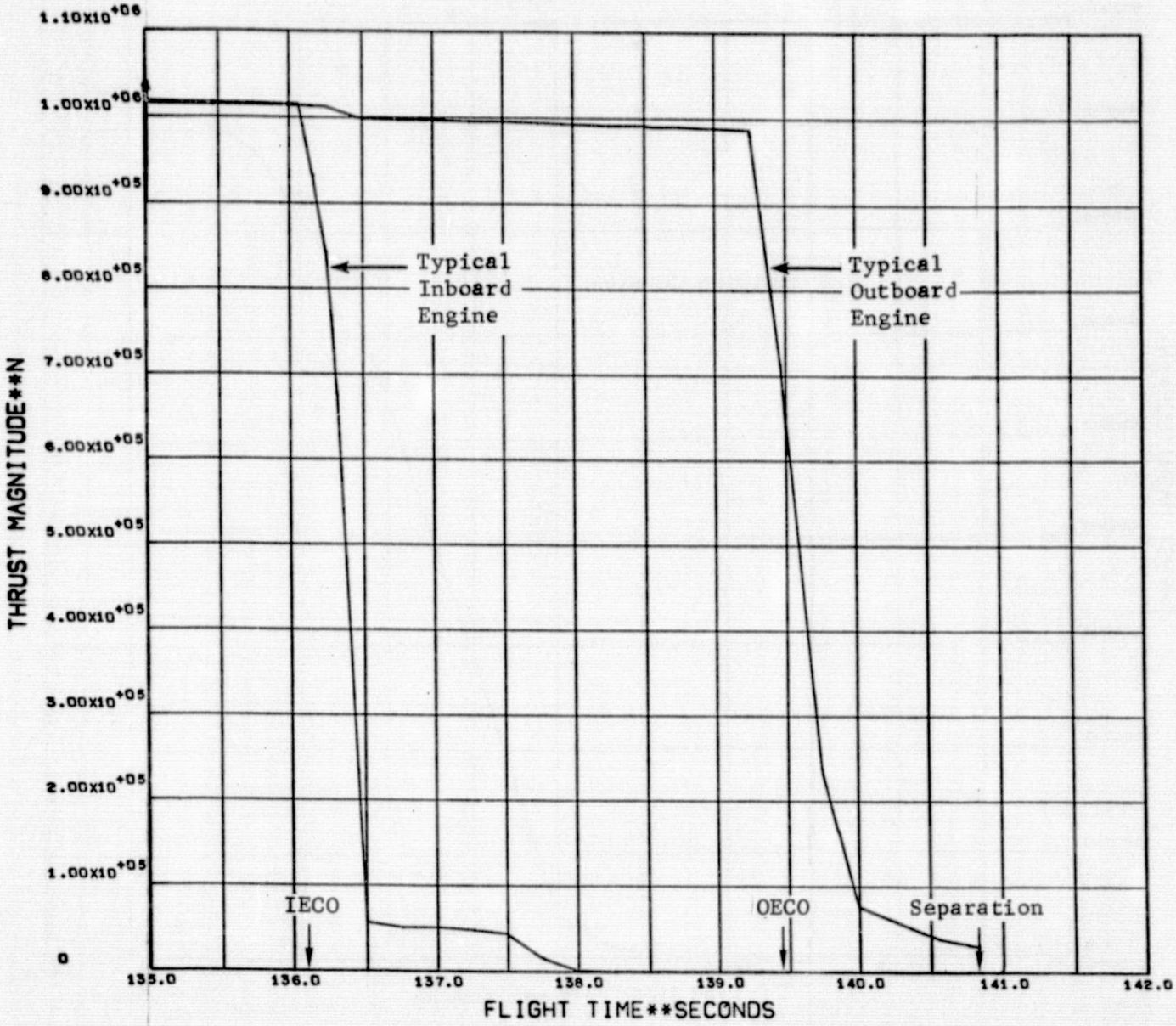


FIGURE 4A
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
J-2 ENGINE THRUST BUILDUP

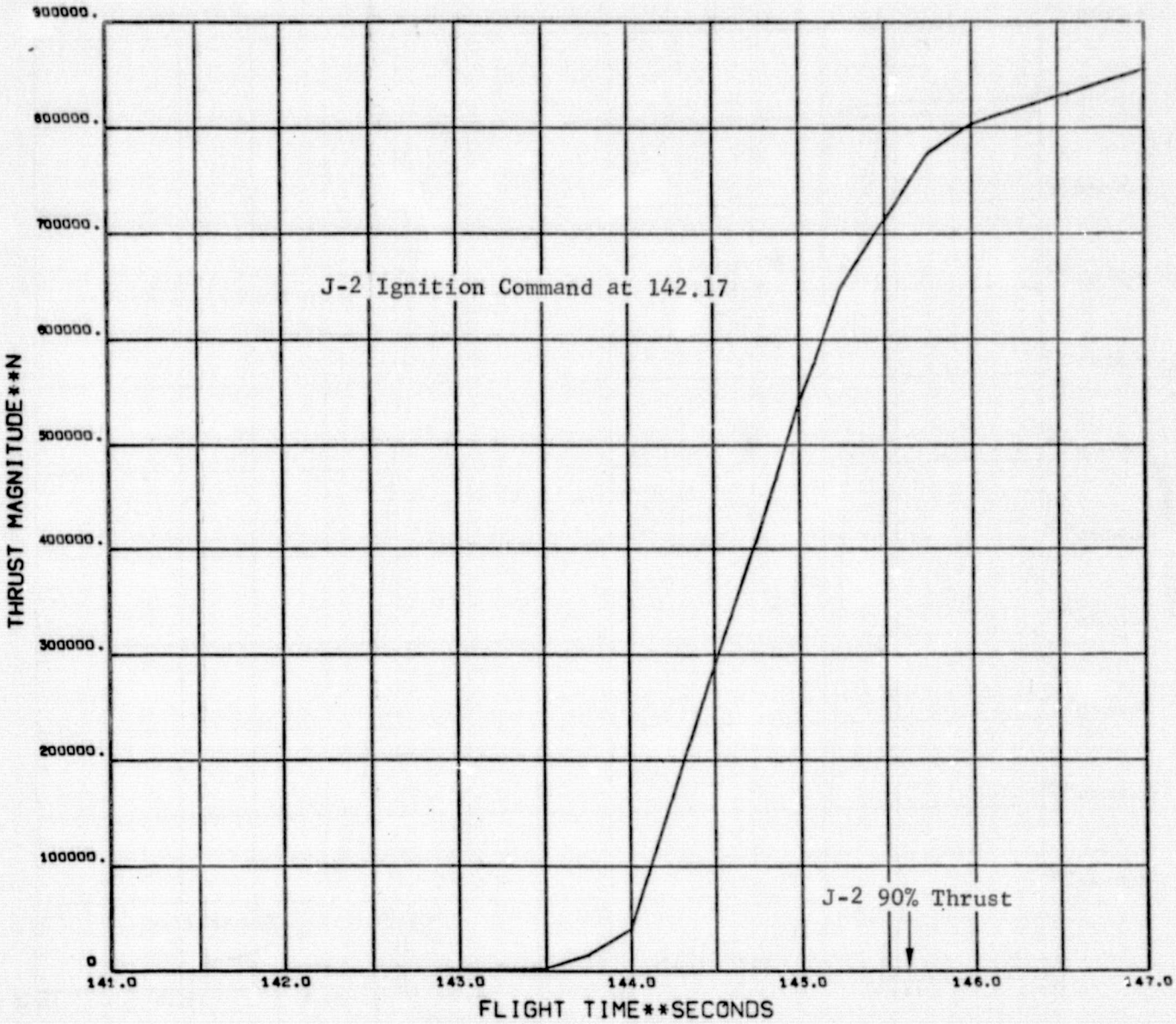


FIGURE 5A
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
J-2 ENGINE THRUST HISTORY

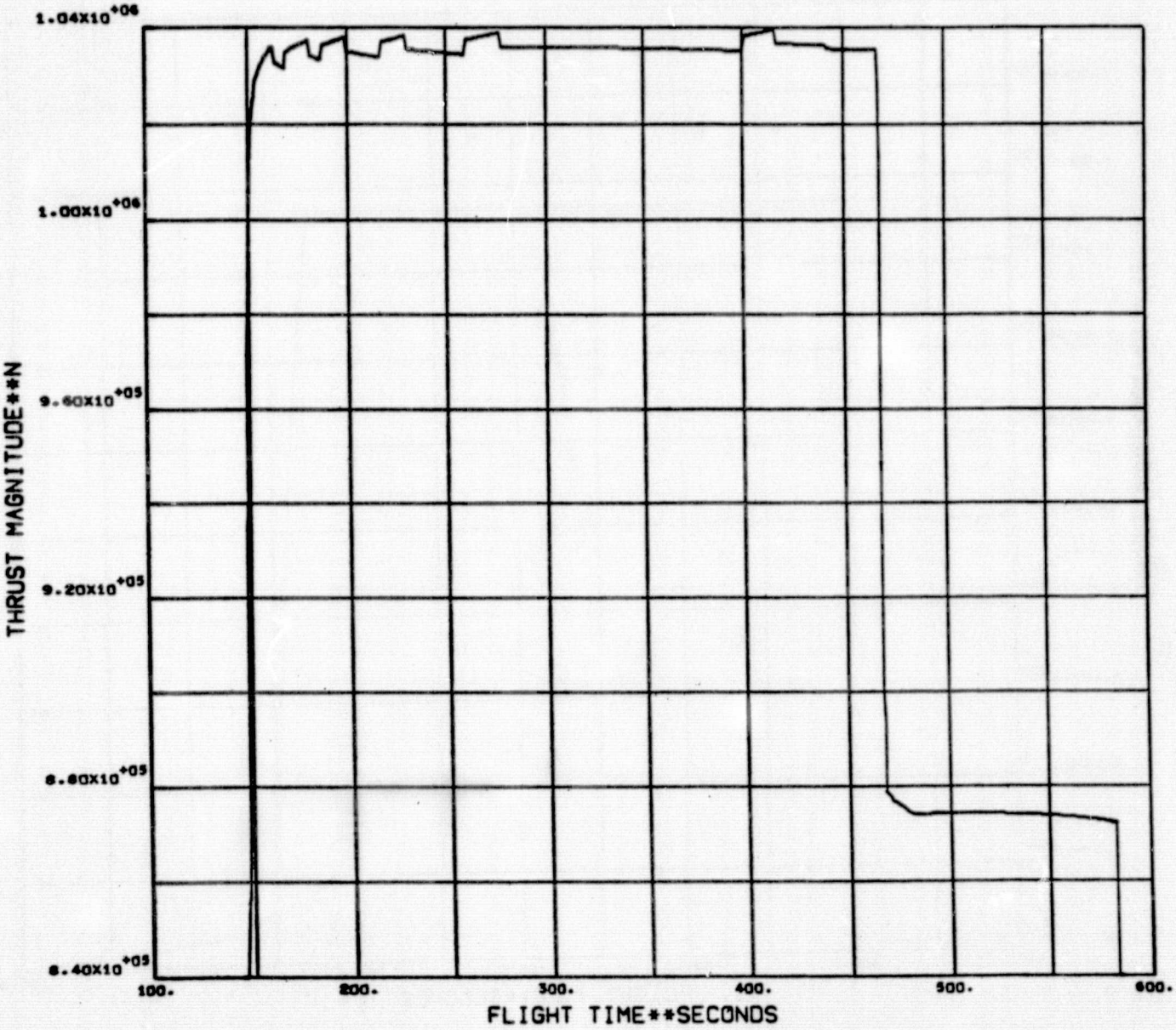


FIGURE 6A
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
J-2 ENGINE THRUST DECAY

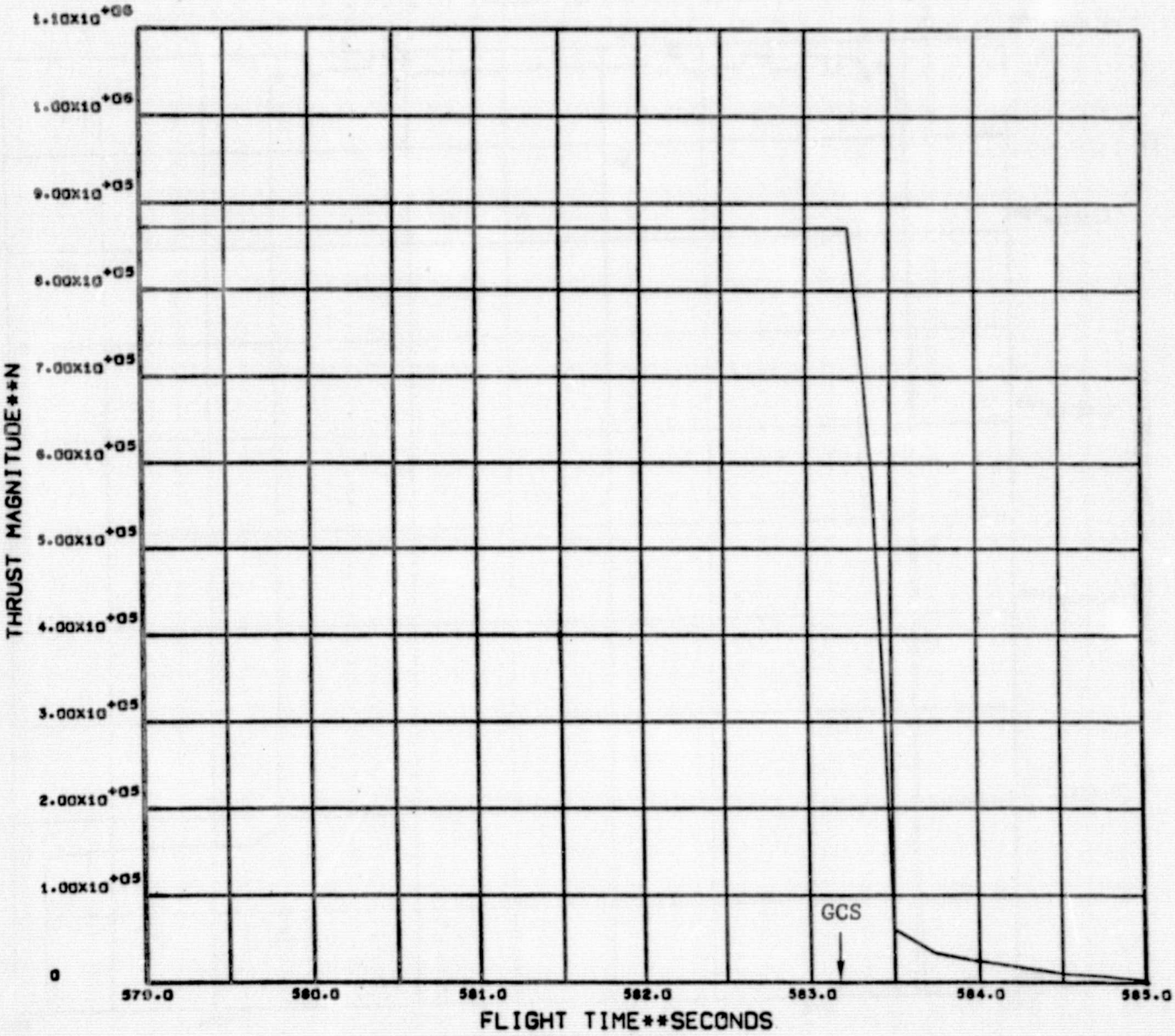
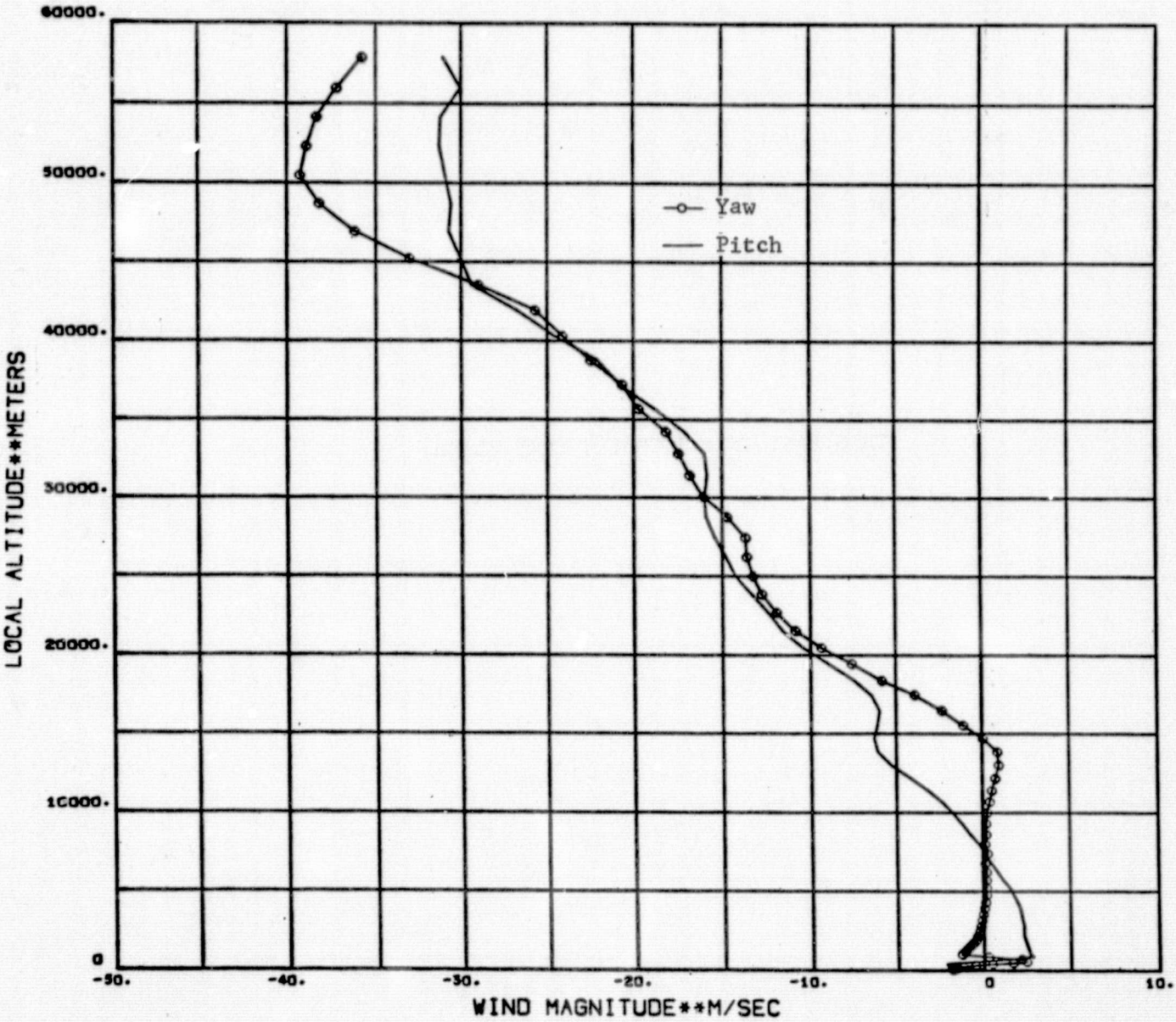


FIGURE 7A
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
JULY MEAN WIND PROFILES, INERTIAL PITCH AND YAW PLANE



Note: Positive wind magnitudes denote tailwind/left crosswind.

APPENDIX B: "LAUNCH VEHICLE TRAJECTORY GUIDANCE PRESETTINGS"

PRECEDING PAGE BLANK NOT FILMED

TABLE 1 B

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
S-IB STAGE STEERING PROGRAM

Roll (χ_X), Pitch (χ_Y) and Yaw (χ_Z) Attitude Programs

For the time segment Time Base 1 Time (T) $\leq$ 9.8 sec.:

χ_X = -44.842 deg.; and
χ_Y = χ_Z = 0. deg.

For the time segment 9.8 < T $\leq$ 46.8 sec.:

χ_X = χ_Z = 0. deg.; and
χ_Y = $A0+A1T+A2T^2+A3T^3$ deg.; where
A0 = $-.417928 \times 10^0$ deg.
A1 = $.191600 \times 10^0$ deg./sec.
A2 = $-.166429 \times 10^{-1}$ deg./sec.^{2}
A3 = $.115531 \times 10^{-3}$ deg./sec.^{3}

For the time segment 46.8 < T $\leq$ 87.8 sec.:

χ_X = χ_Z = 0. deg.; and
χ_Y = $B0+B1T+B2T^2+B3T^3$ deg.; where
B0 = $-.834601 \times 10^0$ deg.
B1 = $.174800 \times 10^0$ deg./sec.
B2 = $-.142616 \times 10^{-1}$ deg./sec.^{2}
B3 = $.765357 \times 10^{-4}$ deg./sec.^{3}

For the time segment 87.8 < T $\leq$ 128.8 sec.:

χ_X = χ_Z = 0. deg.; and
χ_Y = $C0+C1T+C2T^2+C3T^3$ deg.; where
C0 = $.744985 \times 10^1$ deg.
C1 = $-.684825 \times 10^0$ deg./sec.
C2 = $.153426 \times 10^{-2}$ deg./sec.^{2}
C3 = $-.406969 \times 10^{-5}$ deg./sec.^{3}

For the time segment T > 128.8 sec.:

χ_X = χ_Z = 0. deg.; and
χ_Y = -63.999 deg.

TABLE 2B

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
S-IB STAGE PITCH ATTITUDE COMMAND HISTORY

TIME BASE 1 TIME (T) (SEC)	PITCH ATTITUDE COMMAND (Xy) (DEG)	TIME BASE 1 TIME (T) (SEC)	PITCH ATTITUDE COMMAND (Xy) (DEG)
.0	.00	77.8	-37.52
9.8	.00	79.8	-38.81
11.8	-.28	81.8	-40.07
13.8	-.64	83.8	-41.30
15.8	-1.09	85.8	-42.48
17.8	-1.63	87.8	-43.60
19.8	-2.25	89.8	-44.62
21.8	-2.95	91.8	-45.64
23.8	-3.73	93.8	-46.65
25.8	-4.57	95.8	-47.65
27.8	-5.47	97.8	-48.66
29.8	-6.43	99.8	-49.66
31.8	-7.44	101.8	-50.66
33.8	-8.49	103.8	-51.66
35.8	-9.59	105.8	-52.65
37.8	-10.72	107.8	-53.64
39.8	-11.87	109.8	-54.63
41.8	-13.05	111.8	-55.62
43.8	-14.25	113.8	-56.61
45.8	-15.45	115.8	-57.60
47.8	-16.71	117.8	-58.58
49.8	-18.05	119.8	-59.57
51.8	-19.41	121.8	-60.55
53.8	-20.79	123.8	-61.54
55.8	-22.19	125.8	-62.52
57.8	-23.60	127.8	-63.51
59.8	-25.01	128.8	-64.00
61.8	-26.44	↓	↓
63.8	-27.86		
65.8	-29.28		
67.8	-30.69		
69.8	-32.09		
71.8	-33.48		
73.8	-34.85		
75.8	-36.19	IGM Initiation	-64.00

TABLE 3B

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
GUIDANCE PRESETTINGS

FUNCTION	EDD SYMBOL	INITIAL VALUE	UNITS	DESCRIPTION
Preflight Prepare to Launch (PTL) Special Data	A_{00}	467.766	deg	Coefficients of the variable azimuth polynominal.
	A_{01}	-19.43775	---	
	A_{10}	-1.1165417	---	
	A_{11}	0.0934375	deg^{-1}	
Boost Initialization	A_{zL}	90.00	deg	Position I Azimuth.
	G_L	9.791855	m/sec^2	Gravitational acceleration vector at the launch site.
	R_L	6373402.4	m	Geocentric radius to the center of the IU on the launch pad, used to calculate initial conditions.
	X_{LS}	6373377.1	m	Initial component of R_L along X_S axis.
First Stage Guidance	B_{11}	0.0	---	Coefficients used to calculate the attitude freeze interval for an S-IB engine failure during the first failure period.
	B_{12}	15.0	sec	
	B_{21}	-0.375	---	Coefficients used to calculate the attitude freeze interval for an S-IB engine failure during the second failure period.
	B_{22}	15.0	sec	
	C_{ar1}	20.0	sec	Constant time decrement of T_{ar} in the event of an S-IB engine failure prior to T_{far}.
	GANTRY	161.4	m	Three sigma altitude gain from liftoff to 10.0 seconds flight time.

TABLE 3B (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
GUIDANCE PRESETTINGS

FUNCTION	EDD SYMBOL	INITIAL VALUE	UNITS	DESCRIPTION
	T_{f1}	3.0	sec	Time Base 1 time to initiate second engine failure period.
	T_{f2}	39.8	sec	Time Base 1 time to initiate third engine failure period.
	T_{ar}	128.8	sec	Nominal Time Base 1 time of attitude arrest.
	T_{far}	140.0	sec	Time Base 1 time to end tilt arrest time decrement (C_{ar1}) in the event of an S-IB engine failure.
	TMEFRZ	0.0	sec	Time Base 1 time to end attitude freeze (Recalculated upon engine failure).
	T_{SO}	9.8	sec	Backup Time Base 1 time to start pitch, yaw and roll programs.
	T_{T2}	30.0	sec	Earliest chi freeze initiation in the event of an S-IB engine failure.
Boost Navigation	FMO	12.8	m/sec^2	Initial (F/M) for S-IB burn.
	FM2	23.1	m/sec^2	Constant (F/M) between IECO and T3 initiation.
	FM4	5.26	m/sec^2	Initial (F/M) for S-IVB burn.
	$(M/F)_0$	0.190	sec^2/m	M/F at S-IVB 90% thrust used to initialize the S-IVB smoothing filter.

TABLE 3B (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
GUIDANCE PRESETTINGS

FUNCTION	EDL SYMBOL	INITIAL VALUE	UNITS	DESCRIPTION
	MFK1	0.32157638	---	$(M/F)_S$ filter coefficients for S-IVB stage.
	MFK2	-0.2687668	---	
	MFK3	0.0	---	
	MFK4	0.0	---	
	MFK5	1.6504718	---	$(M/F)_S$ filter coefficients for S-IVB stage. (Smoothed values)
	MFK6	-0.70328021	---	
	MFK7	0.0	---	
	MFK8	0.0	---	
Boost IGM	G_T	-9.350	m/sec^2	Terminal gravitational acceleration vector.
	M_{GR}	128020.14	kg	Estimated vehicle mass at IGM initiation.
	$\dot{M}_{2G}$	248.3540	kg/sec	Average first IGM stage flowrate.
	$\dot{M}_{3G}$	208.1099	kg/sec	Average third IGM stage flowrate.
	P_{CMR}	35.0	sec	Duration of artificial τ_3 mode.
	ROV	1.0	---	Mission dependent constant multiplier for terminal range angle equation.
	SMCG	0.03	rad/sec	Steering misalignment control gain.

TABLE 3B (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
GUIDANCE PRESETTINGS

FUNCTION	EDD SYMBOL	INITIAL VALUE	UNITS	DESCRIPTION
	SQ1	5833.5262	m/sec	First guess at square root of $(\Delta\dot{X}_V^2 + \Delta\dot{Z}_V^2)$ for S-IVB burn.
	SQ2	0.99997288	---	First guess at square root of $(1 - (F'_{SY})^2)$.
	T_{10}	294.0	sec	Nominal first IGM stage burn time.
	T_{1i}	294.0	sec	First stage IGM time-to-go.
	T_{3i}	114.18	sec	Third stage IGM time-to-go.
	$T_{3_{IGM}}$	35.0	sec	Time Base 3 time to initiate IGM.
	T_{HSL}	5.0	sec	T_{3i} value to freeze IGM commands.
	T_{SMC}	60.53	sec	Time Base 3 time to initiate thrust misalignment correction.
	V_{ex1}	4169.2826	m/sec	Average first IGM stage exhaust velocity.
	V_{ex3}	4200.7949	m/sec	Average third IGM stage exhaust velocity.
	V_{GRD}	150.0	m/sec	Minimum velocity-to-go for high speed loop initiation.
	YAWLIM	45.0	deg	Yaw command limit.

TABLE 3B (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY GUIDANCE PRESETTINGS

FUNCTION	EDD SYMBOL	INITIAL VALUE	UNITS	DESCRIPTION
	$\ddot{X}_{VgT}$	-9.350	m/sec^2	Terminal gravitation vector components, IGM coordinate system.
	$\ddot{Y}_{VgT}$	0.0	m/sec^2	
	$\ddot{Z}_{VgT}$	0.0	m/sec^2	
	ΔV_b	6.7118	m/sec	J-2 thrust decay velocity bias.
	ϵ_2	25.0	sec	T_{3i} value to initiate IGM $\Delta\overline{V}$ guidance.
	τ_3	264.30	sec	Initial mass to mass flowrate for third IGM stage.
	τ_{10}	517.03	sec	Initial ratio of first IGM stage mass to mass flowrate, used in artificial τ_3 calculations.
Target Load Data	A_z	45.158	deg	Platform azimuth.
	i	51.780	deg	Required inclination of parking orbit.
	R_T	6528178.	m	Terminal radius required.
	V_T	7818.46	m/sec	Terminal velocity required.
	T_{GRRO}	71382.8	sec	Nominal value of T_{GRR} (GMT).
	T_{LWC}	71909.0	sec	Liftoff time of launch window closing (GMT).

TABLE 3B (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
GUIDANCE PRESETTINGS

FUNCTION	EDD SYMBOL	INITIAL VALUE	UNITS	DESCRIPTION
	θ_T	0.0	deg	Terminal flight path angle required.
	λ_o	156.887	deg	Required terminal descending node argument.
	$\dot{\lambda}$	-0.004098	deg/sec	Time rate of change of descending node argument.

NOTE: The following target load data changes are required for launch window opening (LWO) and launch window closing (LWC) trajectories.

		LWO	LWC		
	A_z	48.463	37.400	deg	
	λ_o	157.775	154.802	deg	
Accelerometer Processing	BIAS1	0.0	m/sec		Velocity bias used in $(F/M)_c$ calculations during the BML in which liftoff occurs.
	BIAS2	0.0	m/sec		Velocity bias used in $(F/M)_c$ calculations during the BML in which S-IB IECO occurs.

TABLE 3B (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
GUIDANCE PRESETTINGS

FUNCTION	EDD SYMBOL	INITIAL VALUE	UNITS	DESCRIPTION
	BIAS3	0.0	m/sec	Velocity bias used in $(F/M)_c$ calculations during the BML in which S-IB OECO occurs.
	BIAS4	0.0	m/sec	Velocity bias used in $(F/M)_c$ calculations during the BML in which 90% J-2 thrust is achieved (i.e., at T3+T3FMC).
	BIAS5	1.06	m/sec	Velocity bias used in $(F/M)_c$ calculations during the BML in which S-IVB EMRC occurs.
	BIAS6	0.0	m/sec	Velocity bias used in $(F/M)_c$ calculations during the BML in which S-IVB cutoff occurs.
	SIBEOB	0.875	---	Engine out bias used to modify the backup force and mass flow rate presettings during Time Base 1.
	F_0	5764191.7	n	Backup force for computing $(F/M)_c$ at first motion.
	F_1	7409196.6	n	Backup force for computing $(F/M)_c$ between first motion and IECO.
	F_{2I}	271422.55	n	Backup force for computing $(F/M)_c$ between OECO & 90% J-2 thrust.
	F_2	1025021.5	n	Backup force for computing $(F/M)_c$ between J-2 90% thrust and EMRC.
	F_3	848824.71	n	Backup force for computing $(F/M)_c$ between EMRC and GCS.

TABLE 3B (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
GUIDANCE PRESETTINGS

FUNCTION	EDD SYMBOL	INITIAL VALUE	UNITS	DESCRIPTION
	M_0	588672.08	kg	Vehicle mass at first motion used for computing $(F/M)_c$ in the first portion of the BML in which liftoff occurs.
	$\dot{M}_0$	0.0	kg/sec	Backup mass flowrate for computing (F/M) at first motion.
	M_1	588672.08	kg	Vehicle mass at first motion.
	$\dot{M}_1$	3123.7173	kg/sec	Backup mass flowrate for computing (F/M) between first motion and IECO.
	M_2	135149.48	kg	Vehicle mass at 90% S-IVB stage thrust less mass to be jettisoned.
	$\dot{M}_2$	250.28976	kg/sec	Backup mass flowrate for computing $(F/M)_c$ between J-2 90% thrust and EMRC.
	$\dot{M}_3$	201.78261	kg/sec	Backup mass flowrate for computing (F/M) between EMRC and GCS.
	PF	1.0	---	Performance factor initialization used for $(F/M)_c$ backup computations.
	PF_0	1.0	---	
	PF_1	1.0	---	
Variable Data Tape Data	$*B_{XO}$	-0.040	m/sec^2	Constant acceleration bias terms for X, Y, and Z axes.
	B_{YO}	0.000	m/sec^2	
	$**B_{ZO}$	-0.132	m/sec^2	

* Used only during S-IB stage flight.
** Used only during S-IVB stage flight.

TABLE 3B (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY GUIDANCE PRESETTINGS

FUNCTION	EDD SYMBOL	INITIAL VALUE	UNITS	DESCRIPTION
	C_{a1}	0.99999584	---	X-components of thrust misalignment vectors used in $(F/M)_c$ calculations.
	C_{a2}	0.99999426		
	C_{a3}	0.99999220		
	C_{a4}	0.99999008		
	P_{bx}	0.0	---	Performance factor biases along X_B, Y_B, and Z_B axes for backup acceleration calculations.
	P_{by}	0.0		
	P_{bz}	0.0		
	$S\alpha C\beta 1$	-0.00288053	---	Y-components of thrust misalignment vector used in $(F/M)_c$ calculations.
	$S\alpha C\beta 2$	-0.00338344		
	$S\alpha C\beta 3$	-0.00394660		
	$S\alpha C\beta 4$	-0.00445155		
	$S\alpha S\beta 1$	0.00013555	---	Z-components of thrust misalignment vector used in $(F/M)_c$ calculations.
	$S\alpha S\beta 2$	0.00015395		
	$S\alpha S\beta 3$	0.00015115		
	$S\alpha S\beta 4$	0.00017381		

TABLE 3B (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
GUIDANCE PRESETTINGS

FUNCTION	EDD SYMBOL	INITIAL VALUE	UNITS	DESCRIPTION
	T_{TMA1}	35.532	sec	Time Base 3 times to begin using thrust misalignment angles (vectors) in backup accelerometer calculations.
	T_{TMA2}	140.532		
	T_{TMA3}	250.532		
	T_{TMA4}	360.532		

APPENDIX C: "NOMINAL TRAJECTORY LISTINGS, ENGLISH UNITS"

PRECEDING PAGE BLANK NOT FILMED

TABLE 1C
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC2)	DYNAMIC PRESSURE (LB/FT2)	A.H.I. (LB-FT/FT2-RAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1)	-17.20	1311641.	0.	0.	.000	0.	0.	.00	.000
2)	.00	1296407.	1630471.	161.	40.532	0.	0.	.01	.000
	5.00	1264785.	1669891.	756.	42.529	3.	102.	.04	6.188
	10.00	1232920.	1681229.	2919.	43.865	12.	1941.	.09	3.305
	15.00	1200940.	1691932.	6599.	45.219	30.	11203.	.15	.270
	20.00	1168875.	1703059.	11577.	46.630	59.	40345.	.21	-2.729
	25.00	1136752.	1714637.	16756.	48.125	99.	110747.	.28	-1.528
	30.00	1104592.	1727517.	22895.	49.714	152.	254439.	.35	-1.254
	35.00	1072401.	1741646.	29832.	51.414	218.	517283.	.44	-.874
	40.00	1040191.	1757194.	37666.	53.236	295.	960295.	.54	-.501
	45.00	1007930.	1774101.	48588.	55.122	380.	1659411.	.65	-.155
	50.00	975651.	1791017.	60211.	57.113	471.	2704206.	.77	.055
	55.00	943376.	1805710.	111016.	57.828	559.	4188236.	.92	.056
3)	57.74	925721.	1812324.	150121.	57.798	600.	5210069.	1.00	.043
	65.00	878758.	1833161.	165822.	61.065	685.	8664173.	1.25	.013
	70.00	846361.	1847076.	144730.	64.726	723.	11712054.	1.47	.006
4)	73.25	825310.	1854542.	131580.	67.177	731.	13989148.	1.63	.030
	80.00	781602.	1867572.	104265.	72.588	682.	19276773.	2.00	-.170
	85.00	749252.	1874693.	84779.	76.863	587.	23333436.	2.25	-.176
	90.00	717109.	1879478.	65704.	81.378	483.	27190121.	2.52	-.027
	95.00	684983.	1881398.	49080.	86.066	386.	30738118.	2.80	.029
	100.00	652890.	1881416.	35746.	90.954	302.	33902157.	3.11	-.089
	105.00	620845.	1879376.	25626.	96.068	229.	36644503.	3.44	-.237
	110.00	588859.	1876524.	16980.	101.605	169.	38938729.	3.77	-.717
	115.00	556934.	1873204.	8835.	107.710	122.	40808566.	4.13	-1.154
	120.00	525084.	1868552.	2811.	114.330	86.	42304276.	4.50	-1.642
	125.00	493317.	1862519.	-740.	121.534	60.	43484432.	4.91	-2.308
5)	129.00	467987.	1857286.	-2325.	127.864	45.	44238961.	5.26	-2.837
6)	133.07	442315.	1849482.	-4174.	134.842	34.	44863811.	5.72	-2.028
7)	136.07	423450.	1840231.	-6061.	140.285	28.	45246403.	6.13	-1.167
8)	139.47	410775.	645416.	-5808.	51.008	20.	45592882.	6.42	-.292
9)	140.57	409509.	35372.	-5267.	3.193	18.	45683041.	6.46	-.026
10)	140.77	409279.	37844.	-5162.	3.381	17.	45698205.	6.46	.020
11)	140.85	409246.	35901.	-5121.	3.226	17.	45704096.	6.46	.039

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 1C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	-17.20	20910035.	1340.44	90.000	20909952.	41798.	-41568.	.00	945.22	950.44
2)	.00	20910035.	1340.44	90.000	20909939.	58050.	-25215.	-1.48	944.65	951.01
	5.00	20910150.	1341.06	87.954	20910046.	62773.	-20459.	45.97	944.23	951.19
	10.00	20910525.	1343.68	85.593	20910410.	67492.	-15703.	100.91	943.66	951.21
	15.00	20911193.	1349.84	82.965	20911066.	72209.	-10947.	162.56	943.21	951.84
	20.00	20912189.	1363.54	80.108	20912047.	76926.	-6178.	231.06	943.42	956.98
	25.00	20913547.	1387.11	77.081	20913388.	81642.	-1364.	306.51	942.92	970.07
	30.00	20915302.	1422.53	73.958	20915124.	86354.	3538.	389.04	942.00	992.40
	35.00	20917490.	1472.32	70.845	20917290.	91063.	8579.	478.59	941.43	1025.86
	40.00	20920145.	1538.15	67.842	20919922.	95769.	13818.	575.11	941.11	1072.12
	45.00	20923302.	1621.12	65.054	20923052.	100474.	19324.	678.16	940.92	1132.60
	50.00	20926993.	1722.10	62.565	20926714.	105178.	25170.	787.26	940.74	1208.65
	55.00	20931242.	1840.82	60.529	20930930.	109881.	31441.	898.77	940.35	1302.53
3)	57.74	20933805.	1911.44	59.674	20933474.	112457.	35088.	957.81	940.02	1361.09
	65.00	20941373.	2121.74	58.130	20940984.	119280.	45607.	1111.58	939.42	1543.91
	70.00	20947256.	2295.18	57.476	20946821.	123976.	53705.	1224.12	939.01	1699.31
4)	73.25	20951391.	2421.53	57.218	20950921.	127026.	59410.	1300.33	938.77	1814.30
	80.00	20960801.	2719.85	57.089	20960252.	133362.	72564.	1464.63	937.63	2091.24
	85.00	20968509.	2972.55	57.303	20967888.	138044.	83608.	1590.34	935.38	2330.66
	90.00	20976868.	3253.05	57.700	20976163.	142714.	95920.	1720.10	932.40	2598.89
	95.00	20985902.	3561.93	58.226	20985098.	147368.	109646.	1854.01	929.31	2895.93
	100.00	20995631.	3900.15	58.873	20994709.	152007.	124933.	1990.33	926.41	3223.59
	105.00	21006069.	4268.36	59.608	21005006.	156633.	141938.	2128.43	923.64	3582.67
	110.00	21017228.	4667.92	60.429	21015994.	161243.	160821.	2266.27	920.39	3975.72
	115.00	21029108.	5101.37	61.323	21027669.	165836.	181761.	2402.88	917.04	4405.58
	120.00	21041710.	5570.96	62.269	21040022.	170413.	204947.	2537.59	913.82	4874.54
	125.00	21055030.	6079.21	63.265	21053040.	174973.	230583.	2668.54	910.00	5385.87
5)	129.00	21066196.	6515.73	64.087	21063919.	178607.	253003.	2770.00	906.79	5827.49
6)	133.07	21078014.	6988.98	64.904	21075396.	182289.	277678.	2873.73	903.61	6306.42
7)	136.07	21087050.	7357.95	65.422	21084145.	184996.	297151.	2958.82	901.17	6676.28
8)	139.47	21097497.	7569.20	66.020	21094228.	188057.	320272.	2963.84	899.33	6906.50
9)	140.57	21100869.	7569.23	66.234	21097474.	189046.	327879.	2935.29	898.98	6918.75
10)	140.77	21101478.	7567.35	66.274	21098061.	189226.	329263.	2929.26	898.92	6919.26
11)	140.85	21101718.	7566.60	66.290	21098292.	189297.	329810.	2926.88	898.90	6919.45

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 1C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	EARTH FIXED POSITION (FT)	EARTH FIXED VELOCITY (FT/S)	EARTH FIXED PATH ANGLE (DEG)	EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1) -17.20	295.	.00	N/A	295.	0.	-0.	.00	-.00	-.00
2) .00	295.	.00	N/A	295.	-0.	0.	.00	-.00	-.00
5.00	411.	47.87	.482	411.	-1.	0.	47.87	-.30	-.04
10.00	786.	103.24	.563	786.	-3.	-1.	103.24	-.81	-.28
15.00	1454.	165.33	.555	1454.	-9.	-2.	165.32	-1.23	.04
20.00	2450.	234.31	1.343	2450.	-15.	7.	234.26	-1.04	4.82
25.00	3809.	310.66	3.365	3808.	-20.	59.	310.16	-1.61	17.48
30.00	5567.	395.15	5.847	5563.	-31.	197.	393.18	-2.65	39.33
35.00	7766.	488.63	8.627	7751.	-46.	471.	483.25	-3.37	72.22
40.00	10450.	592.21	11.599	10408.	-65.	940.	580.36	-3.88	117.84
45.00	13669.	706.76	14.670	13566.	-85.	1673.	684.07	-4.30	177.59
50.00	17476.	833.21	17.776	17259.	-107.	2742.	793.92	-4.71	252.82
55.00	21924.	970.03	20.991	21511.	-133.	4231.	906.28	-5.34	345.80
3) 57.74	24644.	1046.88	22.794	24076.	-148.	5257.	965.84	-5.78	403.84
65.00	32856.	1264.75	27.654	31649.	-193.	8821.	1121.21	-6.62	585.19
70.00	39447.	1439.52	30.993	37538.	-227.	12122.	1235.06	-7.14	739.45
4) 73.25	44196.	1565.49	33.121	41676.	-251.	14707.	1312.25	-7.41	853.66
80.00	55384.	1860.50	37.411	51094.	-303.	21370.	1478.91	-8.50	1128.82
85.00	64962.	2109.43	40.428	58807.	-351.	27598.	1606.67	-10.58	1366.82
90.00	75783.	2385.79	43.231	67170.	-410.	35088.	1738.80	-13.27	1633.52
95.00	87988.	2690.38	45.801	76205.	-483.	43983.	1875.41	-15.91	1928.92
100.00	101720.	3023.91	48.185	85930.	-569.	54431.	2014.79	-18.19	2254.84
105.00	117128.	3387.20	50.393	96358.	-665.	66586.	2156.35	-20.13	2612.07
110.00	134366.	3781.64	52.471	107495.	-771.	80612.	2298.10	-22.31	3003.18
115.00	153592.	4209.70	54.442	119340.	-887.	96684.	2439.10	-24.30	3431.01
120.00	174980.	4673.73	56.314	131886.	-1013.	114992.	2578.73	-25.83	3897.85
125.00	198714.	5176.36	58.107	145124.	-1146.	135739.	2715.21	-27.57	4407.00
5) 129.00	219522.	5608.36	59.489	156199.	-1259.	154240.	2821.55	-28.80	4846.83
6) 133.07	242464.	6077.30	60.807	167897.	-1378.	174922.	2930.70	-29.67	5323.88
7) 136.07	260614.	6443.86	61.645	176823.	-1468.	191445.	3020.08	-30.30	5692.24
8) 139.47	282187.	6651.12	62.450	187120.	-1571.	211218.	3028.79	-30.36	5921.39
9) 140.57	289277.	6649.33	62.694	190438.	-1604.	217742.	3001.00	-30.25	5933.52
10) 140.77	290565.	6647.10	62.738	191038.	-1611.	218929.	2995.11	-30.23	5934.00
11) 140.85	291073.	6646.22	62.755	191274.	-1613.	219398.	2992.77	-30.22	5934.19

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 1C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	-17.20	295.	.000	.00	90.000	N/A	-80.621	28.466	28.627
2)	.00	295.	.000	5.96	90.000	N/A	-80.621	28.466	28.627
	5.00	411.	.000	48.21	89.986	N/A	-80.621	28.466	28.627
	10.00	786.	.001	103.41	89.971	N/A	-80.621	28.466	28.627
	15.00	1454.	.002	165.54	89.942	N/A	-80.621	28.466	28.627
	20.00	2450.	.004	234.41	89.796	29.211	-80.621	28.466	28.627
	25.00	3808.	.012	310.27	89.392	38.121	-80.621	28.466	28.627
	30.00	5564.	.035	394.39	88.713	40.269	-80.621	28.466	28.628
	35.00	7752.	.081	487.53	87.747	41.766	-80.620	28.467	28.628
	40.00	10408.	.159	590.76	86.480	42.734	-80.619	28.468	28.629
	45.00	13567.	.280	705.09	84.920	43.347	-80.617	28.469	28.631
	50.00	17260.	.457	831.71	83.094	43.743	-80.615	28.471	28.633
	55.00	21512.	.703	969.22	81.025	43.984	-80.612	28.474	28.636
3)	57.74	24077.	.873	1046.68	79.828	44.075	-80.610	28.476	28.638
	65.00	31652.	1.460	1267.05	76.518	44.303	-80.602	28.483	28.645
	70.00	37542.	2.004	1444.93	74.126	44.429	-80.595	28.490	28.652
4)	73.25	41682.	2.430	1574.31	72.562	44.503	-80.589	28.495	28.657
	80.00	51106.	3.526	1872.68	69.362	44.601	-80.574	28.508	28.670
	85.00	58826.	4.549	2123.86	67.089	44.610	-80.561	28.520	28.682
	90.00	67200.	5.779	2409.19	64.970	44.609	-80.544	28.535	28.696
	95.00	76252.	7.238	2720.61	63.040	44.622	-80.525	28.552	28.714
	100.00	86001.	8.950	3060.11	61.300	44.652	-80.502	28.572	28.734
	105.00	96464.	10.941	3427.50	59.744	44.693	-80.476	28.596	28.758
	110.00	107651.	13.235	3823.08	58.346	44.730	-80.445	28.623	28.785
	115.00	119563.	15.862	4262.46	57.097	44.773	-80.410	28.654	28.816
	120.00	132202.	18.851	4740.84	55.987	44.824	-80.370	28.689	28.852
	125.00	145563.	22.234	5259.55	54.994	44.872	-80.325	28.729	28.892
5)	129.00	156765.	25.248	5694.92	54.278	44.913	-80.284	28.765	28.927
6)	133.07	168625.	28.614	6166.86	53.620	44.960	-80.239	28.804	28.967
7)	136.07	177694.	31.302	6533.87	53.179	44.994	-80.203	28.836	28.999
8)	139.47	188180.	34.515	6741.01	52.942	45.028	-80.160	28.874	29.037
9)	140.57	191564.	35.575	6739.02	52.937	45.037	-80.146	28.886	29.049
10)	140.77	192176.	35.767	6736.38	52.938	45.039	-80.143	28.889	29.052
11)	140.85	192418.	35.843	6735.34	52.938	45.040	-80.142	28.890	29.053

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 1C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	-17.20	.000	.000	-44.842	-.003	.003	.002	.000	.000	.000
2)	.00	-.045	.044	-44.808	-.003	.003	.002	-.045	.044	.034
	5.00	-.017	-.016	-44.843	-.001	.001	.003	-.001	-.023	-.001
	10.00	-.011	-.020	-44.843	.002	.000	.000	.007	-.022	-.001
	15.00	-.662	-.005	-40.739	-.202	.006	1.001	.148	.121	-.897
	20.00	-2.000	.023	-35.771	-.329	-.002	1.003	.191	.166	-.929
	25.00	-3.847	-.039	-30.773	-.406	-.000	1.000	.271	.116	-.931
	30.00	-6.078	-.024	-25.771	-.481	.002	1.000	.328	.132	-.929
	35.00	-8.614	-.010	-20.770	-.532	.001	1.000	.399	.140	-.928
	40.00	-11.374	-.009	-15.771	-.570	-.002	1.000	.481	.127	-.929
	45.00	-14.300	-.021	-10.773	-.598	-.004	.999	.543	.082	-.931
	50.00	-17.433	-.043	-5.777	-.685	-.007	1.000	.614	.019	-.935
	55.00	-20.888	-.075	-.804	-.699	-.006	.922	.601	-.066	-.805
3)	57.74	-22.814	-.083	.051	-.705	.007	-.068	.600	-.083	.050
	65.00	-27.958	-.080	-.001	-.711	.000	.000	.610	-.080	-.001
	70.00	-31.483	-.099	-.000	-.697	-.004	-.000	.606	-.099	-.001
4)	73.25	-33.737	-.094	-.000	-.688	.002	-.000	.597	-.094	-.001
	80.00	-38.262	-.111	.004	-.634	.015	.001	.549	-.111	.003
	85.00	-41.287	-.013	.004	-.592	.006	-.001	.608	-.013	.004
	90.00	-44.110	.047	-.000	-.510	.005	-.002	.512	.047	.000
	95.00	-46.690	.055	-.002	-.513	-.004	.000	.461	.055	-.002
	100.00	-49.220	.020	-.001	-.503	-.008	.001	.440	.020	-.001
	105.00	-51.574	-.031	.001	-.510	-.019	.001	.580	-.031	.001
	110.00	-54.104	-.086	.005	-.504	-.007	.001	.530	-.086	.005
	115.00	-56.599	-.104	.007	-.494	.001	.000	.506	-.104	.006
	120.00	-59.055	-.094	.007	-.490	.002	-.000	.515	-.094	.007
	125.00	-61.608	-.180	.007	-.473	.011	-.000	.422	-.180	.007
5)	129.00	-63.529	-.158	.007	-.484	.003	-.000	.470	-.158	.006
6)	133.07	-64.056	-.153	.004	.030	-.005	-.002	-.058	-.153	.004
7)	136.07	-64.048	-.168	.002	.002	-.002	-.001	-.049	-.168	.003
8)	139.47	-64.014	-.085	.001	.010	.005	-.001	-.015	-.085	.001
9)	140.57	-64.006	-.092	.001	.005	-.020	.000	-.007	-.092	.001
10)	140.77	-64.005	-.097	.001	.005	-.024	-.000	-.006	-.097	.001
11)	140.85	-64.005	-.099	.001	.005	-.026	-.000	-.006	-.099	.001

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 2C

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/S2)	DYNAMIC PRESSURE (LB/FT2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
1)	140.85	307882.	9104.	838.	.864	17.	1.086	-63.999	.039
2)	142.17	307811.	9068.	727.	.872	15.	1.110	-63.999	.384
3)	145.57	307319.	165330.	532.	17.253	10.	1.172	-63.999	1.539
4)	148.57	305897.	210049.	390.	22.053	7.	1.227	-63.999	2.280
5)	152.77	303758.	230311.	247.	24.370	4.	1.305	-63.999	2.890
	160.00	299604.	232585.	120.	24.965	2.	1.443	-63.999	4.463
6)	165.17	296772.	232136.	71.	25.160	1.	1.543	-63.999	5.552
	170.00	294130.	232658.	43.	25.446	1.	1.638	-63.999	6.569
7)	171.47	293323.	232788.	36.	25.531	0.	1.667	-63.999	6.876
8)	175.00	282236.	232977.	24.	26.556	0.	1.737	-63.999	7.616
	180.00	279490.	233190.	19.	26.843	0.	1.839	-58.999	11.845
	190.00	274007.	233072.	10.	27.367	0.	2.046	-56.105	18.471
	200.00	268514.	232692.	3.	27.881	0.	2.259	-57.288	18.820
	210.00	263035.	232542.	1.	28.444	0.	2.478	-58.231	19.411
	220.00	257554.	233226.	1.	29.135	0.	2.703	-59.364	19.828
	230.00	252060.	232800.	0.	29.715	0.	2.934	-60.729	19.873
	240.00	246580.	232729.	0.	30.367	0.	3.172	-61.738	20.216
	250.00	241103.	232650.	0.	31.046	0.	3.416	-62.817	20.484
	260.00	235627.	233272.	0.	31.852	0.	3.667	-63.938	20.643
	270.00	230135.	233470.	0.	32.640	0.	3.925	-65.266	20.556
	280.00	224644.	232929.	0.	33.360	0.	4.191	-66.443	20.504
	290.00	219163.	232925.	0.	34.194	0.	4.464	-67.420	20.639
	300.00	213684.	232922.	0.	35.071	0.	4.745	-68.534	20.601
	310.00	208205.	232915.	0.	35.992	0.	5.034	-69.680	20.486
	320.00	202727.	232907.	0.	36.964	0.	5.332	-70.821	20.330
	330.00	197249.	232892.	0.	37.988	0.	5.638	-71.956	20.126
	340.00	191772.	232878.	0.	39.070	0.	5.953	-73.093	19.869
	350.00	186296.	232862.	0.	40.216	0.	6.278	-74.232	19.517
	360.00	180821.	232846.	0.	41.431	0.	6.612	-75.361	19.213
	370.00	175347.	232819.	0.	42.719	0.	6.957	-76.496	18.874
	380.00	169873.	232790.	0.	44.090	0.	7.312	-77.634	18.500
	390.00	164399.	232766.	0.	45.553	0.	7.677	-78.776	18.073
	400.00	158926.	232742.	0.	47.117	0.	8.055	-79.922	17.596
	410.00	153435.	233621.	0.	48.988	0.	8.444	-81.169	16.997
	420.00	147945.	233062.	0.	50.684	0.	8.845	-82.342	16.434
	430.00	142465.	233046.	0.	52.630	0.	9.260	-83.428	15.986

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 2C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/S2)	DYNAMIC PRESSURE (LB/FT2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
440.00	136985.	233031.	0.	54.732	0.	9.687	-84.579	15.443
450.00	131507.	232811.	0.	56.958	0.	10.129	-85.730	14.854
460.00	126029.	232790.	0.	59.428	0.	10.586	-86.888	14.220
9) 469.00	121263.	197590.	0.	52.425	0.	11.010	-87.936	13.635
470.00	120763.	197448.	0.	52.604	0.	11.058	-88.002	13.580
480.00	116144.	196665.	0.	54.479	0.	11.544	-89.123	13.079
490.00	111562.	196553.	0.	56.685	0.	12.044	-90.268	12.511
500.00	106980.	196573.	0.	59.118	0.	12.560	-91.408	11.956
510.00	102399.	196570.	0.	61.763	0.	13.090	-92.751	11.166
520.00	97817.	196561.	0.	64.652	0.	13.638	-93.954	10.439
530.00	93235.	196550.	0.	67.826	0.	14.202	-95.051	9.833
540.00	88654.	196522.	0.	71.321	0.	14.784	-96.179	9.198
550.00	84073.	196473.	0.	75.188	0.	15.385	-97.336	8.561
560.00	79491.	196409.	0.	79.496	0.	16.006	-98.487	7.913
570.00	74911.	196306.	0.	84.312	0.	16.648	-99.961	6.766
580.00	70333.	196162.	0.	89.734	0.	17.312	-99.748	7.393
10) 583.18	68876.	196099.	0.	91.602	0.	17.528	-99.748	7.551
11) 583.38	68840.	137272.	0.	64.157	0.	17.542	-99.748	7.560
12) 583.98	68759.	5556.	0.	2.600	0.	17.583	-99.748	7.600
13) 593.18	68744.	0.	1.	-.000	0.	18.212	-99.767	8.236

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 2C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1) 140.85	21101728.	7566.60	66.290	21098301.	189297.	329829.	2926.88	898.90	6919.45
2) 142.17	21105722.	7550.97	66.554	21102140.	190484.	338970.	2885.61	898.53	6919.76
3) 145.57	21115774.	7526.32	67.230	21111775.	193538.	362506.	2786.22	897.12	6933.80
4) 148.57	21124422.	7549.13	67.794	21120031.	196225.	383383.	2718.63	894.61	6985.57
5) 152.77	21136243.	7598.21	68.566	21131264.	199977.	412902.	2630.67	892.46	7072.19
160.00	21155860.	7693.45	69.862	21149750.	206420.	464608.	2482.07	889.27	7227.56
6) 165.17	21169324.	7766.13	70.762	21162313.	211013.	502273.	2376.72	886.89	7340.12
170.00	21181480.	7836.85	71.582	21173553.	215290.	537973.	2278.79	884.64	7445.85
7) 171.47	21185097.	7859.02	71.827	21176877.	216588.	548927.	2249.17	883.95	7478.24
8) 175.00	21193650.	7916.37	72.405	21184696.	219707.	575480.	2179.47	882.19	7559.14
180.00	21205411.	7999.85	73.190	21195348.	224111.	613564.	2083.18	879.15	7673.66
190.00	21227878.	8166.24	74.483	21215338.	232866.	691389.	1919.32	871.75	7889.47
200.00	21249114.	8342.72	75.686	21233735.	241543.	771377.	1759.73	863.40	8109.18
210.00	21269137.	8529.70	76.838	21250530.	250131.	853592.	1599.08	854.08	8334.82
220.00	21287968.	8727.76	77.934	21265716.	258622.	938094.	1438.15	843.97	8566.98
230.00	21305633.	8937.97	78.981	21279289.	267008.	1024958.	1275.86	833.19	8807.11
240.00	21322141.	9159.06	79.980	21291227.	275283.	1114258.	1111.38	821.61	9054.19
250.00	21337513.	9391.19	80.926	21301514.	283436.	1206065.	945.83	808.82	9308.37
260.00	21351771.	9634.65	81.820	21310139.	291456.	1300451.	778.70	794.81	9570.19
270.00	21364941.	9890.72	82.663	21317085.	299328.	1397499.	609.77	779.59	9841.07
280.00	21377038.	10158.88	83.463	21322326.	307044.	1497302.	437.90	763.22	10120.70
290.00	21388082.	10438.26	84.213	21325836.	314588.	1599940.	263.76	745.34	10408.27
300.00	21398100.	10729.51	84.913	21327596.	321945.	1705496.	87.64	725.79	10704.58
310.00	21407121.	11033.14	85.566	21327581.	329099.	1814063.	-91.25	704.67	11010.24
320.00	21415169.	11349.47	86.175	21325762.	336033.	1925734.	-273.22	681.91	11325.68
330.00	21422273.	11678.83	86.740	21322107.	342731.	2040610.	-458.48	657.44	11651.30
340.00	21428462.	12021.58	87.263	21316581.	349176.	2158795.	-647.26	631.13	11987.54
350.00	21433767.	12378.20	87.744	21309150.	355348.	2280399.	-839.91	602.90	12334.95
360.00	21438220.	12749.24	88.185	21299770.	361227.	2405534.	-1036.84	572.65	12694.10
370.00	21441858.	13135.19	88.586	21288399.	366794.	2534322.	-1238.20	540.34	13065.53
380.00	21444718.	13536.71	88.948	21274991.	372027.	2666889.	-1444.37	505.85	13449.92
390.00	21446843.	13954.54	89.273	21259496.	376903.	2803367.	-1655.77	469.09	13848.01
400.00	21448276.	14389.49	89.561	21241858.	381400.	2943898.	-1872.80	429.87	14260.62
410.00	21449067.	14844.13	89.812	21222021.	385492.	3088639.	-2095.90	388.04	14690.29
420.00	21449266.	15318.17	90.031	21199917.	389153.	3237761.	-2326.38	343.68	15136.58
430.00	21448923.	15811.74	90.215	21175472.	392356.	3391428.	-2563.91	296.36	15599.67

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 2C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
	440.00	21448104.	16326.94	90.363	21148614.	395070.	3549819.	-2808.95	245.89	16081.61
	450.00	21446876.	16865.00	90.479	21119265.	397263.	3713128.	-3062.57	192.14	16583.49
	460.00	21445309.	17427.91	90.562	21087333.	398900.	3881563.	-3325.40	134.82	17107.18
9)	469.00	21443675.	17946.71	90.617	21056308.	399870.	4037719.	-3570.98	81.02	17587.66
	470.00	21443479.	17997.81	90.628	21052723.	399948.	4055330.	-3599.11	75.61	17634.11
	480.00	21441330.	18519.22	90.716	21015312.	400426.	4234024.	-3884.74	19.21	18107.18
	490.00	21438872.	19062.15	90.778	20974994.	400323.	4417534.	-4180.70	-40.13	18598.00
	500.00	21436183.	19629.28	90.810	20931663.	399611.	4606054.	-4487.32	-102.92	19109.21
	510.00	21433350.	20222.75	90.816	20885206.	398253.	4799795.	-4806.52	-169.09	19642.52
	520.00	21430450.	20844.94	90.798	20835483.	396217.	4998986.	-5140.58	-238.90	20199.73
	530.00	21427580.	21497.87	90.751	20782349.	393458.	5203879.	-5488.73	-313.74	20783.02
	540.00	21424855.	22184.38	90.674	20725658.	389924.	5414746.	-5852.02	-393.99	21394.98
	550.00	21422404.	22907.86	90.568	20665251.	385560.	5631887.	-6232.47	-479.76	22038.52
	560.00	21420365.	23672.30	90.432	20600944.	380309.	5855637.	-6632.25	-571.46	22717.05
	570.00	21418838.	24483.47	90.293	20532486.	374101.	6086354.	-7064.23	-671.48	23432.58
	580.00	21417982.	25343.99	90.089	20459636.	366860.	6324450.	-7506.39	-777.44	24194.37
10)	583.18	21417912.	25629.06	90.008	20435519.	364330.	6401860.	-7648.24	-812.26	24447.76
11)	583.38	21417912.	25646.13	90.003	20433988.	364168.	6406751.	-7657.01	-814.35	24462.85
12)	583.98	21417911.	25650.04	90.002	20429388.	363679.	6421429.	-7675.23	-815.09	24461.21
13)	593.18	21417906.	25651.12	90.001	20357538.	356158.	6646087.	-7944.11	-819.64	24376.20

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 2C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1) 140.85	291094.	6646.22	62.755	191284.	-1613.	219417.	2992.77	-30.22	5934.19
2) 142.17	299592.	6628.29	63.047	195211.	-1653.	227256.	2952.33	-30.05	5934.40
3) 145.57	321382.	6598.00	63.801	205076.	-1754.	247441.	2855.16	-30.02	5948.17
4) 148.57	340617.	6616.58	64.455	213542.	-1846.	265361.	2789.81	-31.14	5999.60
5) 152.77	367687.	6659.94	65.360	225081.	-1978.	290738.	2705.16	-31.24	6085.72
160.00	414769.	6746.01	66.881	244127.	-2201.	335307.	2562.42	-30.68	6240.33
6) 165.17	448820.	6812.66	67.938	257116.	-2359.	367865.	2461.37	-30.23	6352.41
170.00	480920.	6878.14	68.901	268775.	-2504.	398795.	2367.53	-29.70	6457.77
7) 171.47	490737.	6898.80	69.188	272230.	-2547.	408299.	2339.17	-29.53	6490.05
8) 175.00	514479.	6952.67	69.868	280373.	-2651.	431361.	2272.54	-29.15	6570.72
180.00	548400.	7031.68	70.791	291501.	-2795.	464502.	2180.68	-29.08	6684.93
190.00	617383.	7191.36	72.314	312510.	-3092.	532437.	2025.75	-30.27	6900.08
200.00	687958.	7362.25	73.730	332017.	-3403.	602528.	1875.42	-31.98	7119.30
210.00	760222.	7544.47	75.082	350017.	-3733.	674842.	1724.37	-34.17	7344.68
220.00	834271.	7738.54	76.364	366506.	-4087.	749443.	1573.41	-36.64	7576.81
230.00	910217.	7945.43	77.583	381483.	-4466.	826406.	1421.49	-39.23	7817.14
240.00	988171.	8163.81	78.744	394930.	-4872.	905809.	1267.76	-42.08	8064.67
250.00	1068242.	8393.84	79.837	406837.	-5310.	987723.	1113.39	-45.58	8319.54
260.00	1150544.	8635.74	80.866	417195.	-5786.	1072225.	957.85	-49.73	8582.31
270.00	1235200.	8890.72	81.833	425992.	-6306.	1159401.	800.96	-54.48	8854.40
280.00	1322337.	9158.21	82.745	433207.	-6877.	1249344.	641.60	-59.74	9135.52
290.00	1412074.	9437.32	83.596	438819.	-7504.	1342138.	480.43	-65.88	9424.85
300.00	1504534.	9728.66	84.388	442812.	-8198.	1437871.	317.78	-73.03	9723.20
310.00	1599844.	10032.69	85.123	445168.	-8967.	1536635.	152.87	-81.06	10031.20
320.00	1698136.	10349.69	85.805	445862.	-9822.	1638529.	-14.60	-90.02	10349.28
330.00	1799544.	10679.94	86.435	444868.	-10771.	1743656.	-184.80	-99.95	10677.87
340.00	1904206.	11023.79	87.015	442158.	-11824.	1852123.	-357.94	-110.94	11017.42
350.00	2012266.	11381.69	87.546	437700.	-12993.	1964043.	-534.35	-123.04	11368.47
360.00	2123869.	11754.15	88.031	431460.	-14289.	2079533.	-714.42	-136.33	11731.62
370.00	2239168.	12141.65	88.470	423400.	-15724.	2198718.	-898.25	-150.79	12107.44
380.00	2358322.	12544.83	88.865	413482.	-17309.	2321727.	-1086.22	-166.51	12496.60
390.00	2481495.	12964.40	89.218	401662.	-19058.	2448698.	-1278.68	-183.55	12899.88
400.00	2608858.	13401.17	89.529	387893.	-20985.	2579775.	-1476.04	-202.03	13318.10
410.00	2740601.	13857.69	89.799	372126.	-23104.	2715121.	-1678.62	-222.03	13753.85
420.00	2876924.	14333.64	90.033	354300.	-25430.	2854911.	-1887.75	-243.43	14206.70
430.00	3018022.	14829.16	90.229	334351.	-27978.	2999314.	-2103.06	-266.60	14676.86

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 2C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
	440.00	3164106.	15346.34	90.387	312218.	-30768.	3148514.	-2324.94	-291.69	15166.40
	450.00	3315402.	15886.41	90.509	287828.	-33819.	3302712.	-2554.40	-318.71	15676.46
	460.00	3472150.	16451.33	90.596	261104.	-37150.	3462120.	-2792.02	-347.89	16208.94
9)	469.00	3618094.	16971.89	90.653	234985.	-40406.	3610229.	-3014.18	-375.24	16697.88
	470.00	3634589.	17023.16	90.664	231957.	-40782.	3626951.	-3039.82	-377.76	16745.30
	480.00	3802347.	17546.29	90.756	200265.	-44692.	3796806.	-3300.02	-404.58	17228.42
	490.00	3975348.	18090.93	90.820	165926.	-48878.	3971583.	-3569.59	-432.93	17729.99
	500.00	4153820.	18659.77	90.852	128843.	-53357.	4151478.	-3848.77	-463.20	18252.66
	510.00	4338015.	19254.94	90.857	88913.	-58148.	4336714.	-4139.41	-495.20	18798.21
	520.00	4528204.	19878.80	90.837	46009.	-63267.	4527528.	-4443.70	-529.05	19368.54
	530.00	4724678.	20533.42	90.787	-3.	-68740.	4724178.	-4760.84	-566.07	19965.86
	540.00	4927758.	21221.62	90.705	-49254.	-74600.	4926947.	-5091.74	-606.49	20592.80
	550.00	5137794.	21946.80	90.593	-101890.	-80881.	5136146.	-5438.33	-650.23	21252.38
	560.00	5355170.	22712.91	90.450	-158079.	-87617.	5352119.	-5802.63	-697.52	21948.10
	570.00	5580309.	23525.79	90.305	-218057.	-94852.	5575240.	-6197.45	-750.28	22682.40
	580.00	5813684.	24387.97	90.093	-282045.	-102633.	5805932.	-6600.42	-806.42	23463.95
10)	583.18	5889781.	24673.54	90.009	-303258.	-105229.	5881027.	-6729.33	-824.83	23723.81
11)	583.38	5894592.	24690.64	90.004	-304605.	-105394.	5885773.	-6737.30	-825.91	23739.30
12)	583.98	5909034.	24694.53	90.002	-308652.	-105890.	5900017.	-6754.28	-824.80	23738.56
13)	593.18	6130434.	24695.29	90.001	-371949.	-113376.	6118090.	-7005.63	-802.33	23667.16

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 2C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	140.85	192427.	35.846	6735.33	52.938	45.040	-80.142	28.890	29.053
2)	142.17	196437.	37.119	6720.34	52.948	45.050	-80.125	28.905	29.068
3)	145.57	206528.	40.395	6678.95	52.956	45.075	-80.081	28.943	29.106
4)	148.57	215212.	43.300	6686.77	52.911	45.087	-80.042	28.977	29.141
5)	152.77	227084.	47.412	6715.59	52.847	45.119	-79.986	29.026	29.189
	160.00	246788.	54.624	6799.07	52.741	45.183	-79.889	29.110	29.274
6)	165.17	260317.	59.887	6866.18	52.668	45.230	-79.817	29.172	29.336
	170.00	272535.	64.882	6932.05	52.603	45.274	-79.750	29.231	29.395
7)	171.47	276170.	66.416	6952.82	52.584	45.288	-79.729	29.249	29.413
8)	175.00	284769.	70.138	7006.97	52.536	45.321	-79.679	29.292	29.457
	180.00	296596.	75.482	7086.33	52.467	45.363	-79.606	29.355	29.519
	190.00	319197.	86.424	7246.56	52.340	45.438	-79.457	29.483	29.648
	200.00	340572.	97.699	7417.94	52.217	45.511	-79.303	29.614	29.780
	210.00	360738.	109.318	7600.59	52.099	45.584	-79.144	29.750	29.916
	220.00	379717.	121.292	7795.06	51.986	45.658	-78.980	29.889	30.056
	230.00	397533.	133.635	8002.30	51.878	45.735	-78.810	30.033	30.200
	240.00	414199.	146.361	8221.01	51.776	45.814	-78.635	30.180	30.348
	250.00	429733.	159.482	8451.32	51.678	45.893	-78.453	30.333	30.501
	260.00	444160.	173.013	8693.47	51.584	45.973	-78.265	30.489	30.658
	270.00	457503.	186.969	8948.69	51.494	46.053	-78.071	30.651	30.820
	280.00	469780.	201.366	9216.39	51.410	46.136	-77.870	30.817	30.987
	290.00	481009.	216.220	9495.68	51.330	46.219	-77.662	30.988	31.158
	300.00	491218.	231.547	9787.20	51.254	46.303	-77.447	31.165	31.335
	310.00	500437.	247.363	10091.39	51.183	46.388	-77.224	31.347	31.518
	320.00	508690.	263.688	10408.53	51.117	46.474	-76.993	31.534	31.706
	330.00	516005.	280.538	10738.93	51.057	46.564	-76.754	31.727	31.899
	340.00	522413.	297.935	11082.91	51.003	46.656	-76.506	31.926	32.099
	350.00	527944.	315.898	11440.93	50.955	46.751	-76.250	32.131	32.305
	360.00	532632.	334.449	11813.52	50.914	46.849	-75.983	32.343	32.517
	370.00	536512.	353.612	12201.15	50.879	46.951	-75.707	32.561	32.735
	380.00	539623.	373.408	12604.45	50.852	47.058	-75.421	32.785	32.961
	390.00	542007.	393.865	13024.14	50.833	47.170	-75.123	33.017	33.193
	400.00	543709.	415.008	13461.05	50.822	47.287	-74.815	33.256	33.433
	410.00	544778.	436.866	13917.70	50.818	47.409	-74.494	33.503	33.680
	420.00	545265.	459.472	14393.79	50.825	47.539	-74.161	33.758	33.936
	430.00	545220.	482.856	14889.46	50.841	47.676	-73.814	34.020	34.199

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 2C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
	440.00	544710.	507.052	15406.80	50.866	47.820	-73.454	34.291	34.470
	450.00	543801.	532.096	15947.03	50.902	47.972	-73.079	34.571	34.751
	460.00	542566.	558.027	16512.12	50.949	48.132	-72.688	34.859	35.040
9)	469.00	541241.	582.156	17032.86	51.005	48.287	-72.322	35.127	35.309
	470.00	541080.	584.883	17084.15	51.014	48.306	-72.281	35.157	35.339
	480.00	539285.	612.607	17607.49	51.112	48.500	-71.858	35.434	35.646
	490.00	537193.	641.189	18152.35	51.223	48.706	-71.418	35.779	35.962
	500.00	534881.	670.666	18721.42	51.346	48.922	-70.962	36.102	36.286
	510.00	532436.	701.080	19316.84	51.482	49.151	-70.487	36.434	36.618
	520.00	529937.	732.475	19940.96	51.634	49.394	-69.994	36.776	36.960
	530.00	527479.	764.899	20595.86	51.798	49.647	-69.479	37.126	37.312
	540.00	525181.	798.405	21284.34	51.976	49.913	-68.944	37.487	37.673
	550.00	523169.	833.048	22009.82	52.169	50.194	-68.385	37.857	38.044
	560.00	521583.	868.892	22776.25	52.380	50.490	-67.801	38.238	38.426
	570.00	520525.	906.005	23589.46	52.606	50.801	-67.191	38.630	38.818
	580.00	520152.	944.464	24451.99	52.854	51.133	-66.552	39.034	39.222
10)	583.18	520239.	957.000	24737.68	52.939	51.244	-66.342	39.165	39.353
11)	583.38	520249.	957.793	24754.78	52.945	51.251	-66.329	39.173	39.362
12)	583.98	520278.	960.172	24758.71	52.971	51.279	-66.289	39.198	39.387
13)	593.18	520727.	996.651	24695.29	53.386	51.720	-65.673	39.576	39.765

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 2C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	140.85	-64.005	-.099	.001	.045	-.026	-.000	-.006	-.099	.001
2)	142.17	-63.985	-.207	-.001	.033	-.137	-.003	.014	-.207	-.001
3)	145.57	-63.592	-1.066	-.062	.138	-.202	-.056	.407	-1.066	-.065
4)	146.57	-63.512	-.894	-.340	-.060	.225	-.098	.489	-.893	-.345
5)	152.77	-63.811	-.204	-.566	-.038	.039	-.004	.189	-.203	-.567
	160.00	-63.872	-.298	-.685	-.011	.005	-.034	.128	-.297	-.686
6)	165.17	-63.931	-.269	-.648	-.009	.000	.005	.070	-.269	-.648
	170.00	-63.963	-.274	-.717	-.006	-.000	-.031	.037	-.274	-.717
7)	171.47	-63.971	-.274	-.769	-.005	.000	-.040	.029	-.274	-.770
8)	175.00	-63.976	-.315	-.645	-.002	-.008	.044	.025	-.315	-.645
	180.00	-60.758	-.762	.037	1.132	-.041	.109	-1.758	-.358	.053
	190.00	-55.852	-.825	-.097	-.220	-.023	-.143	.253	-.294	-.100
	200.00	-57.126	-.993	-.608	-.117	-.017	-.035	.164	-.297	-.610
	210.00	-58.094	-1.118	-.644	-.097	-.010	.064	.139	-.313	-.646
	220.00	-59.163	-1.219	-.030	-.128	-.007	.057	.201	-.330	-.034
	230.00	-60.548	-1.277	.513	-.130	-.009	.055	.180	-.326	.509
	240.00	-61.594	-1.434	.433	-.101	-.017	-.042	.143	-.321	.429
	250.00	-62.663	-1.598	.003	-.111	-.016	-.044	.154	-.326	-.001
	260.00	-63.783	-1.759	-.443	-.113	-.016	-.045	.156	-.330	-.447
	270.00	-65.091	-1.884	-.601	-.130	-.013	.051	.176	-.337	-.606
	280.00	-66.303	-2.039	-.071	-.110	-.018	.055	.141	-.335	-.075
	290.00	-67.271	-2.251	.505	-.104	-.019	.056	.147	-.343	.499
	300.00	-68.377	-2.434	.428	-.114	-.017	-.047	.156	-.354	.422
	310.00	-69.524	-2.601	-.046	-.115	-.017	-.048	.156	-.355	-.053
	320.00	-70.668	-2.773	-.524	-.114	-.017	-.048	.155	-.361	-.531
	330.00	-71.804	-2.944	-.547	-.113	-.018	.052	.154	-.365	-.555
	340.00	-72.938	-3.116	-.026	-.114	-.018	.052	.155	-.373	-.034
	350.00	-74.124	-3.292	.479	-.114	-.017	.051	.107	-.387	.474
	360.00	-75.244	-3.454	.453	-.114	-.015	-.049	.115	-.393	.446
	370.00	-76.380	-3.616	-.042	-.114	-.016	-.050	.116	-.398	-.049
	380.00	-77.519	-3.775	-.540	-.114	-.015	-.050	.116	-.402	-.548
	390.00	-78.663	-3.933	-.525	-.115	-.016	.050	.115	-.407	-.533
	400.00	-79.807	-4.092	-.029	-.115	-.015	.049	.115	-.418	-.037
	410.00	-81.044	-4.218	.439	-.125	-.013	.046	.124	-.425	.431
	420.00	-82.235	-4.363	.525	-.110	-.017	-.050	.104	-.426	.517
	430.00	-83.313	-4.533	.030	-.113	-.015	-.051	.114	-.435	.021

1) S-IC/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 2C (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
	440.00	-84.463	-4.680	-.488	-.116	-.014	-.052	.118	-.441	-.498
	450.00	-85.618	-4.824	-.568	-.115	-.014	.048	.114	-.446	-.577
	460.00	-86.773	-4.965	-.091	-.116	-.013	.047	.116	-.456	-.100
9)	469.00	-87.819	-5.087	.334	-.116	-.013	.047	.116	-.463	.324
	470.00	-87.930	-5.103	.382	-.122	-.022	.051	.071	-.433	.376
	480.00	-88.999	-5.302	.568	-.121	-.006	-.056	.121	-.478	.557
	490.00	-90.157	-5.387	.026	-.110	-.013	-.053	.109	-.472	.016
	500.00	-91.286	-5.510	-.512	-.121	-.008	-.056	.123	-.485	-.523
	510.00	-92.611	-5.550	-.532	-.140	-.006	.040	.142	-.486	-.545
	520.00	-93.844	-5.693	-.089	-.111	-.018	.047	.110	-.482	-.099
	530.00	-94.940	-5.868	.388	-.111	-.016	.047	.109	-.491	.377
	540.00	-96.063	-6.006	.573	-.114	-.012	-.054	.114	-.501	.561
	550.00	-97.218	-6.121	.024	-.116	-.011	-.055	.116	-.505	.012
	560.00	-98.374	-6.230	-.529	-.116	-.011	-.055	.114	-.509	-.541
	570.00	-100.005	-6.441	-.220	.020	.005	.086	-.043	-.533	-.215
	580.00	-99.787	-6.368	.574	.025	.011	-.016	-.041	-.542	.578
10)	583.18	-99.765	-6.359	.511	-.000	-.001	-.022	-.019	-.533	.512
11)	583.38	-99.765	-6.359	.506	-.000	-.001	-.022	-.019	-.534	.508
12)	583.98	-99.765	-6.360	.493	-.000	-.001	-.022	-.019	-.534	.495
13)	593.18	-99.767	-6.366	.293	.000	-.001	-.022	-.020	-.540	.295

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 3C-1

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC2)	PITCH ANGLE OF ATTACK (DEG)	AXIAL FORCE (LB)	NORMAL FORCE (LB)
1)	593.18	68744.	0.	1.	-.000	8.236	-1.	0.
2)	593.78	68743.	0.	1.	-.000	8.277	-1.	0.
	600.00	68731.	0.	1.	-.000	8.704	-1.	0.
3)	603.38	68725.	0.	1.	-.000	8.936	-1.	0.
4)	993.98	68647.	0.	1.	-.000	-.005	-1.	0.
	1000.00	68568.	0.	1.	-.000	-.022	-1.	0.
	1000.00	68466.	0.	1.	-.000	-.045	-1.	0.
	1200.00	68365.	0.	1.	-.000	-.067	-1.	0.
5)	1264.78	68332.	0.	1.	-.000	-.073	-1.	0.
6)	1283.38	68332.	0.	1.	-.000	-.075	-1.	0.
	1400.00	68332.	0.	1.	-.000	23.605	-1.	1.
	1600.00	68332.	0.	2.	.000	-118.278	1.	2.
	1800.00	68332.	0.	1.	.000	-176.905	1.	0.
	2000.00	68332.	0.	1.	.000	-176.912	1.	0.
	2200.00	68332.	0.	1.	.000	-176.927	1.	0.
	2400.00	68332.	0.	1.	.000	-176.947	1.	0.
	2600.00	68332.	0.	1.	.000	-176.971	1.	0.
	2800.00	68332.	0.	1.	.000	-176.996	1.	0.
7)	2993.38	68332.	0.	0.	.000	-177.017	0.	0.
	3000.00	68332.	0.	1.	.000	-175.327	0.	0.
	3200.00	68332.	0.	1.	.000	-129.069	1.	1.
	3400.00	68332.	0.	1.	-.000	-82.806	-0.	1.
8)	3533.38	68332.	0.	1.	-.000	-58.056	-1.	1.
9)	3580.38	68309.	0.	1.	-.000	-58.057	-1.	1.
	3600.00	68299.	0.	1.	-.000	-59.398	-1.	1.
	3800.00	68197.	0.	1.	-.000	-73.066	-0.	1.
	4000.00	68096.	0.	2.	-.000	-86.739	-0.	2.
	4200.00	67995.	0.	2.	.000	-100.420	0.	2.
	4400.00	67893.	0.	2.	.000	-114.109	1.	2.
10)	4433.38	67876.	0.	2.	.000	-116.395	1.	2.

1) ORBIT INSERTION; INERTIAL ATTITUDE HOLD AND LOX NPV IN PROGRESS;
2) BEGIN LH2 NPV;
3) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM ALONG THE LOCAL HORIZONTAL, NOSE LEADING, POSITION 1 DOWN;
4) END LOX NPV;
5) END LH2 NPV;
6) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM NOSE THREE DEGREES ABOVE THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;
7) INITIATE A MANEUVER TO POSITION THE S-IVB/CSM FOR SEPARATION;
8) BEGIN LH2 NPV;
9) BEGIN INERTIAL ATTITUDE HOLD;
10) END LH2 NPV;

TABLE 3C-1 (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC2)	PITCH ANGLE OF ATTACK (DEG)	AXIAL FORCE (LB)	NORMAL FORCE (LB)
11)	4440.20	37132.	0.	2.	.001	-116.062	1.	1.
	4600.00	37132.	0.	2.	.001	-127.608	1.	1.
	4800.00	37132.	0.	2.	.001	-141.517	1.	1.
	5000.00	37132.	0.	2.	.001	-155.232	1.	1.
12)	5040.20	65533.	0.	2.	.001	-157.989	2.	1.
	5200.00	65533.	0.	1.	.001	-168.950	1.	0.
	5400.00	65533.	0.	1.	.001	177.331	1.	0.
	5600.00	65533.	0.	1.	.001	163.015	1.	0.
	5800.00	65533.	0.	2.	.001	149.905	1.	1.
	6000.00	65533.	0.	2.	.001	136.199	1.	1.
	6200.00	65533.	0.	2.	.000	122.499	1.	2.
13)	6293.38	65533.	0.	2.	.000	116.103	1.	2.
	6400.00	65479.	0.	2.	.000	108.802	1.	2.
	6600.00	65378.	0.	2.	.000	95.107	0.	2.
14)	6773.38	65290.	0.	2.	-.000	83.234	-0.	2.
	6800.00	65290.	0.	2.	-.000	81.411	-0.	2.
	7000.00	65290.	0.	2.	-.000	67.714	-1.	2.
	7200.00	65290.	0.	2.	-.001	54.015	-1.	2.
	7400.00	65290.	0.	2.	-.001	40.315	-1.	1.
	7600.00	65290.	0.	1.	-.001	26.616	-1.	1.
	7800.00	65290.	0.	1.	-.000	12.919	-1.	0.
	8000.00	65290.	0.	1.	-.000	-.772	-1.	0.
	8200.00	65290.	0.	1.	-.000	-14.458	-1.	0.
	8400.00	65290.	0.	1.	-.000	-28.138	-1.	1.
15)	8513.38	65290.	0.	1.	-.000	-35.891	-1.	1.
	8600.00	65290.	0.	1.	-.000	-15.772	-1.	0.
	8800.00	65290.	0.	1.	-.000	30.497	-1.	1.
16)	8942.38	65290.	0.	1.	-.000	59.342	-1.	1.
	9000.00	65290.	0.	1.	-.000	65.402	-1.	1.
	9200.00	65290.	0.	1.	-.000	41.724	-1.	1.
17)	9240.20	32397.	0.	1.	-.001	38.974	-1.	1.
	9400.00	32397.	0.	1.	-.001	28.039	-1.	0.
	9600.00	32397.	0.	1.	-.001	14.346	-1.	0.
	9800.00	32397.	0.	1.	-.001	.642	-1.	0.

11) CSM SEPARATION; SLA PANEL JETTISON;
12) CSM DOCKING;
13) BEGIN LH2 NPV;
14) END LH2 NPV;
15) INITIATE A MANEUVER TO POSITION THE VEHICLE FOR DOCKING MODULE EXTRACTION;
16) BEGIN INERTIAL ATTITUDE HOLD;
17) DOCKING MODULE EXTRACTION;

TABLE 3C-1 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC2)	PITCH ANGLE OF ATTACK (DEG)	AXIAL FORCE (LB)	NORMAL FORCE (LB)
18)	9893.38	32397.	0.	1.	-.001	-5.759	-1.	0.
	10000.00	32397.	0.	2.	-.001	-44.916	-1.	1.
	10200.00	32397.	0.	2.	.001	-118.735	1.	2.
	10400.00	32397.	0.	1.	.001	179.948	1.	0.
	10600.00	32397.	0.	1.	.001	179.955	1.	0.
	10800.00	32397.	0.	1.	.001	179.966	1.	0.
	11000.00	32397.	0.	1.	.001	179.982	1.	0.
	11200.00	32397.	0.	1.	.001	-179.998	1.	0.
	11400.00	32397.	0.	1.	.001	-179.976	1.	0.
	11600.00	32397.	0.	1.	.001	-179.953	1.	0.
	11800.00	32397.	0.	1.	.001	-179.934	1.	0.
	12000.00	32397.	0.	1.	.001	-179.919	1.	0.
	12200.00	32397.	0.	1.	.001	-179.912	1.	0.
	12400.00	32397.	0.	1.	.001	-179.913	1.	0.
	12600.00	32397.	0.	1.	.001	-179.922	1.	0.
	12800.00	32397.	0.	1.	.001	-179.938	1.	0.
	13000.00	32397.	0.	1.	.001	-179.959	1.	0.
	13200.00	32397.	0.	1.	.001	-179.982	1.	0.
	13400.00	32397.	0.	1.	.001	179.996	1.	0.
	13600.00	32397.	0.	1.	.001	179.977	1.	0.
	13800.00	32397.	0.	0.	.000	179.962	0.	0.
	14000.00	32397.	0.	0.	.000	179.952	0.	0.
	14200.00	32397.	0.	0.	.000	179.947	0.	0.
	14400.00	32397.	0.	0.	.000	179.944	0.	0.
	14600.00	32397.	0.	1.	.001	179.944	1.	0.
	14800.00	32397.	0.	1.	.001	179.945	1.	0.
	15000.00	32397.	0.	1.	.001	179.945	1.	0.
	15200.00	32397.	0.	1.	.001	179.945	1.	0.
	15400.00	32397.	0.	1.	.001	179.946	1.	0.
	15600.00	32397.	0.	1.	.001	179.948	1.	0.
	15800.00	32397.	0.	1.	.001	179.954	1.	0.
	16000.00	32397.	0.	1.	.001	179.963	1.	0.
	16200.00	32397.	0.	1.	.001	179.977	1.	0.
	16400.00	32397.	0.	1.	.001	179.995	1.	0.
	16600.00	32397.	0.	1.	.001	-179.983	1.	0.
	16800.00	32397.	0.	1.	.001	-179.961	1.	0.
	17000.00	32397.	0.	1.	.001	-179.941	1.	0.
	17200.00	32397.	0.	1.	.001	-179.925	1.	0.
	17400.00	32397.	0.	1.	.001	-179.916	1.	0.
	17600.00	32397.	0.	1.	.001	-179.915	1.	0.

18) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/IU ALONG THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;

TABLE 3C-1 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC2)	PITCH ANGLE OF ATTACK (DEG)	AXIAL FORCE (LB)	NORMAL FORCE (LB)
17800.00	32397.	0.	1.	.001	-179.922	1.	0.
18000.00	32397.	0.	1.	.001	-179.936	1.	0.
18200.00	32397.	0.	1.	.001	-179.956	1.	0.
18400.00	32397.	0.	1.	.001	-179.977	1.	0.
18600.00	32397.	0.	1.	.001	-179.999	1.	0.
18800.00	32397.	0.	1.	.001	179.981	1.	0.
19000.00	32397.	0.	1.	.001	179.966	1.	0.
19200.00	32397.	0.	0.	.000	179.956	0.	0.
19400.00	32397.	0.	0.	.000	179.950	0.	0.
19600.00	32397.	0.	1.	.001	179.947	1.	0.
19800.00	32397.	0.	1.	.001	179.947	1.	0.
20000.00	32397.	0.	1.	.001	179.947	1.	0.
20200.00	32397.	0.	1.	.001	179.948	1.	0.
20400.00	32397.	0.	1.	.001	179.948	1.	0.
20600.00	32397.	0.	1.	.001	179.948	1.	0.
20800.00	32397.	0.	1.	.001	179.949	1.	0.
21000.00	32397.	0.	1.	.001	179.953	1.	0.
21200.00	32397.	0.	1.	.001	179.960	1.	0.
21400.00	32397.	0.	1.	.001	179.972	1.	0.
21600.00	32397.	0.	1.	.001	179.989	1.	0.
21800.00	32397.	0.	1.	.001	-179.991	1.	0.
22000.00	32397.	0.	1.	.001	-179.969	1.	0.
22200.00	32397.	0.	1.	.001	-179.949	1.	0.
22400.00	32397.	0.	1.	.001	-179.932	1.	0.
22600.00	32397.	0.	1.	.001	-179.921	1.	0.
22800.00	32397.	0.	1.	.001	-179.918	1.	0.
23000.00	32397.	0.	1.	.001	-179.923	1.	0.
23200.00	32397.	0.	1.	.001	-179.935	1.	0.
23400.00	32397.	0.	1.	.001	-179.953	1.	0.
23600.00	32397.	0.	1.	.001	-179.974	1.	0.
23800.00	32397.	0.	1.	.001	-179.995	1.	0.
24000.00	32397.	0.	1.	.001	179.986	1.	0.
24200.00	32397.	0.	1.	.001	179.970	1.	0.
24400.00	32397.	0.	1.	.001	179.959	1.	0.
24600.00	32397.	0.	1.	.001	179.953	1.	0.
24800.00	32397.	0.	1.	.001	179.950	1.	0.
25000.00	32397.	0.	1.	.001	179.950	1.	0.
25200.00	32397.	0.	1.	.001	179.950	1.	0.
25400.00	32397.	0.	1.	.001	179.951	1.	0.
25600.00	32397.	0.	1.	.001	179.950	1.	0.
25800.00	32397.	0.	1.	.001	179.950	1.	0.
26000.00	32397.	0.	2.	.002	179.950	2.	0.
26200.00	32397.	0.	2.	.002	179.953	2.	0.
26400.00	32397.	0.	2.	.002	179.958	2.	0.

TABLE 3C-1 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC2)	PITCH ANGLE OF ATTACK (DEG)	AXIAL FORCE (LB)	NORMAL FORCE (LB)
	26600.00	32397.	0.	1.	.001	179.969	1.	0.
	26800.00	32397.	0.	1.	.001	179.983	1.	0.
19)	27000.00	32397.	0.	1.	.001	-179.998	1.	0.

19) END OF IU BATTERY LIFETIME.

TABLE 3C-2

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	SPACE FIXED RADIUS (FT)	SPACE FIXED VELOCITY (FT/S)	SPACE FIXED PATH ANGLE (DEG)	SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	593.18	21417906.	25651.12	90.001	20357538.	356158.	6646087.	-7944.11	-819.64	24376.20
2)	593.78	21417905.	25651.10	90.001	20352766.	355666.	6660711.	-7961.60	-819.93	24370.46
	600.00	21417904.	25650.93	90.000	20302705.	350559.	6812040.	-8142.56	-822.83	24310.32
3)	603.38	21417904.	25650.83	90.000	20274994.	347773.	6894222.	-8240.83	-824.39	24277.03
4)	643.98	21417946.	25649.67	89.996	19916628.	313937.	7871325.	-9409.15	-842.04	23846.69
	800.00	21418839.	25644.88	89.979	18111220.	178372.	11433223.	-13666.90	-890.64	21681.38
	1000.00	21421755.	25638.49	89.956	14888185.	-2255.	15402388.	-18409.18	-906.94	17821.67
	1200.00	21426612.	25632.43	89.936	10817652.	-180940.	18494469.	-22101.91	-871.40	12952.51
5)	1264.78	21428563.	25630.61	89.930	9354820.	-236698.	19277309.	-23036.63	-849.13	11203.60
6)	1283.38	21429153.	25630.10	89.928	8924060.	-252425.	19480915.	-23279.72	-841.80	10688.67
	1400.00	21433136.	25627.04	89.919	6131385.	-347529.	20539475.	-24537.52	-786.64	7350.96
	1600.00	21440831.	25622.29	89.910	1095760.	-492665.	21407145.	-25579.05	-657.99	1334.56
	1800.00	21449029.	25618.09	89.908	-4003209.	-608310.	21063359.	-25167.95	-493.20	-4755.79
	2000.00	21456986.	25614.04	89.915	-8875942.	-688183.	19522969.	-23327.40	-302.03	-10574.51
	2200.00	21463990.	25609.72	89.929	-13245668.	-728105.	16873797.	-20161.88	-95.63	-15790.73
	2400.00	21469447.	25604.91	89.949	-16864253.	-726219.	13266753.	-15851.95	114.02	-20107.56
	2600.00	21472959.	25599.70	89.972	-19526463.	-683082.	8907223.	-10643.96	314.91	-23279.85
	2800.00	21474368.	25594.49	89.996	-21081722.	-601599.	4043212.	-4835.38	495.67	-25128.70
7)	2993.38	21473803.	25590.11	90.017	-21450147.	-491093.	-879901.	1041.30	641.82	-25560.86
	3000.00	21473752.	25589.98	90.017	-21442589.	-486832.	-1049011.	1243.12	646.23	-25551.60
	3200.00	21471385.	25586.96	90.035	-20589442.	-345671.	-6080773.	7247.32	758.41	-24527.41
	3400.00	21467661.	25586.24	90.048	-18571215.	-186423.	-10767343.	12839.06	826.33	-22116.31
8)	3533.38	21464638.	25587.37	90.053	-16631644.	-74702.	-13568845.	16182.51	845.28	-19802.15
9)	3580.38	21463499.	25588.10	90.055	-15845361.	-34928.	-14477745.	17267.60	846.82	-18869.36
	3600.00	21463014.	25588.46	90.056	-15502317.	-18316.	-14843814.	17704.70	846.67	-18455.25
	3800.00	21457847.	25593.87	90.059	-11556055.	149023.	-18079674.	21571.39	818.77	-13749.58
	4000.00	21452470.	25608.22	90.061	-6955049.	306107.	-20291429.	24221.00	744.68	-8262.12
	4200.00	21447078.	25612.84	90.060	-1959088.	444113.	-21352796.	25501.63	628.95	-2299.72
	4400.00	21441759.	25624.64	90.059	3149035.	555365.	-21201986.	25336.45	476.46	3802.30
10)	4433.38	21440880.	25626.63	90.059	3992123.	570874.	-21058215.	25167.14	450.56	4810.05

1) ORBIT INSERTION; INERTIAL ATTITUDE HOLD AND LOX NPV IN PROGRESS;
2) BEGIN LH2 NPV;
3) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM ALONG THE LOCAL HORIZONTAL, NOSE LEADING, POSITION 1 DOWN;
4) END LOX NPV;
5) END LH2 NPV;
6) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM NOSE THREE DEGREES ABOVE THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;
7) INITIATE A MANEUVER TO POSITION THE S-IVB/CSM FOR SEPARATION;
8) BEGIN LH2 NPV;
9) BEGIN INERTIAL ATTITUDE HOLD;
10) END LH2 NPV;

TABLE 3C-2 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
11)	4440.20	21440700.	25627.04	90.059	4163558.	573925.	-21024724.	25127.62	444.78	5014.99
	4600.00	21436534.	25636.27	90.058	8079175.	633767.	-19845661.	23729.30	302.06	9697.81
	4800.00	21431411.	25646.50	90.057	12550210.	675147.	-17359199.	20766.62	110.05	15049.19
	5000.00	21426446.	25654.30	90.054	16306346.	677490.	-13882962.	16614.19	-86.40	19547.50
12)	5040.20	21425479.	25655.52	90.053	16955097.	673232.	-13081384.	15655.78	-125.40	20324.53
	5200.00	21421794.	25659.12	90.049	19132212.	641055.	-9614612.	11508.57	-275.86	22931.79
	5400.00	21417730.	25660.68	90.041	20865701.	568339.	-4797776.	5743.17	-447.45	25005.73
	5600.00	21414625.	25659.20	90.028	21407606.	463919.	292180.	-349.71	-591.43	25650.00
	5800.00	21412888.	25655.30	90.010	20727365.	334147.	5364368.	-6419.49	-699.81	24829.32
	6000.00	21412873.	25649.90	89.990	18864567.	186757.	10129382.	-12118.72	-766.84	22593.49
	6200.00	21414810.	25643.89	89.967	15926282.	30395.	14315960.	-17123.24	-789.21	19073.04
13)	6293.38	21416401.	25641.10	89.957	14231317.	-43141.	16004062.	-19140.37	-784.08	17043.99
	6400.00	21418734.	25638.04	89.946	12080573.	-125899.	17686324.	-21150.08	-766.25	14470.52
	6600.00	21424448.	25632.78	89.928	7546704.	-273204.	20049428.	-23972.40	-699.84	9048.42
14)	6773.38	21430519.	25628.80	89.917	3258158.	-387186.	21177858.	-25319.59	-610.37	3921.89
	6800.00	21431518.	25628.24	89.916	2582678.	-403220.	21271510.	-25431.34	-594.28	3114.54
	7000.00	21439331.	25624.22	89.911	-2529267.	-508733.	21283537.	-25444.55	-456.05	-2994.62
	7200.00	21447165.	25620.37	89.915	-7498514.	-584008.	20085122.	-24011.10	-293.40	-8932.20
	7400.00	21454289.	25616.28	89.927	-12042508.	-625104.	17744682.	-21212.28	-115.93	-14360.34
	7600.00	21460063.	25611.70	89.945	-15902887.	-630080.	14395675.	-17207.72	66.03	-18969.69
	7800.00	21464037.	25606.62	89.967	-18860356.	-599093.	10229024.	-12226.47	241.98	-22497.87
	8000.00	21465980.	25601.38	89.990	-20747275.	-534359.	5482092.	-6553.53	401.91	-24745.10
	8200.00	21465912.	25596.55	90.011	-21457195.	-439997.	424933.	-512.62	536.88	-25585.78
	8400.00	21464052.	25592.92	90.030	-20950666.	-321765.	-4655274.	5553.19	639.54	-24975.00
15)	8513.38	21462339.	25591.73	90.038	-20131609.	-246770.	-7435685.	8872.28	681.25	-23994.90
	8600.00	21460769.	25591.37	90.043	-19257138.	-186701.	-9470607.	11301.38	704.49	-22949.96
	8800.00	21456488.	25592.61	90.052	-16472909.	-42700.	-13748540.	16408.89	726.56	-19626.50
16)	8942.38	21453063.	25595.37	90.056	-13910732.	60691.	-16331618.	19494.79	720.22	-16569.77
	9000.00	21451621.	25596.93	90.056	-12755520.	101936.	-17246981.	20589.07	710.90	-15191.70
	9200.00	21446496.	25604.29	90.058	-8314940.	238970.	-19767571.	23606.50	652.97	-9893.77
17)	9240.20	21445456.	25606.10	90.058	-7356738.	264898.	-20142388.	24056.18	636.76	-8750.26
	9400.00	21441324.	25614.10	90.058	-3402074.	360682.	-21166629.	25289.07	558.48	-4029.07
	9600.00	21436214.	25623.44	90.057	1704921.	460302.	-21363348.	25537.80	433.15	2072.84
	9800.00	21431189.	25637.09	90.056	6715984.	532377.	-20344729.	24333.37	284.40	8066.40

11) CSM SEPARATION; SLA PANEL JETTISON;
12) CSM DOCKING;
13) BEGIN LH2 NPV;
14) END LH2 NPV;
15) INITIATE A MANEUVER TO POSITION THE VEHICLE FOR DOCKING MODULE EXTRACTION;
16) BEGIN INERTIAL ATTITUDE HOLD;
17) DOCKING MODULE EXTRACTION;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 3C-2 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
18)	9893.38	21428864.	25642.25	90.055	8941819.	555453.	-19460164.	23288.08	209.36	10730.65
	10000.00	21426236.	25647.65	90.055	11345425.	573084.	-16169907.	21739.00	121.01	13608.95
	10200.00	21421405.	25655.82	90.053	15328359.	580443.	-14952629.	17896.79	-47.45	18380.75
	10400.00	21416784.	25661.18	90.050	18436310.	554421.	-10884564.	13031.15	-211.16	22105.22
	10600.00	21412602.	25663.41	90.043	20490856.	496926.	-6194951.	7415.58	-360.68	24566.03
	10800.00	21409194.	25662.59	90.032	21374210.	411669.	-1152057.	1375.87	-487.48	25621.05
	11000.00	21406957.	25659.32	90.017	21036126.	303923.	3955604.	-4739.93	-584.53	25210.95
	11200.00	21406266.	25654.44	89.998	19896596.	180190.	8836205.	-10580.98	-646.66	23361.83
	11400.00	21407406.	25648.86	89.976	16844337.	47795.	13211474.	-15814.22	-670.83	20182.29
	11600.00	21410482.	25643.36	89.955	13231319.	-85550.	16832518.	-20143.05	-656.20	15855.88
	11800.00	21415389.	25638.42	89.936	8863846.	-212189.	19493745.	-23323.13	-604.19	10629.94
	12000.00	21421779.	25634.22	89.922	3990771.	-324964.	21044257.	-25175.18	-518.30	4801.59
	12200.00	21429109.	25630.60	89.915	-1110528.	-417605.	21396239.	-25594.51	-403.89	-1298.36
	12400.00	21436700.	25627.18	89.916	-6149729.	-485080.	20529921.	-24557.06	-267.91	-7323.32
	12600.00	21443840.	25623.51	89.925	-10839967.	-523868.	18494836.	-22121.50	-118.44	-12930.19
	12800.00	21449871.	25619.27	89.941	-14914213.	-532142.	15407142.	-18426.64	35.73	-17799.01
	13000.00	21454294.	25614.35	89.961	-18140633.	-509861.	11443085.	-13683.98	185.64	-21652.00
	13200.00	21456822.	25608.99	89.983	-20335976.	-458742.	6828823.	-8165.36	322.72	-24270.21
	13400.00	21457403.	25603.76	90.004	-21376039.	-382142.	1827314.	-2186.46	439.28	-25506.45
	13600.00	21456196.	25599.45	90.022	-21202567.	-284826.	-3276941.	3912.19	528.95	-25293.22
	13800.00	21453524.	25596.94	90.037	-19826235.	-172671.	-8194161.	9785.23	587.04	-23645.46
	14000.00	21449793.	25596.99	90.046	-17325643.	-52309.	-12645670.	15101.84	610.72	-20658.36
	14200.00	21445401.	25600.10	90.051	-13842610.	69262.	-16379334.	19563.39	599.16	-16500.91
	14400.00	21440697.	25606.30	90.054	-9574167.	185079.	-19183445.	22918.80	553.52	-11406.35
	14600.00	21435893.	25615.19	90.054	-4761696.	288595.	-20898337.	24977.50	476.82	-5659.92
	14800.00	21431107.	25625.89	90.053	322232.	374050.	-21425419.	25619.79	373.82	415.66
	15000.00	21426364.	25637.24	90.053	5388855.	436780.	-20733031.	24804.36	250.72	6476.77
	15200.00	21421644.	25647.93	90.053	10149353.	473484.	-18858772.	22572.34	114.85	12177.54
	15400.00	21416962.	25656.77	90.052	14331391.	482402.	-15908010.	19046.88	-25.77	17189.69
	15600.00	21412392.	25662.87	90.050	17695036.	463409.	-12048299.	14427.55	-162.89	21222.68
	15800.00	21408140.	25665.82	90.045	20047039.	418013.	-7499948.	8979.30	-288.54	24042.12
	16000.00	21404510.	25665.70	90.036	21252375.	349238.	-2523419.	3016.38	-395.56	25484.76
	16200.00	21401889.	25663.01	90.022	21242198.	261429.	2596453.	-3117.15	-478.01	25468.51
	16400.00	21400668.	25658.56	90.005	20017675.	159967.	7566749.	-9068.72	-531.51	23996.61
	16600.00	21401165.	25653.25	89.984	17649588.	50932.	12103691.	-14498.20	-553.46	21156.21
	16800.00	21403550.	25647.90	89.963	14273871.	-59263.	15948826.	-19097.18	-543.15	17111.91
	17000.00	21407776.	25643.08	89.943	10083558.	-164250.	18883531.	-22605.62	-501.72	12095.51
	17200.00	21413571.	25639.00	89.928	5317688.	-258068.	20741182.	-24825.50	-432.08	6392.67
	17400.00	21420450.	25636.59	89.919	247810.	-335496.	21416389.	-25631.26	-338.69	327.37
	17600.00	21427775.	25632.47	89.918	-4837287.	-392342.	20870943.	-24976.87	-227.31	-5755.64

18) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/IU ALONG THE LOCAL HORIZONTAL, TAIL LEADING, POSITION I DOWN;

TABLE 3C-2 (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

ORBITAL FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
17800.00	21434844.	25629.19	89.925	-9647863.	-425667.	19136094.	-22899.10	-104.65	-11509.80
18000.00	21440996.	25625.35	89.939	-13909753.	-433938.	16310941.	-19516.21	21.99	-16606.49
18200.00	21445681.	25620.78	89.957	-17380107.	-417101.	12556876.	-15021.87	145.20	-20754.43
18400.00	21448574.	25615.61	89.978	-19861481.	-376563.	8088330.	-9673.91	257.88	-23717.26
18600.00	21449564.	25610.34	89.999	-21213132.	-315079.	3160309.	-3778.85	353.68	-25327.54
18800.00	21448771.	25605.70	90.018	-21358965.	-236567.	-1946394.	2326.71	427.38	-25496.19
19000.00	21446482.	25602.58	90.033	-20291547.	-145860.	-6941429.	8296.08	475.13	-24216.56
19200.00	21443085.	25601.81	90.043	-18072144.	-48398.	-11591281.	13792.21	494.68	-21563.45
19400.00	21438986.	25603.94	90.048	-14826921.	50087.	-15485155.	18505.93	485.41	-17687.75
19600.00	21434531.	25609.16	90.051	-10739746.	143908.	-18549292.	22171.97	448.34	-12807.49
19800.00	21429963.	25617.19	90.051	-6041977.	227739.	-20559328.	24582.62	386.06	-7196.24
20000.00	21425408.	25627.26	90.051	-999831.	296912.	-21400007.	25598.79	302.53	-1169.12
20200.00	21420890.	25638.28	90.050	4104247.	347674.	-21021932.	25158.35	202.88	4933.39
20400.00	21416391.	25648.98	90.050	8967537.	377391.	-19444862.	23281.14	93.14	10763.37
20600.00	21411879.	25658.12	90.050	13323584.	384696.	-16757168.	20069.76	-20.12	15985.72
20800.00	21407416.	25666.75	90.049	16918423.	369554.	-13111364.	15705.37	-130.22	20297.88
21000.00	21403154.	25669.34	90.046	19545405.	333251.	-8715566.	10437.89	-230.70	23449.11
21200.00	21399371.	25668.85	90.038	21053548.	278299.	-3821488.	4571.15	-315.83	25256.58
21400.00	21396435.	25666.73	90.027	21356474.	208261.	1290379.	-1556.01	-380.88	25616.69
21600.00	21394737.	25668.72	90.011	20437324.	127517.	6327266.	-7590.71	-422.43	24510.77
21800.00	21394634.	25657.72	89.991	18349453.	40988.	11001193.	-13187.31	-438.54	22005.02
22000.00	21396345.	25658.56	89.971	15212947.	-46170.	15045521.	-18027.21	-428.79	18245.26
22200.00	21399882.	25647.88	89.951	11207426.	-128873.	18229974.	-21836.24	-394.29	13447.56
22400.00	21405045.	25643.96	89.935	6561684.	-202399.	20373494.	-24399.10	-337.54	7885.61
22600.00	21411418.	25640.77	89.924	1540710.	-262653.	21354298.	-25570.72	-262.29	1875.71
22800.00	21418398.	25637.97	89.921	-3569214.	-306396.	21116691.	-25284.28	-173.28	-4240.34
23000.00	21425305.	25635.09	89.926	-8476659.	-331412.	19674352.	-23555.48	-75.98	-10113.94
23200.00	21431472.	25631.70	89.937	-12901623.	-336628.	17109729.	-20482.54	23.73	-15409.39
23400.00	21436336.	25629.53	89.955	-16591636.	-322152.	13569464.	-16241.32	119.96	-19823.61
23600.00	21439513.	25622.63	89.975	-19336380.	-289250.	9255996.	-11075.35	207.11	-23104.39
23800.00	21440854.	25617.41	89.995	-20979818.	-240245.	4415849.	-5281.23	280.24	-25065.55
24000.00	21440433.	25612.55	90.014	-21429070.	-178355.	-674764.	809.39	335.38	-25597.56
24200.00	21438502.	25608.94	90.029	-20659428.	-107482.	-5725895.	6849.72	369.70	-24673.11
24400.00	21435430.	25607.41	90.039	-18715386.	-31967.	-10450406.	12497.81	381.67	-22347.23
24600.00	21431616.	25608.64	90.045	-15707764.	43678.	-14580068.	17435.34	371.08	-18752.96
24800.00	21427421.	25612.90	90.048	-11807276.	115033.	-17880419.	21384.30	339.04	-14093.17
25000.00	21423110.	25620.04	90.048	-7234995.	178018.	-20163650.	24121.25	287.87	-8629.53
25200.00	21418808.	25629.42	90.048	-2250218.	229126.	-21299046.	25489.11	220.92	-2669.00
25400.00	21414542.	25640.02	90.047	2863751.	265613.	-21220532.	25406.20	142.42	3451.83
25600.00	21410293.	25650.59	90.048	7815336.	285647.	-19930870.	23872.16	57.24	9384.54
25800.00	21405999.	25659.91	90.048	12321218.	288407.	-17502034.	20969.84	-29.45	14788.37
26000.00	21401696.	25666.94	90.048	16122764.	274114.	-14071742.	16862.30	-112.44	19350.50
26200.00	21397480.	25671.06	90.046	19001317.	244007.	-9835780.	11784.39	-186.82	22805.63
26400.00	21393605.	25672.16	90.040	20791258.	200247.	-5036846.	6028.94	-248.32	24952.95

TABLE 3C-2 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
	26600.00	21390415.	25670.57	90.030	21389860.	145765.	49784.	-71.32	-293.55	25668.79
	26800.00	21388304.	25667.00	90.016	20763207.	84067.	5132419.	-6164.49	-320.20	24913.68
19)	27000.00	21387644.	25662.32	89.998	18947905.	19003.	9920074.	-11900.81	-327.13	22733.69

19) END OF IU BATTERY LIFETIME.

TABLE 3C-3

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	593.18	6130434.	24695.29	90.001	-371949.	-113376.	6118090.	-7005.63	-602.33	23667.16
2)	593.78	6144870.	24695.25	90.001	-376157.	-113857.	6132289.	-7021.98	-600.65	23662.32
	600.00	6294418.	24694.85	90.000	-420340.	-118788.	6279244.	-7191.22	-785.41	23611.55
3)	603.38	6375766.	24694.64	90.000	-444823.	-121431.	6359071.	-7283.14	-776.96	23583.41
4)	643.98	7350552.	24692.06	89.995	-762785.	-150880.	7309310.	-8377.12	-672.94	23217.86
	800.00	11058251.	24682.52	89.978	-2386921.	-222410.	10795279.	-12385.62	-235.13	21348.72
	1000.00	15678680.	24672.32	89.955	-5330156.	-208606.	14743369.	-16914.81	378.45	17957.43
	1200.00	20090410.	24665.78	89.933	-9092611.	-71108.	17914908.	-20542.12	990.82	13617.64
5)	1264.78	21464747.	24664.55	89.927	-10454756.	-814.	18746558.	-21490.92	1177.98	12045.44
6)	1283.38	21853869.	24664.27	89.925	-10856831.	21583.	18966295.	-21741.38	1230.11	11581.27
	1400.00	24234356.	24663.30	89.916	-13474222.	183273.	20142388.	-23079.62	1536.60	8558.54
	1600.00	28055792.	24664.16	89.906	-18242976.	535007.	21308099.	-24397.05	1954.82	3046.87
	1800.00	31504555.	24666.97	89.905	-23147155.	953228.	21350353.	-24428.44	2193.92	-2626.24
	2000.00	34535582.	24669.70	89.912	-27928565.	1398077.	20266897.	-23175.30	2216.15	-8160.15
	2200.00	37109483.	24670.36	89.927	-32336126.	1823821.	18115253.	-20707.10	2001.05	-13260.42
	2400.00	39193142.	24667.59	89.947	-36139215.	2182569.	15009862.	-17157.99	1547.72	-17654.98
	2600.00	40760232.	24660.98	89.971	-39139924.	2428276.	11116043.	-12719.46	875.55	-21109.54
	2800.00	41791601.	24651.22	89.996	-41183492.	2520748.	6641067.	-7629.41	23.35	-23440.86
7)	2993.38	42268298.	24640.37	90.017	-42151354.	2435502.	1985124.	-2342.43	-919.44	-24511.53
	3000.00	42275485.	24639.99	90.018	-42166246.	2429307.	1822876.	-2158.31	-953.04	-24526.78
	3200.00	42207549.	24629.60	90.036	-42040598.	2135841.	-3082783.	3406.03	-1984.51	-24312.10
	3400.00	41590784.	24622.50	90.050	-40816949.	1637002.	-7816024.	8774.07	-2993.39	-22810.59
8)	3533.38	40879116.	24620.67	90.056	-39421559.	1195724.	-10752350.	12107.34	-3613.65	-21131.28
9)	3580.38	40572068.	24620.68	90.057	-38826286.	1021073.	-11729008.	13217.23	-3816.78	-20418.50
	3600.00	40435333.	24620.79	90.058	-38562557.	945391.	-12126485.	13669.17	-3898.76	-20103.16
	3800.00	38758292.	24625.61	90.062	-35397595.	89651.	-15786305.	17840.83	-4622.10	-16332.85
	4000.00	36583561.	24636.90	90.063	-31488755.	-886582.	-18601862.	21076.15	-5092.89	-11697.65
	4200.00	33941814.	24653.34	90.062	-27040704.	-1926818.	-20423869.	23209.78	-5254.00	-6441.17
	4400.00	30870617.	24672.61	90.061	-22285734.	-2964903.	-21155387.	24132.11	-5066.66	-841.25
10)	4433.38	30319211.	24675.90	90.061	-21479509.	-3132957.	-21167660.	24163.81	-4999.94	106.05

1) ORBIT INSERTION; INERTIAL ATTITUDE HOLD AND LOX NPV IN PROGRESS;
2) BEGIN LH2 NPV;
3) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM ALONG THE LOCAL HORIZONTAL, NOSE LEADING, POSITION 1 DOWN;
4) END LOX NPV;
5) END LH2 NPV;
6) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM NOSE THREE DEGREES ABOVE THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;
7) INITIATE A MANEUVER TO POSITION THE S-IVB/CSM FOR SEPARATION;
8) BEGIN LH2 NPV;
9) BEGIN INERTIAL ATTITUDE HOLD;
10) END LH2 NPV;

TABLE 3C-3 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
11)	4440.20	30205308.	24676.57	90.061	-21314772.	-3166992.	-21166277.	24165.94	-4985.05	299.53
	4600.00	27414864.	24691.73	90.060	-17471932.	-3929097.	-20757373.	23795.56	-4514.39	4803.43
	4800.00	23627900.	24707.83	90.059	-12850358.	-4746849.	-19251322.	22218.48	-3605.86	10188.90
	5000.00	19574501.	24718.62	90.056	-8661749.	-5349957.	-16718647.	19485.37	-2375.92	15022.83
12)	5040.20	18734587.	24720.01	90.055	-7691910.	-5439853.	-16096909.	18808.47	-2094.80	15903.84
	5200.00	15339845.	24722.90	90.051	-5123600.	-5679740.	-13296621.	15743.21	-884.58	19041.81
	5400.00	11061273.	24720.57	90.042	-2418415.	-5691803.	-9170955.	11193.22	785.97	22027.27
	5600.00	7073963.	24712.73	90.029	-683977.	-5360004.	-4565466.	6079.20	2536.36	23818.67
	5800.00	4687100.	24701.46	90.011	+6234.	-4679282.	270529.	673.10	4256.29	24322.69
	6000.00	6275969.	24689.32	89.989	-415246.	-3667124.	5076175.	-4740.77	5831.81	23517.60
	6200.00	10058400.	24678.73	89.966	-1884282.	-2363558.	9593461.	-9881.34	7152.70	21453.16
13)	6293.38	12013793.	24674.85	89.955	-2912230.	-1671589.	11534987.	-12112.74	7653.69	20088.57
	6400.00	14279414.	24671.45	89.943	-4331928.	-829680.	13581152.	-14485.12	8119.66	18246.45
	6600.00	18495110.	24668.22	89.925	-7626904.	855211.	16827598.	-18318.90	8650.99	14074.78
14)	6773.38	22020860.	24668.43	89.913	-11035432.	2366111.	18908703.	-20869.57	8713.28	9852.49
	6800.00	22547138.	24668.66	89.912	-11595237.	2597723.	19161831.	-21190.59	8688.37	9165.91
	7000.00	26345938.	24671.43	89.908	-16029405.	4295548.	20962525.	-22958.15	8201.64	3766.31
	7200.00	29826403.	24674.59	89.912	-20699078.	5843455.	20664379.	-23536.49	7192.14	-1772.64
	7400.00	32935981.	24676.13	89.924	-25363007.	7139774.	19761588.	-22902.01	5694.26	-7210.06
	7600.00	35630931.	24674.49	89.943	-29781509.	8092993.	17808100.	-21094.00	3774.89	-12232.08
	7800.00	37875147.	24668.96	89.965	-33728925.	8628010.	14914551.	-18212.64	1530.54	-16568.49
	8000.00	39639798.	24659.95	89.989	-37005258.	8691567.	11241934.	-14413.23	-917.85	-19988.23
	8200.00	40903286.	24648.86	90.012	-39446358.	8256477.	6992444.	-9897.07	-3431.84	-22312.26
	8400.00	41651196.	24637.88	90.031	-40931968.	7324303.	2398069.	-4899.83	-5863.75	-23422.93
15)	8513.38	41843138.	24632.67	90.039	-41320767.	6585741.	-265437.	-1950.33	-7149.45	-23491.48
	8600.00	41876227.	24629.53	90.045	-41391331.	5926343.	-2292286.	321.50	-8065.46	-23269.26
	8800.00	41578057.	24626.05	90.054	-40806107.	4122826.	-6826331.	5501.91	-9897.11	-21868.21
16)	8942.38	41050294.	24627.34	90.058	-39769840.	2638563.	-9624690.	9021.07	-10906.71	-20153.65
	9000.00	40763220.	24628.82	90.059	-39210684.	2000452.	-10961777.	10381.15	-11235.26	-19302.32
	9200.00	39445033.	24638.18	90.060	-36690027.	-331679.	-14479040.	14715.62	-11980.45	-15714.93
17)	9240.20	39120984.	24640.79	90.060	-36082560.	-814820.	-15094250.	15501.36	-12051.95	-14887.14
	9400.00	37643635.	24653.13	90.060	-33375244.	-2747516.	-17192659.	18289.19	-12063.67	-11302.66
	9600.00	35386210.	24671.64	90.059	-29437092.	-5110725.	-18961066.	20923.18	-11451.89	-6305.91
	9800.00	32707434.	24690.92	90.058	-25077554.	-7282296.	-19694178.	22485.27	-10151.85	-997.03

11) CSM SEPARATION; SLA PANEL JETTISON;
12) CSM DOCKING;
13) BEGIN LH2 NPV;
14) END LH2 NPV;
15) INITIATE A MANEUVER TO POSITION THE VEHICLE FOR DOCKING MODULE EXTRACTION;
16) BEGIN INERTIAL ATTITUDE HOLD;
17) DOCKING MODULE EXTRACTION;

TABLE 3C-3 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
18)	9893.38	31324150.	24699.33	90.057	-22960058.	-8192582.	-19670275.	22823.24	-9321.22	1507.17
	10000.00	29650377.	24707.92	90.057	-20519819.	-9128719.	-19358419.	22896.82	-8211.98	4333.64
	10200.00	26268381.	24719.92	90.055	-15996983.	-10530304.	-17978795.	22138.12	-5721.61	9393.68
	10400.00	22628941.	24725.70	90.052	-11739923.	-11387047.	-15637545.	20251.09	-2807.49	13905.82
	10600.00	18823281.	24724.88	90.045	-7965161.	-11635478.	-12469473.	17336.66	373.24	17624.44
	10800.00	14991545.	24718.24	90.033	-4863552.	-11233846.	-8654073.	13549.35	3642.17	20350.46
	11000.00	11395396.	24707.71	90.018	-2590412.	-10185320.	-4405006.	9088.27	6810.48	21942.92
	11200.00	8621243.	24695.78	89.998	-1257752.	-8528898.	42329.	4185.25	9690.55	22326.18
	11400.00	7798084.	24684.93	89.976	-929017.	-6340041.	4444200.	-908.10	12107.24	21492.70
	11600.00	9477021.	24677.12	89.953	-1616454.	-3727124.	8562100.	-5933.56	13908.16	19501.70
	11800.00	12637034.	24673.33	89.934	-3281060.	-825963.	12175675.	-10638.91	14972.61	16474.46
	12000.00	16332812.	24673.45	89.919	-5834983.	2207279.	15094424.	-14789.71	15218.93	12586.81
	12200.00	20136230.	24676.29	89.912	-9146159.	5204486.	17167669.	-18180.04	14610.03	8059.31
	12400.00	23847954.	24679.99	89.913	-13045020.	7994903.	18292349.	-20642.25	13156.96	3145.47
	12600.00	27352070.	24682.47	89.922	-17332999.	10414900.	18418272.	-22055.34	10919.90	-1882.01
	12800.00	30572193.	24681.96	89.939	-21792561.	12317669.	17550452.	-22351.41	8006.32	-6746.30
	13000.00	33448998.	24677.50	89.959	-26198234.	13582231.	15748366.	-21519.47	4565.94	-11182.29
	13200.00	35935913.	24669.19	89.982	-30328127.	14121130.	13122052.	-19606.05	782.65	-14951.89
	13400.00	37995760.	24658.22	90.004	-33975185.	13886241.	9825320.	-16712.27	-3136.03	-17857.59
	13600.00	39599463.	24646.68	90.023	-36957560.	12872300.	6046496.	-12987.72	-6971.04	-19753.04
	13800.00	40725375.	24637.06	90.038	-39127450.	11117957.	1997466.	-8621.81	-10504.48	-20550.05
	14000.00	41358896.	24631.72	90.048	-40378090.	8704308.	-2098365.	-3833.62	-13531.72	-20221.71
	14200.00	41492199.	24632.38	90.053	-40648580.	5751104.	-6018334.	1139.04	-15872.57	-18802.07
	14400.00	41124105.	24639.66	90.056	-39926564.	2410861.	-9552448.	6050.48	-17381.11	-16382.97
	14600.00	40260013.	24652.94	90.056	-38248682.	-1138851.	-12514392.	10658.02	-17953.95	-13108.39
	14800.00	38912040.	24670.42	90.055	-35698933.	-4704612.	-14751261.	14732.69	-17536.99	-9166.06
	15000.00	37099240.	24689.43	90.055	-32404848.	-8087528.	-16151514.	18069.89	-16130.15	-4781.76
	15200.00	34848002.	24707.00	90.055	-28531567.	-11094308.	-16650805.	20499.74	-13789.72	-199.60
	15400.00	32192715.	24720.43	90.054	-24273928.	-13548510.	-16235306.	21896.70	-10627.40	4323.48
	15600.00	29176848.	24727.86	90.052	-19846770.	-15301214.	-14942124.	22187.30	-6805.67	8536.60
	15800.00	25855207.	24728.59	90.046	-15473993.	-16240403.	-12856773.	21355.09	-2529.34	12209.24
	16000.00	22298714.	24723.23	90.037	-11376913.	-16298284.	-10107643.	19442.10	1966.39	15145.18
	16200.00	18605914.	24713.50	90.023	-7762788.	-15455984.	-6857967.	16546.29	6430.04	17193.96
	16400.00	14932208.	24701.80	90.005	-4814149.	-13745276.	-3295783.	12815.63	10609.07	18258.87
	16600.00	11568274.	24690.65	89.983	-2679640.	-11247318.	377262.	8439.47	14264.60	18300.95
	16800.00	9123487.	24682.19	89.961	-1466741.	-8088535.	3957561.	3638.27	17184.93	17339.30
	17000.00	8588668.	24677.65	89.941	-1236656.	-4433997.	7250901.	-1347.51	19197.08	15448.07
	17200.00	10290825.	24677.18	89.925	-2001443.	-478694.	10082964.	-6268.85	20176.22	12750.87
	17400.00	13343786.	24679.82	89.916	-3723464.	3562861.	12308471.	-10879.68	20052.94	9413.07
	17600.00	16930279.	24683.83	89.915	-6317117.	7468228.	13818609.	-14948.39	18817.95	5632.23

18) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/IU ALONG THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 3C-3 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
17800.00	20644618.	24687.09	89.922	-9652879.	11019304.	14546379.	-18269.22	16523.96	1626.94
18000.00	24284751.	24687.70	89.936	-13563558.	14014641.	14469585.	-20672.91	13264.20	-2375.56
18200.00	27731787.	24684.45	89.956	-17852552.	16281060.	13611227.	-22036.06	9267.11	-6152.62
18400.00	30904290.	24677.15	89.977	-22303776.	17683892.	12037302.	-22288.04	4687.29	-9499.18
18600.00	33740737.	24666.74	89.999	-26692637.	18134985.	9852046.	-21414.86	-206.76	-12239.64
18800.00	36192375.	24655.10	90.019	-30797463.	17598094.	7191062.	-19459.62	-5147.10	-14237.43
19000.00	38220047.	24644.68	90.034	-34410717.	16091216.	4212755.	-16519.51	-9861.75	-15401.69
19200.00	39792639.	24637.95	90.044	-37349227.	13605897.	1088848.	-12740.16	-14089.70	-16690.68
19400.00	40886325.	24636.83	90.050	-39463190.	10503613.	-2005573.	-8308.01	-17594.73	-15112.11
19600.00	41484136.	24642.26	90.053	-40643425.	6709593.	-4901730.	-3441.45	-20177.53	-13720.95
19800.00	41575802.	24653.92	90.053	-40826822.	2504341.	-7446222.	1618.96	-21686.07	-11615.04
20000.00	41157738.	24670.29	90.053	-39999733.	-1686661.	-9509010.	6620.95	-22024.04	-8929.06
20200.00	40233173.	24688.90	90.052	-38199198.	-6224809.	-10990052.	11311.92	-21157.26	-5826.00
20400.00	38812364.	24706.81	90.052	-35511808.	-10271217.	-11824262.	15451.08	-19117.48	-2492.51
20600.00	36912817.	24721.20	90.052	-32070051.	-13799998.	-11984490.	18822.19	-16002.74	880.41
20800.00	34559611.	24729.99	90.051	-28046192.	-16611248.	-11482347.	21245.94	-11973.82	4100.00
21000.00	31785694.	24732.18	90.047	-23643725.	-18542840.	-10366664.	22590.86	-7246.03	6967.78
21200.00	28632533.	24728.11	90.040	-19086936.	-19480182.	-8719710.	22781.60	-2077.00	9389.58
21400.00	25151552.	24719.25	90.028	-14609151.	-19363172.	-6651379.	21803.49	3248.74	11184.58
21600.00	21407832.	24707.89	90.011	-10440486.	-18189881.	-4291827.	19703.11	8436.80	12291.76
21800.00	17490046.	24696.58	89.991	-6795853.	-16016819.	-1783151.	16585.20	13200.10	12673.18
22000.00	13539392.	24687.58	89.969	-3863886.	-12955833.	729332.	12606.46	17274.82	12334.28
22200.00	9845179.	24682.36	89.949	-1797381.	-9168013.	3105562.	7967.17	20434.39	11321.61
22400.00	7162569.	24681.32	89.932	-705510.	-4855056.	5218532.	2901.36	22501.21	9718.31
22600.00	6995562.	24683.73	89.921	-648188.	-248484.	6961034.	-2334.35	23355.90	7638.02
22800.00	9493645.	24687.96	89.918	-1632758.	4402712.	8251031.	-7472.80	22944.05	5217.57
23000.00	13150573.	24691.92	89.923	-3613148.	8845503.	9035475.	-12249.35	21280.04	2608.50
23200.00	17125139.	24693.59	89.935	-6491741.	12836669.	9292342.	-16415.50	18447.33	-32.05
23400.00	21096840.	24691.54	89.953	-10123964.	16156321.	9030799.	-19752.36	14594.85	-2550.89
23600.00	24912854.	24685.31	89.974	-14325492.	18620285.	8289486.	-22083.07	9929.07	-4807.96
23800.00	28478496.	24675.58	89.995	-18881664.	20090478.	7133036.	-23282.79	4702.28	-6684.65
24000.00	31724433.	24664.04	90.014	-23558672.	20482649.	5647095.	-23285.55	-602.21	-8090.37
24200.00	34595446.	24653.04	90.030	-28115684.	19770954.	3932251.	-22087.34	-6286.37	-8966.80
24400.00	37046131.	24645.11	90.041	-32317241.	17989243.	2097345.	-19745.56	-11453.98	-9289.83
24600.00	39039080.	24642.36	90.047	-35945234.	15229122.	252638.	-16375.49	-16026.23	-9069.13
24800.00	40544105.	24645.99	90.050	-38809926.	11635031.	-1996731.	-12144.33	-19755.74	-8345.71
25000.00	41537901.	24656.01	90.050	-40759572.	7396719.	-3056643.	-7263.39	-22438.69	-7187.98
25200.00	42003983.	24671.17	90.050	-41688323.	2739461.	-4348982.	-1978.77	-23925.15	-5686.65
25400.00	41932821.	24689.18	90.049	-41542134.	-2087580.	-5315503.	3439.60	-24127.44	-3940.64
25600.00	41322062.	24707.19	90.049	-40322307.	-6824446.	-5920421.	8710.69	-23026.06	-2090.43
25800.00	40176686.	24722.32	90.050	-38086242.	-11214378.	-6151581.	13556.61	-20672.64	-250.65
26000.00	38509244.	24732.27	90.050	-34945375.	-15017997.	-6020163.	17717.99	-17188.82	1517.32
26200.00	36339792.	24735.80	90.047	-31059831.	-18026824.	-5558872.	20969.22	-12760.59	3052.64
26400.00	33695847.	24732.96	90.042	-26630362.	-20075187.	-4818798.	23132.21	-7628.03	4292.36

TABLE 3C-3 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
	26600.00	30612028.	24725.00	90.031	-21887623.	-21049684.	-3865108.	24087.16	-2071.00	5181.24
	26800.00	27129789.	24714.07	90.017	-17079832.	-20895475.	-2771993.	23779.31	3607.54	5684.65
19)	27000.00	23297262.	24702.73	89.998	-12459379.	-19619145.	-1617227.	22221.51	9099.31	5799.27

19) END OF IU BATTERY LIFETIME.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 3C-4

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	INERTIAL RANGE ANGLE (DEG)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	593.18	520727.	18.212	53.386	51.720	-65.673	39.576	39.765
2)	593.78	520756.	18.254	53.414	51.749	-65.633	39.601	39.790
	600.00	521061.	18.679	53.699	52.052	-65.213	39.854	40.044
3)	603.38	521286.	18.910	53.856	52.219	-64.983	39.991	40.181
4)	643.98	523212.	21.690	55.826	54.303	-62.144	41.596	41.787
	800.00	530606.	32.379	64.983	63.894	-49.794	46.914	47.106
	1000.00	538571.	46.087	80.132	79.742	-30.631	51.085	51.273
	1200.00	543781.	59.792	97.372	97.663	-9.489	51.389	51.576
5)	1264.78	544810.	64.231	102.782	103.291	-2.811	50.610	50.799
6)	1283.38	545042.	65.505	104.285	104.857	-.942	50.312	50.501
	1400.00	545916.	73.493	113.036	113.992	10.127	47.744	47.936
	1600.00	545439.	87.187	124.869	126.435	26.087	41.054	41.244
	1800.00	543521.	100.874	132.883	134.971	38.548	32.415	32.590
	2000.00	541688.	114.553	137.928	140.418	48.536	22.640	22.777
	2200.00	541422.	128.224	140.749	143.501	57.029	12.242	12.322
	2400.00	543761.	141.887	141.792	144.649	64.795	1.558	1.568
	2600.00	549006.	155.538	141.222	144.023	72.470	-9.157	-9.217
	2800.00	556603.	169.156	138.954	141.540	80.671	-19.656	-19.779
7)	2993.38	564953.	177.262	134.813	137.051	89.771	-29.322	-29.486
	3000.00	565236.	176.854	134.631	136.855	90.112	-29.640	-29.805
	3200.00	573108.	163.414	127.600	129.336	101.703	-38.660	-38.848
	3400.00	578387.	149.780	117.001	118.149	116.494	-46.014	-46.206
8)	3533.38	579591.	140.677	107.681	108.399	128.481	-49.494	-49.684
9)	3580.38	579459.	137.469	104.003	104.565	133.083	-50.371	-50.560
	3600.00	579382.	136.129	102.417	102.913	135.053	-50.677	-50.866
	3800.00	575295.	122.470	85.328	85.144	156.030	-51.615	-51.802
	4000.00	566293.	108.802	69.236	68.383	176.046	-48.561	-48.752
	4200.00	553190.	95.125	56.762	55.288	-167.397	-42.290	-42.482
	4400.00	537923.	81.438	48.185	46.176	-154.436	-33.903	-34.081
10)	4433.38	535314.	79.152	47.080	44.992	-152.559	-32.342	-32.536

1) ORBIT INSERTION; INERTIAL ATTITUDE HOLD AND LOX NPV IN PROGRESS;
2) BEGIN LH2 NPV;
3) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM ALONG THE LOCAL HORIZONTAL, NOSE LEADING, POSITION 1 DOWN;
4) END LOX NPV;
5) END LH2 NPV;
6) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM NOSE THREE DEGREES ABOVE THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;
7) INITIATE A MANEUVER TO POSITION THE S-IVB/CSM FOR SEPARATION;
8) BEGIN LH2 NPV;
9) BEGIN INERTIAL ATTITUDE HOLD;
10) END LH2 NPV;

TABLE 3C-4 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	INERTIAL RANGE ANGLE (DEG)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
11)	4440.20	534781.	78.686	46.865	45.761	-152.184	-32.044	-32.217
	4600.00	522687.	67.741	42.715	40.284	-144.110	-24.258	-24.403
	4800.00	509746.	54.037	39.571	36.858	-135.413	-13.909	-13.999
	5000.00	500930.	40.325	38.263	35.423	-127.546	-3.216	-3.238
12)	5040.20	499765.	37.568	38.199	35.353	-126.008	-1.049	-1.056
	5200.00	497275.	26.611	38.589	35.783	-119.861	7.555	7.605
	5400.00	498834.	12.911	40.601	37.989	-111.734	18.155	18.270
	5600.00	504705.	1.439	44.620	42.350	-102.466	28.289	28.450
	5800.00	513260.	14.644	51.266	49.469	-91.166	37.526	37.712
	6000.00	522532.	28.350	61.404	60.182	-76.770	45.191	45.383
	6200.00	530664.	42.066	75.578	75.001	-58.578	50.283	50.472
13)	6293.38	533663.	48.470	83.344	83.082	-48.980	51.458	51.646
	6400.00	536386.	55.781	92.594	92.696	-37.650	51.719	51.906
	6600.00	538882.	69.491	109.038	109.813	-17.278	49.107	49.297
14)	6773.38	538826.	81.371	120.522	121.847	-2.280	44.086	44.279
	6800.00	538667.	83.195	122.010	123.414	-.239	43.140	43.332
	7000.00	536680.	96.892	131.008	132.961	13.105	34.939	35.120
	7200.00	534396.	110.582	136.787	139.179	23.674	25.409	25.559
	7400.00	533357.	124.264	140.164	142.858	32.498	15.137	15.235
	7600.00	534759.	137.939	141.668	144.511	40.402	4.438	4.529
	7800.00	539131.	151.606	141.538	144.369	48.048	-6.237	-6.279
	8000.00	546149.	165.256	139.756	142.414	56.046	-16.828	-16.935
	8200.00	554685.	178.529	136.043	138.377	65.074	-26.995	-27.150
	8400.00	563027.	167.337	129.826	131.705	75.984	-36.339	-36.523
15)	8513.38	566939.	159.607	124.876	126.446	83.400	-41.048	-41.238
	8600.00	569262.	153.696	120.270	121.585	89.819	-44.238	-44.431
	8800.00	571696.	140.037	106.719	107.396	107.393	-49.747	-49.936
16)	8942.38	570485.	130.309	94.991	95.188	121.904	-51.593	-51.780
	9000.00	569248.	126.371	90.003	90.003	128.012	-51.765	-51.952
	9200.00	561703.	112.697	73.279	72.603	148.640	-49.746	-49.936
17)	9240.20	559621.	109.947	70.236	69.427	152.479	-48.885	-49.075
	9400.00	549804.	99.014	59.712	58.399	166.237	-44.228	-44.420
	9600.00	535150.	85.322	50.145	48.270	-179.905	-36.307	-36.490
	9800.00	519898.	71.620	43.925	41.596	-168.973	-26.930	-27.085

11) CSM SEPARATION; SLA PANEL JETTISON;
12) CSM DOCKING;
13) BEGIN LH2 NPV;
14) END LH2 NPV;
15) INITIATE A MANEUVER TO POSITION THE VEHICLE FOR DOCKING MODULE EXTRACTION;
16) BEGIN INERTIAL ATTITUDE HOLD;
17) DOCKING MODULE EXTRACTION;

TABLE 3C-4 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	INERTIAL RANGE ANGLE (DEG)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
18)	9893.38	513218.	65.220	41.923	39.426	-164.570	-22.239	-22.374
	10000.00	506334.	57.910	40.217	37.567	-159.922	-16.723	-16.830
	10200.00	496461.	44.193	38.449	35.628	-151.896	-6.089	-6.130
	10400.00	491518.	30.470	38.344	35.514	-144.220	4.689	4.721
	10600.00	491812.	16.750	39.888	37.210	-136.270	15.365	15.464
	10800.00	496665.	3.131	43.327	40.953	-127.380	25.661	25.812
	11000.00	504599.	10.786	49.200	47.266	-116.714	35.194	35.375
	11200.00	513689.	24.497	58.330	56.948	-103.235	43.363	43.556
	11400.00	522015.	38.222	71.456	70.703	-86.039	49.251	49.442
	11600.00	528076.	51.946	87.994	87.915	-65.571	51.737	51.924
	11800.00	531100.	65.665	104.964	105.564	-44.687	50.164	50.353
	12000.00	531168.	79.379	118.998	120.242	-26.632	44.970	45.163
	12200.00	529156.	93.087	128.995	130.812	-12.374	37.251	37.436
	12400.00	526480.	106.788	135.534	137.822	-1.176	27.996	28.156
	12600.00	524737.	120.482	139.478	142.105	8.022	17.869	17.982
	12800.00	525268.	134.169	141.438	144.256	16.104	7.290	7.339
	13000.00	528811.	147.849	141.726	144.573	23.764	-3.451	-3.474
	13200.00	535293.	161.520	140.387	143.103	31.616	-14.110	-14.202
	13400.00	543710.	175.143	137.215	139.645	40.310	-24.425	-24.570
	13600.00	552511.	171.077	131.713	133.719	50.648	-34.036	-34.215
	13800.00	559757.	157.429	123.098	124.565	63.635	-42.390	-42.581
	14000.00	563691.	143.761	110.577	111.422	80.234	-48.623	-48.814
	14200.00	562866.	130.087	94.443	94.618	100.291	-51.629	-51.816
	14400.00	556972.	116.407	77.347	76.842	121.283	-50.634	-50.822
	14600.00	546431.	102.719	62.790	61.634	139.828	-45.909	-46.101
	14800.00	532632.	89.023	52.230	50.490	154.600	-38.495	-38.683
	15000.00	517611.	75.317	45.240	43.015	166.180	-29.414	-29.579
	15200.00	503657.	61.603	40.958	38.377	175.623	-19.370	-19.490
	15400.00	492878.	47.880	38.734	35.943	-176.159	-8.810	-8.869
	15600.00	486737.	34.152	38.219	35.377	-168.448	1.959	1.973
	15800.00	485803.	20.421	39.333	36.603	-160.623	12.689	12.772
	16000.00	489680.	6.707	42.255	39.792	-152.037	23.115	23.254
	16200.00	496911.	7.107	47.448	45.393	-141.907	32.890	33.065
	16400.00	505792.	20.823	55.674	54.145	-129.235	41.479	41.670
	16600.00	514314.	34.555	67.772	66.856	-113.009	48.047	48.239
	16800.00	520884.	48.287	83.649	83.399	-93.177	51.485	51.673
	17000.00	524410.	62.014	100.884	101.315	-72.033	50.934	51.122
	17200.00	524896.	75.736	115.865	116.952	-53.066	46.552	46.744
	17400.00	523006.	89.453	126.857	128.539	-37.886	39.355	39.544
	17600.00	520073.	103.163	134.178	136.358	-26.020	30.405	30.573

18) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/IU ALONG THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;

TABLE 3C-4 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (FT)	INERTIAL RANGE ANGLE (DEG)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
17800.00	517703.	116.867	138.701	141.255	-16.409	20.444	20.570
18000.00	517359.	130.564	141.115	143.898	-8.116	9.941	10.007
18200.00	519956.	144.255	141.803	144.657	-.405	-.789	-.794
18400.00	525637.	157.939	140.676	143.637	7.347	-11.497	-11.573
18600.00	533654.	171.609	138.188	140.701	15.772	-21.931	-22.065
18800.00	542543.	174.654	133.320	135.441	25.625	-31.763	-31.936
19000.00	550415.	160.999	125.549	127.156	37.869	-40.497	-40.687
19200.00	555386.	147.323	114.021	115.024	53.534	-47.352	-47.543
19400.00	555997.	133.641	98.614	98.955	72.895	-51.248	-51.436
19600.00	551542.	119.955	81.393	81.053	94.009	-51.249	-51.437
19800.00	542262.	106.261	65.974	64.972	113.384	-47.350	-47.541
20000.00	529322.	92.559	54.433	52.827	129.073	-40.481	-40.672
20200.00	514619.	78.849	46.654	44.537	141.337	-31.723	-31.896
20400.00	500420.	65.130	41.786	39.279	151.210	-21.859	-21.992
20600.00	488889.	51.403	39.106	36.352	159.657	-11.388	-11.463
20800.00	481687.	37.669	38.195	35.352	167.434	-.641	-.645
21000.00	479595.	23.930	38.911	36.141	175.179	10.125	10.191
21200.00	482401.	10.193	41.369	38.830	-176.479	20.655	20.782
21400.00	488975.	3.599	45.960	43.796	-166.797	30.630	30.799
21600.00	497550.	17.317	53.380	51.717	-154.829	39.569	39.758
21800.00	506162.	31.058	64.503	63.435	-139.514	46.718	46.910
22000.00	513069.	44.797	79.604	79.193	-120.426	51.008	51.196
22200.00	517119.	58.533	96.863	97.133	-99.257	51.438	51.625
22400.00	518004.	72.264	112.646	113.581	-79.516	47.892	48.083
22600.00	516270.	85.989	124.612	126.160	-63.419	41.255	41.446
22800.00	513136.	99.708	132.730	134.801	-50.853	32.636	32.811
23000.00	510197.	113.422	137.843	140.321	-40.796	22.858	22.996
23200.00	509008.	127.129	140.711	143.453	-32.259	12.444	12.526
23400.00	510663.	140.831	141.786	144.636	-24.464	1.738	1.750
23600.00	515502.	154.527	141.241	144.037	-16.771	-9.004	-9.063
23800.00	522993.	168.216	138.991	141.573	-8.559	-19.534	-19.655
24000.00	531821.	178.049	134.682	136.904	.890	-29.548	-29.714
24200.00	540154.	164.394	127.660	129.395	12.489	-38.601	-38.789
24400.00	546060.	150.708	117.058	118.207	27.296	-45.984	-46.176
24600.00	547933.	137.018	102.454	102.951	45.887	-50.669	-50.858
24800.00	544867.	123.323	85.331	85.147	66.909	-51.614	-51.801
25000.00	536870.	109.623	69.208	68.355	86.965	-48.551	-48.741
25200.00	524882.	95.915	56.722	55.248	103.546	-42.259	-42.451
25400.00	510683.	82.200	48.146	46.137	116.518	-33.848	-34.026
25600.00	496374.	68.475	42.684	40.255	126.851	-24.180	-24.324
25800.00	484277.	54.743	39.551	36.842	135.554	-13.809	-13.898
26000.00	476163.	41.003	38.259	35.423	143.429	-3.096	-3.116
26200.00	473005.	27.258	38.605	35.805	151.132	7.692	7.743
26400.00	474818.	13.510	40.645	38.040	159.283	18.305	18.420

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 3C-4 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	INERTIAL RANGE ANGLE (DEG)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
	26600.00	480653.	.370	44.704	42.445	168.591	28.444	28.605
	26800.00	488853.	13.999	51.413	49.628	179.954	37.675	37.862
19)	27000.00	497456.	27.748	61.639	60.431	-165.557	45.315	45.508

19) END OF IU BATTERY LIFETIME.

TABLE 3C-5

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	RELATIVE VEHICLE ATTITUDE PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	593.18	-99.767	-6.366	.293	.000	.000	.000	8.181	-4.690	-.918
2)	593.78	-99.767	-6.366	.293	.000	.000	.000	8.223	-4.690	-.918
	600.00	-99.767	-6.366	.293	.000	.000	.000	8.649	-4.690	-.918
3)	603.38	-99.767	-6.366	.293	.000	.000	.000	8.881	-4.691	-.918
4)	643.98	-111.537	-1.881	.640	.000	.000	.000	.000	.000	-.000
	800.00	-122.247	-1.990	.477	-.069	-.000	-.002	.000	.000	-.000
	1000.00	-135.973	-2.027	-.006	-.069	.000	-.002	.000	.000	.000
	1200.00	-149.693	-1.948	-.484	-.069	.001	-.002	.000	.000	.000
5)	1264.78	-153.135	-1.898	-.633	.000	.000	.000	.000	.000	.000
6)	1283.38	-155.410	-1.881	-.675	-.069	.001	-.002	.000	.000	.000
	1400.00	-120.425	1.707	-58.984	.300	-.001	-.500	42.988	3.626	-59.503
	1600.00	-60.425	1.399	-158.984	.300	-.002	-.500	116.717	1.915	-160.889
	1800.00	-13.792	1.014	-178.319	-.068	-.002	.001	177.000	-.000	-180.000
	2000.00	-27.469	.576	-178.129	-.068	-.002	.001	177.000	-.000	-180.000
	2200.00	-41.137	.110	-178.048	-.068	-.002	.000	177.000	-.000	-180.000
	2400.00	-54.798	-.358	-178.078	-.068	-.002	-.000	177.000	.000	180.000
	2600.00	-68.456	-.800	-178.216	-.068	-.002	-.001	177.000	.000	-180.000
	2800.00	-82.112	-1.192	-178.455	-.068	-.002	-.001	177.000	.000	-180.000
7)	2993.38	-95.316	-1.503	-178.766	-.068	-.001	-.002	177.000	.000	-180.000
	3000.00	-99.302	-.335	178.085	-.300	.053	-.452	175.492	1.210	176.903
	3200.00	-157.302	.117	178.071	-.300	.002	.000	129.126	1.905	178.806
	3400.00	142.698	.558	178.167	-.300	.002	.001	82.772	.820	-179.935
8)	3533.38	108.807	.834	178.289	.000	.000	.000	58.000	-.000	180.000
9)	3580.38	105.597	.926	178.342	-.068	.002	.001	58.000	-.000	180.000
	3600.00	105.597	.926	178.342	.000	.000	.000	59.340	.001	179.998
	3800.00	105.597	.926	178.342	.000	.000	.000	73.005	.009	179.980
	4000.00	105.597	.926	178.342	.000	.000	.000	86.676	.013	179.960
	4200.00	105.597	.926	178.342	.000	.000	.000	100.357	.012	179.941
	4400.00	105.597	.926	178.342	.000	.000	.000	114.046	.007	179.926
10)	4433.38	105.597	.926	178.342	.000	.000	.000	116.332	.006	179.924

1) ORBIT INSERTION; INERTIAL ATTITUDE HOLD AND LOX NPV IN PROGRESS;
2) BEGIN LH2 NPV;
3) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM ALONG THE LOCAL HORIZONTAL, NOSE LEADING, POSITION 1 DOWN;
4) END LOX NPV;
5) END LH2 NPV;
6) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/CSM NOSE THREE DEGREES ABOVE THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;
7) INITIATE A MANEUVER TO POSITION THE S-IVB/CSM FOR SEPARATION;
8) BEGIN LH2 NPV;
9) BEGIN INERTIAL ATTITUDE HOLD;
10) END LH2 NPV;

TABLE 3C-5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	RELATIVE VEHICLE ATTITUDE PITCH (DEG)	YAW (DEG)	ROLL (DEG)
11)	4440.20	105.597	.926	178.342	.000	.000	.000	116.799	.006	179.923
	4600.00	105.597	.926	178.342	.000	.000	.000	127.746	.001	179.915
	4800.00	105.597	.926	178.342	.000	.000	.000	141.454	-.005	179.909
	5000.00	105.597	.926	178.342	.000	.000	.000	155.171	-.009	179.906
12)	5040.20	105.597	.926	178.342	.000	.000	.000	157.929	-.009	179.906
	5200.00	105.597	.926	178.342	.000	.000	.000	168.894	-.008	179.907
	5400.00	105.597	.926	178.342	.000	.000	.000	-177.378	-.002	179.907
	5600.00	105.597	.926	178.342	.000	.000	.000	-163.640	.009	179.905
	5800.00	105.597	.926	178.342	.000	.000	.000	-149.918	.022	179.900
	6000.00	105.597	.926	178.342	.000	.000	.000	-136.189	.035	179.889
	6200.00	105.597	.926	178.342	.000	.000	.000	-122.465	.048	179.874
13)	6293.38	105.597	.926	178.342	.000	.000	.000	-116.058	.052	179.866
	6400.00	105.597	.926	178.342	.000	.000	.000	-108.746	.057	179.856
	6600.00	105.597	.926	178.342	.000	.000	.000	-95.032	.061	179.836
14)	6773.38	105.597	.926	178.342	.000	.000	.000	-83.149	.061	179.819
	6800.00	105.597	.926	178.342	.000	.000	.000	-81.326	.060	179.817
	7000.00	105.597	.926	178.342	.000	.000	.000	-67.626	.056	179.801
	7200.00	105.597	.926	178.342	.000	.000	.000	-53.934	.050	179.790
	7400.00	105.597	.926	178.342	.000	.000	.000	-40.248	.043	179.783
	7600.00	105.597	.926	178.342	.000	.000	.000	-26.569	.040	179.780
	7800.00	105.597	.926	178.342	.000	.000	.000	-12.896	.040	179.780
	8000.00	105.597	.926	178.342	.000	.000	.000	.773	.045	179.781
	8200.00	105.597	.926	178.342	.000	.000	.000	14.438	.055	179.779
	8400.00	105.597	.926	178.342	.000	.000	.000	28.102	.068	179.774
15)	8513.38	105.597	.926	178.342	.000	.000	.000	35.848	.076	179.769
	8600.00	79.612	1.232	-178.896	-.300	-.001	.001	15.785	-.150	-177.987
	8800.00	19.612	.928	-178.654	-.300	-.002	.001	-30.538	-.534	-179.385
16)	8942.38	-18.988	.681	-178.529	-.068	-.002	.001	-59.400	-.000	-180.000
	9000.00	-18.988	.681	-178.529	.000	.000	.000	-55.461	.003	-179.995
	9200.00	-18.988	.681	-178.529	.000	.000	.000	-41.784	.017	-179.960
17)	9240.20	-18.988	.681	-178.529	.000	.000	.000	-39.034	.020	-179.977
	9400.00	-18.988	.681	-178.529	.000	.000	.000	-28.099	.032	-179.969
	9600.00	-18.988	.681	-178.529	.000	.000	.000	-14.405	.048	-179.962
	9800.00	-18.988	.681	-178.529	.000	.000	.000	-.702	.062	-179.961

11) CSM SEPARATION; SLA PANEL JETTISON;
12) CSM DOCKING;
13) BEGIN LH2 NPV;
14) END LH2 NPV;
15) INITIATE A MANEUVER TO POSITION THE VEHICLE FOR DOCKING MODULE EXTRACTION;
16) BEGIN INERTIAL ATTITUDE HOLD;
17) DOCKING MODULE EXTRACTION;

TABLE 3C-5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	RELATIVE VEHICLE ATTITUDE PITCH (DEG)	YAW (DEG)	ROLL (DEG)
18)	9893.38	-18.988	.681	-178.529	.000	.000	.000	5.699	.067	-179.961
	10000.00	12.997	-.272	178.467	.300	.002	-.000	44.972	-1.547	177.575
	10200.00	72.997	.105	178.447	.300	.002	.000	118.714	-1.308	179.102
	10400.00	120.569	.470	178.517	-.069	.002	.001	180.000	-.000	180.000
	10600.00	106.840	.804	178.670	-.069	.002	.001	180.000	-.000	180.000
	10800.00	93.106	1.088	178.898	-.069	.001	.001	180.000	-.000	180.000
	11000.00	79.369	1.305	179.186	-.069	.001	.002	180.000	-.000	180.000
	11200.00	65.631	1.444	179.518	-.069	.000	.002	180.000	-.000	180.000
	11400.00	51.895	1.499	179.872	-.069	.000	.002	180.000	-.000	180.000
	11600.00	38.164	1.466	-179.771	-.069	-.000	.002	180.000	-.000	-180.000
	11800.00	24.438	1.350	-179.432	-.069	-.001	.002	180.000	-.000	-180.000
	12000.00	10.720	1.157	-179.131	-.069	-.001	.001	180.000	-.000	-180.000
	12200.00	-2.989	.901	-178.883	-.069	-.001	.001	180.000	-.000	180.000
	12400.00	-16.689	.597	-178.703	-.068	-.002	.001	-180.000	-.000	180.000
	12600.00	-30.381	.263	-178.600	-.068	-.002	.000	180.000	-.000	-180.000
	12800.00	-44.067	-.081	-178.578	-.068	-.002	-.000	-180.000	.000	-180.000
	13000.00	-57.746	-.416	-178.638	-.068	-.002	-.000	-180.000	.000	-180.000
	13200.00	-71.422	-.722	-178.775	-.068	-.001	-.001	-180.000	.000	-180.000
	13400.00	-85.096	-.983	-178.979	-.068	-.001	-.001	-180.000	.000	-180.000
	13600.00	-98.770	-1.184	-179.239	-.068	-.001	-.001	-180.000	.000	-180.000
	13800.00	-112.445	-1.314	-179.539	-.068	-.000	-.002	-180.000	.000	-180.000
	14000.00	-126.122	-1.367	-179.860	-.068	-.000	-.002	-180.000	.000	-180.000
	14200.00	-139.802	-1.341	179.815	-.068	.000	-.002	-180.000	.000	180.000
	14400.00	-153.488	-1.239	179.505	-.068	.001	-.001	-180.000	.000	180.000
	14600.00	-167.179	-1.067	179.228	-.068	.001	-.001	-180.000	.000	180.000
	14800.00	179.124	-.837	179.000	-.069	.001	-.001	180.000	.000	180.000
	15000.00	165.419	-.561	178.832	-.069	.001	-.001	180.000	.000	180.000
	15200.00	151.706	-.258	178.733	-.069	.002	-.000	180.000	.000	180.000
	15400.00	137.986	.056	178.709	-.069	.002	.000	180.000	-.000	180.000
	15600.00	124.258	.363	178.760	-.069	.001	.000	180.000	-.000	180.000
	15800.00	110.524	.643	178.881	-.069	.001	.001	180.000	-.000	180.000
	16000.00	96.786	.883	179.065	-.069	.001	.001	180.000	-.000	180.000
	16200.00	83.044	1.067	179.300	-.069	.001	.001	180.000	-.000	180.000
	16400.00	69.302	1.187	179.572	-.069	.000	.001	180.000	-.000	180.000
	16600.00	55.561	1.236	179.864	-.069	.000	.001	180.000	-.000	180.000
	16800.00	41.825	1.213	-179.841	-.069	-.000	.001	180.000	-.000	-180.000
	17000.00	28.093	1.121	-179.560	-.069	-.001	.001	180.000	-.000	-180.000
	17200.00	14.368	.965	-179.309	-.069	-.001	.001	180.000	-.000	-180.000
	17400.00	.651	.756	-179.102	-.069	-.001	.001	180.000	-.000	-180.000
	17600.00	-13.058	.507	-178.951	-.069	-.001	.001	-180.000	-.000	-180.000

18) INITIATE A MANEUVER TO ALIGN AND MAINTAIN THE S-IVB/IU ALONG THE LOCAL HORIZONTAL, TAIL LEADING, POSITION 1 DOWN;

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 3C-5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	RELATIVE VEHICLE ATTITUDE PITCH (DEG)	YAW (DEG)	ROLL (DEG)
17800.00	-26.761	.232	-178.862	-.068	-.001	.000	180.000	-.000	-180.000
18000.00	-40.456	-.050	-178.840	-.068	-.001	-.000	-180.000	.000	-180.000
18200.00	-54.146	-.326	-178.886	-.068	-.001	-.000	-180.000	.000	-180.000
18400.00	-67.832	-.577	-178.994	-.068	-.001	-.001	-180.000	.000	-180.000
18600.00	-81.515	-.791	-179.158	-.068	-.001	-.001	-180.000	.000	-180.000
18800.00	-95.196	-.956	-179.368	-.068	-.001	-.001	-180.000	.000	-180.000
19000.00	-108.878	-1.063	-179.610	-.068	-.000	-.001	-180.000	.000	-180.000
19200.00	-122.561	-1.107	-179.871	-.068	-.000	-.001	-180.000	.000	180.000
19400.00	-136.247	-1.086	179.866	-.068	.000	-.001	-180.000	.000	180.000
19600.00	-149.937	-1.003	179.615	-.068	.001	-.001	-180.000	.000	180.000
19800.00	-163.632	-.864	179.391	-.068	.001	-.001	-180.000	.000	180.000
20000.00	-177.334	-.677	179.206	-.069	.001	-.001	-180.000	.000	180.000
20200.00	168.956	-.454	179.070	-.069	.001	-.001	180.000	.000	180.000
20400.00	155.238	-.209	178.990	-.069	.001	-.000	180.000	.000	180.000
20600.00	141.513	.044	178.971	-.069	.001	.000	180.000	-.000	180.000
20800.00	127.780	.290	179.011	-.069	.001	.000	180.000	-.000	180.000
21000.00	114.041	.514	179.108	-.069	.001	.001	180.000	-.000	180.000
21200.00	100.297	.704	179.255	-.069	.001	.001	180.000	-.000	180.000
21400.00	86.551	.850	179.442	-.069	.001	.001	180.000	-.000	180.000
21600.00	72.803	.943	179.658	-.069	.000	.001	180.000	-.000	180.000
21800.00	59.058	.979	179.890	-.069	.000	.001	180.000	-.000	180.000
22000.00	45.315	.958	-179.876	-.069	-.000	.001	180.000	-.000	-180.000
22200.00	31.577	.881	-179.655	-.069	-.001	.001	180.000	.000	180.000
22400.00	17.845	.754	-179.458	-.069	-.001	.001	180.000	-.000	-180.000
22600.00	4.120	.585	-179.297	-.069	-.001	.001	180.000	-.000	-180.000
22800.00	-9.599	.386	-179.180	-.069	-.001	.000	-180.000	-.000	180.000
23000.00	-23.311	.169	-179.114	-.069	-.001	.000	-180.000	-.000	-180.000
23200.00	-37.017	-.054	-179.100	-.069	-.001	-.000	-180.000	.000	180.000
23400.00	-50.718	-.269	-179.139	-.068	-.001	-.000	-180.000	.000	180.000
23600.00	-64.414	-.463	-179.227	-.068	-.001	-.001	-180.000	.000	-180.000
23800.00	-78.107	-.627	-179.358	-.068	-.001	-.001	180.000	.000	-180.000
24000.00	-91.797	-.750	-179.523	-.068	-.001	-.001	-180.000	.000	-180.000
24200.00	-105.487	-.827	-179.713	-.068	-.000	-.001	180.000	.000	-180.000
24400.00	-119.177	-.854	-179.915	-.068	-.000	-.001	-180.000	.000	-180.000
24600.00	-132.869	-.830	179.883	-.068	.000	-.001	-180.000	.000	180.000
24800.00	-146.565	-.759	179.692	-.068	.000	-.001	-180.000	.000	180.000
25000.00	-160.267	-.644	179.524	-.069	.001	-.001	180.000	.000	180.000
25200.00	-173.974	-.494	179.387	-.069	.001	-.001	-180.000	.000	180.000
25400.00	172.310	-.319	179.289	-.069	.001	-.000	180.000	.000	180.000
25600.00	158.587	-.128	179.236	-.069	.001	-.000	180.000	.000	180.000
25800.00	144.856	.065	179.228	-.069	.001	.000	180.000	-.000	180.000
26000.00	131.117	.250	179.266	-.069	.001	.000	180.000	-.000	180.000
26200.00	117.372	.416	179.347	-.069	.001	.000	180.000	-.000	180.000
26400.00	103.623	.554	179.464	-.069	.001	.001	180.000	-.000	180.000

TABLE 3C-5 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
NOMINAL
ORBITAL FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	RELATIVE VEHICLE ATTITUDE PITCH (DEG)	YAW (DEG)	ROLL (DEG)
	26600.00	89.871	.655	179.610	-.069	.000	.001	180.000	-.000	180.000
	26800.00	76.118	.715	179.775	-.069	.000	.001	180.000	-.000	180.000
19)	27000.00	62.367	.730	179.949	-.069	-.000	.001	180.000	-.000	180.000

19) END OF IU BATTERY LIFETIME.

TABLE 4C

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

S-IB STAGE RE-ENTRY DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC2)	DYNAMIC PRESSURE (LB/FT2)	A.M.I. (LB-FT/FT2-RAD)	MACH NO.
1)	140.85	101358.	26797.	25191.	.510	17.	45704098.	6.46
	141.00	101259.	-134498.	24733.	-50.594	17.	45715351.	6.46
	142.00	100606.	-139565.	21665.	-51.562	15.	45783299.	6.43
2)	142.97	99974.	0.	19174.	-6.171	13.	45840837.	6.42
	143.00	99974.	0.	19106.	-6.149	13.	45842470.	6.42
	160.00	99974.	0.	2601.	-.837	2.	46241190.	6.72
	180.00	99974.	0.	272.	-.087	0.	46297377.	6.89
	200.00	99974.	0.	44.	-.014	0.	46303626.	6.34
	220.00	99974.	0.	15.	-.005	0.	46304929.	5.89
	240.00	99974.	0.	10.	-.003	0.	46305517.	5.70
3)	243.00	99974.	0.	10.	-.003	0.	46305592.	5.70
	260.00	99974.	0.	12.	-.004	0.	46306043.	5.79
	280.00	99974.	0.	28.	-.009	0.	46306957.	6.18
	300.00	99974.	0.	133.	-.043	0.	46310251.	6.74
	320.00	99974.	0.	1176.	-.378	1.	46335738.	6.85
	340.00	99974.	0.	11691.	-3.762	8.	46571076.	6.42
	360.00	99974.	0.	116592.	-37.522	79.	49151016.	6.03
	380.00	99974.	0.	763996.	-245.873	482.	67950419.	4.16
	400.00	99974.	0.	250885.	-80.741	143.	78348530.	1.14
	420.00	99974.	0.	119682.	-38.517	99.	79451037.	.67
	440.00	99974.	0.	112574.	-36.229	103.	80192801.	.52
	460.00	99974.	0.	109999.	-35.400	103.	80829198.	.43
	480.00	99974.	0.	107229.	-34.509	102.	81371199.	.36
	500.00	99974.	0.	105557.	-33.971	101.	81844262.	.31
	520.00	99974.	0.	104435.	-33.610	100.	82265619.	.28
4)	531.00	99974.	0.	103745.	-33.388	100.	82478853.	.26

1) PHYSICAL SEPARATION;
2) RETRO-ROCKET BURNOUT;
3) S-IB STAGE APOGEE;
4) S-IB STAGE IMPACT.

TABLE 4C (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

S-IB STAGE RE-ENTRY DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	140.85	21101718.	7566.61	66.290	21098292.	189297.	329810.	2926.87	898.94	6919.46
	141.00	21102154.	7560.27	66.323	21098711.	189435.	330810.	2920.09	898.89	6915.40
	142.00	21105163.	7493.62	66.550	21101603.	190333.	337701.	2864.63	898.64	6865.91
2)	142.97	21108035.	7451.05	66.762	21104360.	191205.	344346.	2820.91	898.36	6838.53
	143.00	21108122.	7451.30	66.768	21104443.	191232.	344546.	2819.90	898.35	6838.35
	160.00	21153629.	7210.22	70.378	21147614.	206462.	460255.	2265.50	893.50	6786.48
	180.00	21196170.	7015.32	74.844	21186610.	224275.	595746.	1635.42	887.70	6764.03
	200.00	21227021.	6875.84	79.514	21213057.	241967.	730821.	1009.66	881.43	6743.13
	220.00	21246229.	6786.58	84.337	21227008.	259529.	865448.	385.70	874.57	6718.92
	240.00	21253815.	6751.05	89.245	21228491.	276950.	999553.	-237.29	867.42	6690.89
3)	243.00	21253951.	6750.34	89.984	21227639.	279551.	1019619.	-330.69	866.28	6686.35
	260.00	21249788.	6769.06	94.165	21217519.	294222.	1133058.	-859.95	859.66	6658.95
	280.00	21234144.	6840.19	99.024	21194091.	311333.	1265894.	-1482.95	851.38	6623.01
	300.00	21206868.	6962.88	103.750	21158195.	328274.	1397949.	-2106.85	842.59	6582.78
	320.00	21167936.	7132.66	108.287	21109812.	345033.	1529154.	-2731.34	833.26	6536.08
	340.00	21117389.	7323.18	112.586	21048998.	361601.	1659234.	-3345.25	823.36	6462.22
	360.00	21056116.	7298.93	116.565	20976797.	377951.	1786380.	-3816.41	810.87	6168.62
	380.00	20995042.	4949.29	118.843	20905710.	394089.	1894138.	-2776.94	808.78	4016.21
	400.00	20966210.	2016.30	113.995	20871814.	410499.	1944440.	-904.43	833.29	1549.83
	420.00	20952683.	1556.85	112.936	20855525.	427368.	1969609.	-728.98	852.21	1079.86
	440.00	20941460.	1429.01	111.232	20841989.	444528.	1989633.	-629.13	861.44	950.89
	460.00	20931879.	1380.56	108.703	20830195.	461770.	2008310.	-553.19	862.25	925.44
	480.00	20923626.	1360.72	106.465	20819718.	479012.	2026824.	-497.76	861.87	927.88
	500.00	20916357.	1350.14	104.721	20810187.	496239.	2045449.	-457.21	860.67	934.36
	520.00	20909841.	1340.94	103.350	20801370.	513428.	2064184.	-425.58	857.49	938.99
4)	531.00	20906520.	1333.75	102.756	20796770.	522886.	2074497.	-410.82	858.90	934.02

1) PHYSICAL SEPARATION;
2) RETRO-ROCKET BURNOUT;
3) S-IB STAGE APOGEE;
4) S-IB STAGE IMPACT.

TABLE 4C (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

S-IB STAGE RE-ENTRY DATA

FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1) 140.85	291073.	6646.22	62.755	191274.	-1613.	219398.	-2992.77	-30.18	5934.19
141.00	291996.	6639.57	62.789	191703.	-1618.	220246.	2986.05	-30.17	5930.14
142.00	298397.	6570.70	63.009	194662.	-1648.	226153.	2930.85	-30.12	5880.75
2) 142.97	304554.	6526.95	63.227	197483.	-1677.	231842.	2887.54	-30.06	5853.41
143.00	304741.	6526.35	63.234	197568.	-1678.	232015.	2886.54	-30.06	5853.22
160.00	409987.	6256.11	67.231	241955.	-2170.	330972.	2342.15	-27.48	5801.08
180.00	528648.	6031.40	72.296	282605.	-2676.	446762.	1724.06	-22.98	5779.69
200.00	642446.	5867.55	77.688	310944.	-3081.	562175.	1110.27	-17.32	5761.53
220.00	752046.	5763.29	83.327	327027.	-3362.	677211.	498.18	-10.57	5741.71
240.00	858187.	5720.86	89.109	330877.	-3496.	791824.	-113.00	-2.72	5719.74
3) 243.00	873860.	5719.92	89.981	330401.	-3503.	808983.	-204.65	-1.45	5716.25
260.00	961683.	5741.37	94.913	322608.	-3463.	905986.	-723.98	6.21	5695.54
280.00	1063400.	5824.19	100.615	301915.	-3241.	1019635.	-1335.40	16.21	5669.01
300.00	1164255.	5966.84	106.103	269085.	-2808.	1132729.	-1947.86	27.27	5639.88
320.00	1265189.	6163.41	111.292	223995.	-2143.	1245201.	-2561.08	39.34	5605.97
340.00	1367021.	6385.77	116.132	166695.	-1230.	1356819.	-3164.27	51.92	5546.42
360.00	1469078.	6395.81	120.688	98196.	-103.	1465793.	-3628.79	58.03	5266.39
380.00	1555779.	4058.89	126.031	30688.	816.	1555476.	-2618.13	21.53	3101.68
400.00	1587128.	1057.34	140.849	-534.	736.	1587128.	-866.89	-15.69	605.16
420.00	1593412.	631.83	163.789	-14558.	501.	1593346.	-618.09	-6.16	130.90
440.00	1594584.	518.97	175.710	-25888.	467.	1594373.	-518.97	.88	.30
460.00	1594420.	442.74	179.125	-35471.	492.	1594025.	-441.95	1.24	-26.44
480.00	1594091.	385.70	179.396	-43707.	516.	1593491.	-384.88	1.11	-25.01
500.00	1593865.	343.15	178.956	-50963.	533.	1593050.	-342.61	.44	-19.32
520.00	1593741.	309.72	178.562	-57471.	523.	1592704.	-309.33	-2.12	-15.36
4) 531.00	1593673.	294.50	179.778	-60787.	523.	1592513.	-293.77	.48	-20.72

1) PHYSICAL SEPARATION;
2) RETRO-ROCKET BURNOUT;
3) S-IB STAGE APOGEE;
4) S-IB STAGE IMPACT.

TABLE 4C (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

NOMINAL

S-IB STAGE RE-ENTRY DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	140.85	192418.	35.843	6735.34	52.938	45.040	-80.142	28.890	29.053
	141.00	192855.	35.981	6728.40	52.944	45.041	-80.140	28.891	29.054
	142.00	195876.	36.940	6662.02	53.005	45.046	-80.127	28.902	29.066
2)	142.97	198759.	37.864	6617.15	53.042	45.052	-80.116	28.913	29.076
	143.00	198846.	37.892	6616.44	53.043	45.052	-80.114	28.914	29.077
	160.00	244549.	53.924	6309.34	53.230	45.190	-79.898	29.102	29.266
	180.00	287320.	72.631	6086.58	53.407	45.369	-79.646	29.321	29.486
	200.00	318399.	91.249	5924.35	53.579	45.561	-79.391	29.539	29.704
	220.00	337834.	109.812	5821.26	53.752	45.766	-79.136	29.755	29.921
	240.00	345648.	128.342	5779.46	53.927	45.982	-78.881	29.969	30.136
3)	243.00	345819.	131.120	5778.56	53.953	46.016	-78.843	30.002	30.169
	260.00	341849.	146.863	5800.02	54.103	46.212	-78.624	30.183	30.351
	280.00	326433.	165.400	5882.33	54.282	46.453	-78.366	30.396	30.565
	300.00	299385.	183.976	6023.96	54.463	46.707	-78.106	30.609	30.778
	320.00	260682.	202.611	6219.10	54.649	46.974	-77.842	30.821	30.991
	340.00	210364.	221.300	6464.97	54.862	47.250	-77.576	31.033	31.203
	360.00	149318.	239.770	6484.91	55.296	47.486	-77.311	31.241	31.412
	380.00	88432.	255.183	4100.56	59.163	47.390	-77.090	31.415	31.586
	400.00	59670.	260.733	1072.40	75.356	45.767	-77.011	31.478	31.650
	420.00	46158.	261.921	637.86	85.042	45.376	-76.994	31.492	31.664
	440.00	34939.	262.227	519.59	88.922	49.818	-76.990	31.495	31.667
	460.00	25358.	262.287	442.75	89.877	65.427	-76.989	31.496	31.668
	480.00	17105.	262.300	385.68	89.953	74.705	-76.989	31.496	31.668
	500.00	9836.	262.316	343.10	89.852	57.458	-76.988	31.496	31.668
	520.00	3321.	262.339	309.64	89.723	35.874	-76.988	31.496	31.668
4)	531.00	0.	262.348	294.55	89.970	52.596	-76.988	31.496	31.668

1) PHYSICAL SEPARATION;
2) RETRO-ROCKET BURNOUT;
3) S-IB STAGE APOGEE;
4) S-IB STAGE IMPACT.

ORIGINAL PAGE IS OF POOR QUALITY

APPENDIX D: "LAUNCH WINDOW OPENING TRAJECTORY DATA"

PRECEDING PAGE BLANK NOT FILMED

TABLE 1 D

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING POWERED FLIGHT SEQUENCE OF EVENTS

FLIGHT TIME (HR: MIN: SEC)	FLIGHT TIME (SEC)	LVDC FLIGHT PROGRAM TIME(SEC)	EVENT
-0:00:17.20	- 17.20	$(0.00)_0$	Guidance Reference Release (GRR); Initiation of Time Base 0.
-0:00:03.30	- 3.30	---	Time for S-IB Mainstage Ignition.
-0:00:00.20	- 0.20	---	Hold Down Arm Release Signal.
0:00:00.00	0.00	---	First Motion.
0:00:00.20	0.20	$(0.00)_1$	Lift-Off Signal; Initiate Time Base 1.
0:00:10.00	10.00	$(9.80)_1$	Initiate Pitch and Roll Maneuvers.
0:00:57.74	57.74	---	Mach One.
0:01:13.23	73.23	---	Maximum Dynamic Pressure.
0:01:40.20	100.20	$(100.00)_1$	Control Gain Switch Point.
0:02:00.20	120.20	$(120.00)_1$	Control Gain Switch Point.
0:02:08.07	128.07	$(127.87)_1$	Enable S-IB Propellant Level Sensors.
0:02:09.00	129.00	$(128.80)_1$	Arrest Attitude Commands.
0:02:13.07	133.07	$(0.00)_2$	Level Sensor Actuation; Initiate Time Base 2.
0:02:16.07	136.07	$(3.00)_2$	Inboard Engine Cutoff (IECO).
0:02:19.47	139.47	$(0.00)_3$	Outboard Engine Cutoff (OECO); Initiate Time Base 3.
0:02:20.57	140.57	$(1.10)_3$	Ullage Rockets Ignition.
0:02:20.77	140.77	$(1.30)_3$	Separation Signal.
0:02:20.85	140.85	---	S-IB/S-IVB Physical Separation.
0:02:22.17	142.17	$(2.70)_3$	J-2 Engine Start Command.
0:02:25.57	145.57	---	90% J-2 Thrust Level.
0:02:28.17	148.17	$(8.70)_3$	Command 5.5:1 EMR.
0:02:28.57	148.57	---	Ullage Burn Out.
0:02:32.77	152.77	$(13.30)_3$	Jettison Ullage Rocket Motors.
0:02:45.10	165.10	---	Dynamic Pressure = 1 PSF.
0:02:51.47	171.47	---	LES Jettison
0:02:54.47	174.47	$(35.00)_3$	Command Active Guidance Initiation.
0:03:01.47	181.47	$(42.00)_3$	Control Gain Switch Point.
0:05:45.57	345.57	$(206.10)_3$	Control Gain Switch Point.
0:07:47.57	467.57	$(328.10)_3$	Command EMR Shift to 4.8:1.
0:09:44.07	584.07	---	Guidance Cutoff Signal (GCS).
0:09:44.27	584.27	$(0.00)_4$	Initiate Time Base 4; Inertial Attitude Freeze.
0:09:44.87	584.87	$(0.60)_4$	Begin LOX NPV.
0:09:54.07	594.07	---	Orbit Insertion.

TABLE 2D

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
POWERED FLIGHT TRAJECTORY EVENT SUMMARY

EVENT	FLIGHT TIME (SEC)	ALTITUDE (KM)	SPACE FIXED VELOCITY (M/S)	SPACE FIXED FLIGHT PATH ANGLE (DEG)	SPACE FIXED AZIMUTH (DEG)	GEODETIC LAT. (DEG)	LONGITUDE POSITIVE EAST (DEG)
GUIDANCE REF. RELEASE	-17.20	.09	408.57	90.000	90.00	28.63	-80.62
FIRST MOTION	.00	.09	408.57	90.000	90.00	28.63	-80.62
MACH ONE	57.74	7.34	586.02	59.863	80.50	28.64	-80.61
MAX. DYN. PRESSURE	73.23	12.70	743.50	57.492	73.82	28.65	-80.59
TILT ARREST	129.00	47.80	1997.90	64.224	57.00	28.91	-80.27
INBOARD ENGINE CUTOFF	136.07	54.19	2255.05	65.534	55.98	28.98	-80.18
OUTBOARD ENGINE CUTOFF	139.47	57.39	2319.57	66.125	55.77	29.01	-80.13
S-IB/S-IVB PHYSICAL SEP.	140.85	58.68	2318.81	66.393	55.76	29.03	-80.12
J-2 ENG. START COMMAND	142.17	59.90	2314.07	66.656	55.77	29.04	-80.10
ULLAGE CASE JETTISON	152.77	69.26	2328.67	68.653	55.69	29.16	-79.95
LES JETTISON	171.47	84.24	2408.49	71.890	55.46	29.37	-79.68
IGM INITIATION	175.00	86.87	2426.02	72.463	55.42	29.41	-79.63
EMR SHIFT, 5.5:1/4.8:1	469.00	164.91	5465.81	90.615	52.04	35.00	-72.02
GUIDANCE CUTOFF SIGNAL	584.07	158.45	7811.73	90.009	52.61	39.04	-65.99
ORBIT INSERTION	594.07	158.60	7818.46	90.001	53.04	39.45	-65.33

TABLE 3D

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IB STAGE END CONDITIONS OF FLIGHT

FLIGHT TIME: OECO + 1.379 SECONDS	140.847	(SEC)
RADIUS:	6431842.	(M)
ALTITUDE:	58679.	(M)
SPACE FIXED VELOCITY:	2318.81	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	66.393	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	55.763	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	48.387	(DEG)
GEOCENTRIC DECLINATION:	28.864	(DEG)
GEODETIC LATITUDE:	29.027	(DEG)
LONGITUDE: (POSITIVE EAST)	-80.115	(DEG)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	6430763.	(M)
YS	55702.	(M)
ZS	103809.	(M)
$\dot{X}S$	892.21	(M/S)
$\dot{Y}S$	257.23	(M/S)
$\dot{Z}S$	2124.77	(M/S)

VEHICLE ATTITUDES AND ATTITUDE RATES

PITCH ATTITUDE ANGLE	-64.004	(DEG)
YAW ATTITUDE ANGLE	-.097	(DEG)
ROLL ATTITUDE ANGLE	.000	(DEG)
PITCH RATE	.005	(DEG/S)
YAW RATE	-.025	(DEG/S)
ROLL RATE	-.000	(DEG/S)

TABLE 4D

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE END CONDITIONS OF FLIGHT

FLIGHT TIME: GCS	584.066	(SEC)
RADIUS:	6528180.	(M)
ALTITUDE:	158454.	(M)
SPACE FIXED VELOCITY:	7811.73	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	90.009	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	52.606	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	50.891	(DEG)
GEOCENTRIC DECLINATION:	38.850	(DEG)
GEODETIC LATITUDE:	39.038	(DEG)
LONGITUDE: (POSITIVE EAST)	-65.991	(DEG)
INCLINATION:	51.776	(DEG)
DESCENDING NODE ARGUMENT:	157.768	(DEG)
INERTIAL RANGE ANGLE:	17.596	(DEG)
WEIGHT:	68472.	(LBS)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	6226319.	(M)
YS	45441.	(M)
ZS	1961639.	(M)
$\dot{X}S$	-2332.62	(M/S)
$\dot{Y}S$	-752.22	(M/S)
$\dot{Z}S$	7417.30	(M/S)

VEHICLE ATTITUDE ANGLES

PITCH ATTITUDE ANGLE	-99.780	(DEG)
YAW ATTITUDE ANGLE	-13.733	(DEG)
ROLL ATTITUDE ANGLE	.458	(DEG)

OSCULATING CONIC PARAMETERS

* PERIGEE ALTITUDE	142.07	(KM)
* APOGEE ALTITUDE	150.34	(KM)
ECCENTRICITY	.0006	
SEMI-MAJOR AXIS	6524.37	(KM)
TRUE ANOMALY	194.547	(DEG)
PERIOD	87.41	(MIN)

* REFERENCED TO EQUATORIAL RADIUS (6378.165 KM)

TABLE 4D (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE END CONDITIONS OF FLIGHT

FLIGHT TIME: ORBIT INSERTION	594.066	(SEC)
RADIUS:	6528178.	(M)
ALTITUDE:	158603.	(M)
SPACE FIXED VELOCITY:	7818.46	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	90.001	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	53.043	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	51.356	(DEG)
GEOCENTRIC DECLINATION:	39.264	(DEG)
GEODETIC LATITUDE:	39.453	(DEG)
LONGITUDE: (POSITIVE EAST)	-65.329	(DEG)
INCLINATION:	51.780	(DEG)
DESCENDING NODE ARGUMENT:	157.775	(DEG)
INERTIAL RANGE ANGLE:	18.279	(DEG)
WEIGHT:	68340.	(LBS)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	6202536.	(M)
YS	37900.	(M)
ZS	2035734.	(M)
$\dot{X}S$	-2422.75	(M/S)
$\dot{Y}S$	-754.38	(M/S)
$\dot{Z}S$	7395.24	(M/S)

VEHICLE ATTITUDE ANGLES

PITCH ATTITUDE ANGLE	-99.781	(DEG)
YAW ATTITUDE ANGLE	-13.740	(DEG)
ROLL ATTITUDE ANGLE	.355	(DEG)

OSCULATING CONIC PARAMETERS

* PERIGEE ALTITUDE	149.92	(KM)
* APOGEE ALTITUDE	164.97	(KM)
ECCENTRICITY	.0012	
SEMI-MAJOR AXIS	6535.61	(KM)
TRUE ANOMALY	358.971	(DEG)
PERIOD	87.64	(MIN)

* REFERENCED TO EQUATORIAL RADIUS (6378.165 KM)

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 5D

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW OPENING

S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC2)	DYNAMIC PRESSURE (N/M2)	A.H.I. (KG-M/M2-RAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1)	-17.20	594950.	0.	0.	.000	0.	0.	.00	.000
2)	.00	588040.	7252697.	715.	12.354	2.	0.	.01	.000
	5.00	573697.	7428096.	3362.	12.963	126.	152.	.04	6.188
	10.00	559243.	7478481.	12984.	13.370	575.	2889.	.09	3.305
	15.00	544737.	7526089.	29360.	13.783	1448.	16672.	.15	.257
	20.00	530193.	7575584.	51509.	14.213	2821.	60047.	.21	-2.745
	25.00	515622.	7627083.	74529.	14.669	4753.	164817.	.28	-1.542
	30.00	501035.	7684383.	101841.	15.153	7290.	378661.	.35	-1.263
	35.00	486433.	7747227.	132697.	15.671	10424.	769815.	.44	-.877
	40.00	471823.	7816392.	167534.	16.226	14100.	1429038.	.54	-.501
	45.00	457190.	7891601.	216096.	16.801	18198.	2469227.	.65	-.153
	50.00	442548.	7966849.	267780.	17.408	22542.	4023505.	.77	.056
	55.00	427908.	8032206.	493623.	17.626	26752.	6231289.	.92	.047
3)	57.74	419892.	8061660.	667683.	17.618	28740.	7753255.	1.00	.033
	65.00	398598.	8154324.	737513.	18.613	32784.	12890555.	1.25	.006
	70.00	383903.	8216221.	643653.	19.729	34596.	17424936.	1.47	-.002
4)	73.23	374417.	8249230.	585608.	20.471	34992.	20789049.	1.63	.020
	80.00	354529.	8307399.	463664.	22.125	32624.	28678206.	2.00	-.169
	85.00	339855.	8339075.	377071.	23.428	28087.	34713917.	2.26	-.166
	90.00	325275.	8360358.	292263.	24.804	23123.	40454252.	2.52	-.011
	95.00	310703.	8368895.	218303.	26.233	18502.	45736837.	2.80	.046
	100.00	296146.	8368970.	158970.	27.723	14460.	50447431.	3.11	-.073
	105.00	281610.	8359893.	113935.	29.282	10985.	54529128.	3.44	-.221
	110.00	267102.	8347205.	75380.	30.970	8069.	57943526.	3.78	-.700
	115.00	252621.	8332435.	39167.	32.830	5820.	60725888.	4.13	-1.137
	120.00	238174.	8311740.	12360.	34.848	4125.	62951230.	4.51	-1.624
	125.00	223765.	8284901.	-3425.	37.044	2895.	64706947.	4.91	-2.288
5)	129.00	212276.	8261623.	-10463.	38.973	2170.	65829624.	5.26	-2.815
6)	133.07	200631.	8226908.	-18762.	41.101	1640.	66759323.	5.73	-2.008
7)	136.07	192074.	8185755.	-27097.	42.760	1326.	67328307.	6.13	-1.150
8)	139.47	186324.	2670954.	-25910.	15.548	962.	67843285.	6.43	-.278
9)	140.57	185750.	157345.	-23483.	.974	848.	67977222.	6.46	-.014
10)	140.77	185646.	168338.	-23013.	1.031	828.	67999747.	6.47	.033
11)	140.85	185631.	159698.	-22830.	.983	820.	68008496.	6.47	.051

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 5D (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW OPENING

S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	-17.20	6373379.	408.57	90.000	6373353.	13449.	-11914.	.00	270.92	305.82
2)	.00	6373379.	408.57	90.000	6373349.	18107.	-6653.	-.45	270.74	305.99
	5.00	6373414.	408.75	87.954	6373382.	19461.	-5123.	14.01	270.61	306.03
	10.00	6373528.	409.55	85.593	6373493.	20813.	-3592.	30.76	270.43	306.03
	15.00	6373732.	411.44	82.965	6373693.	22165.	-2062.	49.55	270.30	306.21
	20.00	6374035.	415.68	80.110	6373992.	23517.	-528.	70.43	270.37	307.78
	25.00	6374449.	423.00	77.087	6374401.	24868.	1020.	93.42	270.19	311.76
	30.00	6374984.	434.03	73.975	6374930.	26219.	2594.	118.58	269.89	318.55
	35.00	6375651.	449.54	70.879	6375590.	27568.	4211.	145.87	269.69	328.74
	40.00	6376460.	470.04	67.901	6376392.	28916.	5888.	175.29	269.58	342.84
	45.00	6377423.	495.86	65.146	6377346.	30263.	7646.	206.70	269.51	361.27
	50.00	6378548.	527.24	62.695	6378462.	31611.	9509.	239.96	269.45	384.44
	55.00	6379843.	564.09	60.698	6379748.	32958.	11500.	273.94	269.33	413.05
3)	57.74	6380625.	586.02	59.863	6380524.	33696.	12657.	291.95	269.25	430.92
	65.00	6382931.	651.15	58.366	6382812.	35650.	15978.	338.80	269.09	486.62
	70.00	6384725.	704.76	57.738	6384591.	36995.	18527.	373.10	268.99	533.98
4)	73.23	6385977.	743.50	57.492	6385832.	37863.	20306.	396.17	268.94	568.78
	80.00	6388855.	835.71	57.375	6388685.	39684.	24435.	446.41	268.64	653.42
	85.00	6391205.	913.45	57.588	6391012.	41025.	27881.	484.73	267.97	726.37
	90.00	6393753.	999.63	57.977	6393534.	42363.	31714.	524.30	267.10	808.10
	95.00	6396508.	1094.41	58.491	6396258.	43696.	35978.	565.13	266.20	898.60
	100.00	6399475.	1198.08	59.121	6399187.	45025.	40717.	606.69	265.36	998.45
	105.00	6402659.	1310.84	59.838	6402326.	46350.	45979.	648.79	264.55	1107.87
	110.00	6406063.	1433.12	60.639	6405676.	47670.	51814.	690.82	263.60	1227.65
	115.00	6409686.	1565.70	61.513	6409234.	48986.	58276.	732.47	262.61	1358.65
	120.00	6413531.	1709.25	62.440	6413000.	50297.	65422.	773.54	261.66	1501.57
	125.00	6417595.	1864.55	63.416	6416968.	51602.	73315.	813.46	260.53	1657.40
5)	129.00	6421001.	1997.90	64.224	6420285.	52643.	80211.	844.39	259.57	1791.99
6)	133.07	6424608.	2142.41	65.026	6423783.	53697.	87796.	876.01	258.63	1937.95
7)	136.07	6427365.	2255.05	65.534	6426450.	54471.	93779.	901.95	257.90	2050.67
8)	139.47	6430553.	2319.57	66.125	6429524.	55347.	100880.	903.48	257.35	2120.83
9)	140.57	6431582.	2319.60	66.338	6430513.	55630.	103216.	894.78	257.25	2124.56
10)	140.77	6431768.	2319.03	66.378	6430692.	55682.	103641.	892.94	257.23	2124.71
11)	140.85	6431842.	2318.81	66.393	6430763.	55702.	103809.	892.21	257.23	2124.77

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 5D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	-17.20	90.	.00	N/A	90.	0.	-0.	.00	-.00	-.00
2)	.00	90.	.00	N/A	90.	-0.	0.	.00	-.00	-.00
	5.00	125.	14.59	.482	125.	-0.	0.	14.59	-.09	-.02
	10.00	239.	31.47	.563	239.	-1.	-0.	31.47	-.24	-.10
	15.00	443.	50.39	.538	443.	-3.	-1.	50.39	-.36	-.01
	20.00	747.	71.42	1.320	747.	-4.	2.	71.40	-.30	1.45
	25.00	1161.	94.69	3.341	1161.	-6.	18.	94.54	-.48	5.30
	30.00	1697.	120.44	5.818	1696.	-9.	59.	119.84	-.81	11.94
	35.00	2367.	148.93	8.597	2363.	-14.	143.	147.30	-1.05	21.95
	40.00	3185.	180.50	11.570	3172.	-20.	285.	176.90	-1.21	35.84
	45.00	4166.	215.41	14.641	4135.	-26.	508.	208.51	-1.33	54.05
	50.00	5326.	253.95	17.748	5261.	-33.	834.	242.00	-1.45	76.96
	55.00	6682.	295.64	20.963	6557.	-41.	1287.	276.25	-1.62	105.29
3)	57.74	7512.	319.09	22.769	7339.	-45.	1600.	294.43	-1.73	122.99
	65.00	10014.	385.47	27.626	9647.	-58.	2685.	341.78	-1.94	178.23
	70.00	12023.	438.73	30.965	11442.	-68.	3690.	376.50	-2.05	225.23
4)	73.23	13460.	476.86	33.079	12695.	-75.	4472.	399.88	-2.10	259.78
	80.00	16880.	567.03	37.382	15575.	-90.	6507.	450.86	-2.35	343.86
	85.00	19799.	642.89	40.397	17926.	-103.	8404.	489.84	-2.94	416.35
	90.00	23097.	727.11	43.198	20476.	-119.	10686.	530.16	-3.69	497.59
	95.00	26817.	819.93	45.766	23231.	-140.	13395.	571.86	-4.42	587.58
	100.00	31002.	921.57	48.148	26196.	-164.	16578.	614.40	-5.05	686.87
	105.00	35698.	1032.29	50.355	29376.	-190.	20281.	657.61	-5.57	795.70
	110.00	40951.	1152.49	52.432	32773.	-219.	24554.	700.88	-6.17	914.86
	115.00	46811.	1282.94	54.403	36386.	-252.	29450.	743.94	-6.70	1045.21
	120.00	53329.	1424.36	56.274	40212.	-286.	35027.	786.58	-7.10	1187.45
	125.00	60562.	1577.54	58.067	44250.	-323.	41347.	828.28	-7.55	1342.58
5)	129.00	66904.	1709.19	59.448	47629.	-354.	46984.	860.77	-7.87	1476.60
6)	133.07	73896.	1852.11	60.766	51198.	-386.	53285.	894.13	-8.09	1621.96
7)	136.07	79427.	1963.82	61.604	53921.	-411.	58319.	921.45	-8.24	1734.20
8)	139.47	86002.	2026.98	62.409	57063.	-439.	64343.	924.16	-8.22	1804.02
9)	140.57	88163.	2026.43	62.651	58075.	-440.	66330.	915.71	-8.18	1807.71
10)	140.77	88555.	2025.75	62.695	58258.	-449.	66692.	913.91	-8.17	1807.86
11)	140.85	88710.	2025.48	62.713	58331.	-450.	66835.	913.20	-8.17	1807.91

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 5D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	-17.20	.090	.000	.00	90.000	N/A	-80.621	28.466	28.627
2)	.00	.090	.000	1.82	90.000	N/A	-80.621	28.466	28.627
	5.00	.125	.001	14.70	89.986	N/A	-80.621	28.466	28.627
	10.00	.239	.001	31.52	89.971	N/A	-80.621	28.466	28.627
	15.00	.443	.003	50.46	89.943	N/A	-80.621	28.466	28.627
	20.00	.747	.007	71.44	89.806	32.734	-80.621	28.466	28.627
	25.00	1.161	.022	94.57	89.424	41.360	-80.621	28.466	28.627
	30.00	1.696	.064	120.21	88.783	43.463	-80.620	28.466	28.628
	35.00	2.363	.148	148.60	87.875	44.973	-80.620	28.467	28.628
	40.00	3.172	.292	180.06	86.688	45.964	-80.619	28.468	28.629
	45.00	4.135	.517	214.90	85.231	46.600	-80.617	28.469	28.631
	50.00	5.261	.844	253.48	83.532	47.017	-80.615	28.471	28.633
	55.00	6.557	1.299	295.39	81.611	47.274	-80.611	28.474	28.635
3)	57.74	7.340	1.613	319.02	80.503	47.378	-80.609	28.476	28.637
	65.00	9.648	2.700	386.16	77.449	47.622	-80.601	28.482	28.644
	70.00	11.443	3.706	440.36	75.247	47.756	-80.593	28.488	28.650
4)	73.23	12.697	4.488	479.50	73.820	47.833	-80.587	28.493	28.655
	80.00	15.579	6.522	570.77	70.873	47.938	-80.572	28.505	28.667
	85.00	17.932	8.415	647.47	68.784	47.948	-80.557	28.517	28.679
	90.00	20.485	10.691	734.60	66.837	47.949	-80.540	28.531	28.692
	95.00	23.245	13.391	829.64	65.064	47.964	-80.520	28.547	28.709
	100.00	26.218	16.560	933.18	63.465	47.995	-80.495	28.566	28.728
	105.00	29.409	20.244	1045.24	62.034	48.037	-80.467	28.588	28.750
	110.00	32.820	24.490	1165.90	60.747	48.074	-80.435	28.614	28.776
	115.00	36.453	29.352	1299.96	59.596	48.117	-80.398	28.643	28.805
	120.00	40.308	34.884	1445.95	58.573	48.169	-80.356	28.676	28.838
	125.00	44.384	41.146	1604.37	57.657	48.217	-80.308	28.713	28.876
5)	129.00	47.801	46.725	1737.37	56.997	48.259	-80.265	28.747	28.909
6)	133.07	51.419	52.956	1881.33	56.390	48.305	-80.218	28.784	28.947
7)	136.07	54.186	57.930	1993.15	55.982	48.340	-80.180	28.814	28.977
8)	139.47	57.386	63.878	2056.22	55.765	48.375	-80.134	28.849	29.012
9)	140.57	58.418	65.839	2055.49	55.762	48.385	-80.119	28.861	29.024
10)	140.77	58.605	66.196	2054.68	55.763	48.386	-80.116	28.863	29.026
11)	140.85	58.679	66.337	2054.35	55.763	48.387	-80.115	28.864	29.027

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 5D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	-17.20	.000	.000	-41.537	-.003	.002	.002	.000	.000	.000
2)	.00	-.047	.042	-41.503	-.003	.002	.002	-.047	.042	.034
	5.00	-.016	-.017	-41.538	-.001	.001	.003	-.001	-.023	-.001
	10.00	-.009	-.021	-41.538	.002	.000	.000	.007	-.022	-.001
	15.00	-.661	-.005	-37.434	-.203	.006	1.001	.155	.113	-.897
	20.00	-2.002	.021	-32.466	-.329	-.002	1.003	.200	.153	-.929
	25.00	-3.845	-.043	-27.468	-.406	-.000	1.000	.282	.098	-.931
	30.00	-6.076	-.028	-22.466	-.481	.002	1.000	.338	.110	-.929
	35.00	-8.613	-.013	-17.465	-.532	.001	1.000	.408	.114	-.928
	40.00	-11.374	-.010	-12.466	-.570	-.001	1.000	.488	.098	-.929
	45.00	-14.299	-.020	-7.468	-.598	-.003	.999	.548	.052	-.931
	50.00	-17.431	-.042	-2.472	-.685	-.007	1.000	.617	-.015	-.935
	55.00	-20.886	-.076	.022	-.699	-.002	-.051	.602	-.076	.021
3)	57.74	-22.814	-.076	-.002	-.704	.004	.004	.602	-.076	-.003
	65.00	-27.954	-.083	-.000	-.711	-.001	.000	.613	-.083	-.001
	70.00	-31.478	-.105	.000	-.697	-.004	-.000	.611	-.105	-.000
4)	73.23	-33.718	-.100	-.000	-.689	.001	-.000	.602	-.100	-.001
	80.00	-38.257	-.122	.004	-.634	.015	.001	.554	-.122	.003
	85.00	-41.287	-.019	.004	-.592	.007	-.001	.609	-.019	.004
	90.00	-44.113	.042	-.000	-.511	.005	-.002	.510	.042	-.000
	95.00	-46.692	.051	-.003	-.512	-.004	.000	.458	.051	-.002
	100.00	-49.222	.018	-.001	-.503	-.008	.001	.438	.018	-.001
	105.00	-51.574	-.033	.001	-.510	-.018	.001	.579	-.033	.000
	110.00	-54.103	-.085	.005	-.504	-.007	.001	.531	-.085	.005
	115.00	-56.598	-.102	.007	-.494	.001	.000	.508	-.102	.006
	120.00	-59.054	-.092	.007	-.490	.002	.000	.516	-.092	.007
	125.00	-61.608	-.178	.007	-.473	.011	-.000	.423	-.178	.006
5)	129.00	-63.529	-.157	.007	-.485	.003	-.000	.470	-.157	.006
6)	133.07	-64.057	-.153	.004	.030	-.005	-.002	-.058	-.153	.004
7)	136.07	-64.048	-.167	.002	.002	-.001	-.001	-.049	-.167	.002
8)	139.47	-64.013	-.084	.001	.010	.005	-.001	-.014	-.084	.001
9)	140.57	-64.006	-.091	.000	.005	-.019	-.000	-.007	-.091	.000
10)	140.77	-64.005	-.095	.000	.005	-.023	-.000	-.006	-.095	.000
11)	140.85	-64.004	-.097	.000	.005	-.025	-.000	-.005	-.097	.000

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 6D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/S2)	DYNAMIC PRESSURE (N/M2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
1) 140.85	139653.	40499.	3709.	.264	820.	1.098	-63.999	.051
2) 142.17	139621.	40337.	3218.	.266	703.	1.122	-63.999	.399
3) 145.57	139397.	735426.	2354.	5.259	471.	1.185	-63.999	1.561
4) 148.57	138753.	934345.	1727.	6.722	335.	1.241	-63.999	2.291
5) 152.77	137783.	1024476.	1094.	7.428	207.	1.320	-63.999	2.885
160.00	135898.	1034592.	532.	7.609	89.	1.458	-63.999	4.459
6) 165.10	134631.	1032608.	314.	7.668	48.	1.558	-63.999	5.532
170.00	133415.	1034917.	188.	7.756	26.	1.655	-63.999	6.562
7) 171.47	133049.	1035492.	158.	7.782	22.	1.684	-63.999	6.869
8) 175.00	128020.	1036335.	106.	8.094	13.	1.756	-63.999	7.609
180.00	126774.	1037282.	82.	8.182	7.	1.858	-58.999	11.838
190.00	124288.	1036754.	41.	8.341	2.	2.067	-56.562	17.970
200.00	121796.	1035066.	14.	8.498	1.	2.281	-57.697	18.421
210.00	119311.	1034398.	6.	8.670	0.	2.502	-58.586	19.086
220.00	116825.	1037443.	3.	8.880	0.	2.728	-59.671	19.578
230.00	114333.	1035546.	1.	9.057	0.	2.961	-60.995	19.664
240.00	111847.	1035230.	1.	9.256	0.	3.200	-61.958	20.034
250.00	109363.	1034881.	1.	9.463	0.	3.445	-62.997	20.352
260.00	106879.	1037645.	0.	9.709	0.	3.698	-64.081	20.559
270.00	104388.	1038526.	0.	9.949	0.	3.957	-65.380	20.518
280.00	101897.	1036118.	0.	10.168	0.	4.224	-66.524	20.527
290.00	99411.	1036101.	0.	10.422	0.	4.498	-67.462	20.735
300.00	96925.	1036088.	0.	10.690	0.	4.780	-68.543	20.702
310.00	94440.	1036058.	0.	10.970	0.	5.071	-69.661	20.567
320.00	91955.	1036020.	0.	11.267	0.	5.369	-70.779	20.426
330.00	89471.	1035957.	0.	11.579	0.	5.676	-71.892	20.267
340.00	86987.	1035893.	0.	11.909	0.	5.992	-73.005	20.069
350.00	84503.	1035824.	0.	12.258	0.	6.318	-74.121	19.785
360.00	82019.	1035750.	0.	12.628	0.	6.653	-75.226	19.500
370.00	79536.	1035633.	0.	13.021	0.	6.998	-76.341	19.120
380.00	77053.	1035502.	0.	13.439	0.	7.353	-77.464	18.694
390.00	74570.	1035393.	0.	13.885	0.	7.719	-78.595	18.308
400.00	72088.	1035288.	0.	14.361	0.	8.096	-79.728	17.891
410.00	69597.	1039200.	0.	14.932	0.	8.486	-80.964	17.355
420.00	67107.	1036712.	0.	15.449	0.	8.887	-82.121	16.809
430.00	64621.	1036641.	0.	16.042	0.	9.301	-83.193	16.302

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (-)	LONGITUDINAL ACCELERATION (M/S2)	DYNAMIC PRESSURE (N/M2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
440.00	62135.	1036573.	0.	16.682	0.	9.728	-84.339	15.687
450.00	59650.	1035595.	0.	17.361	0.	10.169	-85.490	15.120
460.00	57166.	1035502.	0.	18.114	0.	10.625	-86.646	14.547
9) 469.00	55004.	878924.	0.	15.979	0.	11.047	-87.689	14.022
470.00	54777.	878292.	0.	16.034	0.	11.095	-87.752	13.975
480.00	52682.	874810.	0.	16.605	0.	11.580	-88.870	13.484
490.00	50604.	874311.	0.	17.277	0.	12.079	-90.015	12.834
500.00	48525.	874399.	0.	18.019	0.	12.592	-91.166	12.187
510.00	46447.	874388.	0.	18.825	0.	13.121	-92.536	11.381
520.00	44369.	874345.	0.	19.706	0.	13.666	-93.753	10.711
530.00	42291.	874300.	0.	20.673	0.	14.228	-94.856	10.173
540.00	40213.	874175.	0.	21.739	0.	14.807	-95.988	9.537
550.00	38135.	873955.	0.	22.917	0.	15.405	-97.159	8.804
560.00	36057.	873673.	0.	24.230	0.	16.023	-98.354	8.033
570.00	33979.	873234.	0.	25.698	0.	16.661	-99.951	6.762
580.00	31902.	872571.	0.	27.351	0.	17.321	-99.763	7.413
10) 584.07	31058.	872209.	0.	28.082	0.	17.596	-99.763	7.605
11) 584.27	31042.	610557.	0.	19.669	0.	17.610	-99.763	7.613
12) 584.87	31005.	24713.	0.	.797	0.	17.651	-99.763	7.654
13) 594.07	30998.	0.	4.	-.000	0.	18.279	-99.781	8.295

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 6D (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW OPENING

S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	140.85	6431845.	2318.81	66.393	6430765.	55702.	103814.	892.21	257.23	2124.77
2)	142.17	6433063.	2314.07	66.656	6431936.	56042.	106621.	879.64	257.12	2129.86
3)	145.57	6436131.	2306.61	67.328	6434873.	56915.	113849.	849.35	256.71	2129.12
4)	148.57	6438771.	2313.63	67.887	6437389.	57684.	120259.	828.75	255.98	2144.89
5)	152.77	6442380.	2328.67	68.653	6440814.	58758.	129322.	801.94	255.34	2171.27
	160.00	6448369.	2357.84	69.940	6446449.	60601.	145195.	756.65	254.40	2218.60
6)	165.10	6452426.	2379.77	70.821	6450228.	61897.	156600.	724.97	253.70	2252.43
	170.00	6456193.	2401.71	71.646	6453705.	63138.	167713.	694.69	253.03	2285.08
7)	171.47	6457298.	2408.49	71.890	6454719.	63510.	171075.	685.66	252.82	2294.95
8)	175.00	6459910.	2426.02	72.463	6457102.	64402.	179223.	664.41	252.30	2319.59
	180.00	6463503.	2451.54	73.242	6460350.	65661.	190909.	635.07	251.40	2354.47
	190.00	6470368.	2502.48	74.532	6466443.	68164.	214786.	584.80	249.04	2420.42
	200.00	6476854.	2556.55	75.738	6472045.	70640.	239324.	535.62	246.03	2487.67
	210.00	6482966.	2613.75	76.892	6477154.	73082.	264545.	486.15	242.36	2556.88
	220.00	6488713.	2674.27	77.988	6481769.	75485.	290464.	436.64	238.02	2627.62
	230.00	6494100.	2738.42	79.034	6485886.	77841.	317105.	386.75	233.08	2700.93
	240.00	6499133.	2805.83	80.032	6489501.	80145.	344489.	336.22	227.51	2776.30
	250.00	6503817.	2876.52	80.975	6492610.	82388.	372638.	285.43	221.13	2853.77
	260.00	6508160.	2950.60	81.865	6495209.	84564.	401572.	234.18	213.93	2933.50
	270.00	6512170.	3028.45	82.706	6497293.	86664.	431317.	182.42	205.92	3015.93
	280.00	6515852.	3109.93	83.502	6498855.	88680.	461900.	129.79	197.13	3100.96
	290.00	6519212.	3194.76	84.249	6499887.	90604.	493344.	76.49	187.40	3188.34
	300.00	6522258.	3283.13	84.945	6500383.	92425.	525675.	22.62	176.64	3278.30
	310.00	6525000.	3375.20	85.595	6500337.	94134.	558919.	-32.03	164.88	3371.02
	320.00	6527446.	3471.07	86.201	6499740.	95719.	593105.	-87.59	152.09	3466.63
	330.00	6529604.	3570.84	86.762	6498582.	97172.	628262.	-144.12	138.22	3565.26
	340.00	6531483.	3674.63	87.282	6496854.	98480.	664421.	-201.69	123.21	3667.03
	350.00	6533093.	3782.59	87.760	6494545.	99632.	701614.	-260.42	107.01	3772.10
	360.00	6534444.	3894.87	88.198	6491642.	100616.	739875.	-320.42	89.54	3880.63
	370.00	6535546.	4011.62	88.597	6488133.	101419.	779239.	-381.71	70.78	3992.79
	380.00	6536413.	4133.05	88.957	6484003.	102027.	819743.	-444.41	50.65	4108.77
	390.00	6537056.	4259.37	89.280	6479240.	102427.	861428.	-508.65	29.09	4228.79
	400.00	6537489.	4390.86	89.566	6473825.	102604.	904334.	-574.59	6.00	4353.10
	410.00	6537727.	4528.29	89.816	6467742.	102542.	948508.	-642.34	-18.73	4482.48
	420.00	6537785.	4671.58	90.033	6460971.	102224.	994000.	-712.29	-45.08	4616.73
	430.00	6537679.	4820.74	90.216	6453490.	101634.	1040859.	-784.31	-73.29	4755.94

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
	440.00	6537429.	4976.41	90.363	6445278.	100752.	1089138.	-858.53	-103.47	4900.70
	450.00	6537055.	5138.97	90.478	6436311.	99557.	1138893.	-935.28	-135.72	5051.32
	460.00	6536579.	5300.05	90.560	6426563.	98030.	1190186.	-1014.80	-170.21	5206.38
9)	469.00	6536083.	5465.81	90.615	6417098.	96351.	1237718.	-1089.09	-202.63	5352.37
	470.00	6536024.	5481.25	90.626	6416005.	96147.	1243078.	-1097.61	-205.87	5366.28
	480.00	6535371.	5638.75	90.715	6404599.	93921.	1297445.	-1184.06	-239.66	5507.82
	490.00	6534624.	5802.77	90.777	6392314.	91347.	1353252.	-1273.56	-275.32	5654.59
	500.00	6533807.	5974.10	90.809	6379118.	88407.	1410557.	-1366.20	-313.11	5807.35
	510.00	6532945.	6153.43	90.815	6364977.	85078.	1469422.	-1462.62	-353.10	5966.64
	520.00	6532063.	6341.47	90.799	6349850.	81337.	1529914.	-1563.54	-395.47	6132.96
	530.00	6531189.	6538.79	90.754	6333693.	77158.	1592107.	-1668.69	-440.97	6306.88
	540.00	6530356.	6746.23	90.679	6316462.	72506.	1656080.	-1778.34	-489.85	6489.16
	550.00	6529604.	6964.86	90.574	6298109.	67349.	1721922.	-1893.08	-542.22	6680.68
	560.00	6528975.	7195.89	90.441	6278581.	61649.	1789730.	-2013.58	-598.35	6882.47
	570.00	6528497.	7441.02	90.307	6257800.	55363.	1859607.	-2144.06	-659.65	7094.83
	580.00	6528214.	7701.23	90.110	6235692.	48444.	1931674.	-2277.74	-724.74	7320.91
10)	584.07	6528180.	7811.73	90.009	6226319.	45441.	1961639.	-2332.62	-752.22	7417.30
11)	584.27	6528180.	7816.93	90.004	6225852.	45291.	1963123.	-2335.27	-753.51	7421.80
12)	584.87	6528180.	7816.13	90.002	6224449.	44839.	1967576.	-2340.82	-753.84	7421.28
13)	594.07	6528178.	7816.46	90.001	6202536.	37900.	2035734.	-2422.75	-754.38	7395.24

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 6D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	140.85	88717.	2025.48	62.713	58334.	-450.	66840.	913.20	-8.17	1807.91
2)	142.17	91306.	2020.01	63.004	59532.	-461.	69229.	900.88	-8.11	1807.97
3)	145.57	97947.	2010.76	63.757	62542.	-488.	75378.	871.30	-8.08	1812.15
4)	148.57	103809.	2016.40	64.411	65126.	-513.	80838.	851.43	-8.38	1827.81
5)	152.77	112059.	2029.60	65.314	68647.	-548.	88569.	825.68	-8.38	1854.03
	160.00	126408.	2055.79	66.833	74461.	-608.	102147.	782.26	-8.17	1901.12
6)	165.10	136644.	2075.79	67.874	78375.	-649.	111932.	751.94	-8.01	1934.80
	170.00	146567.	2096.00	68.850	81987.	-688.	121489.	722.98	-7.82	1967.34
7)	171.47	149559.	2102.28	69.138	83042.	-699.	124384.	714.36	-7.76	1977.18
8)	175.00	156794.	2118.68	69.817	85529.	-726.	131410.	694.10	-7.62	2001.74
	180.00	167131.	2142.73	70.738	88928.	-764.	141506.	666.17	-7.57	2036.53
	190.00	188152.	2191.46	72.269	95347.	-842.	162202.	618.77	-8.03	2102.28
	200.00	209660.	2243.70	73.698	101304.	-926.	183559.	572.55	-8.99	2169.39
	210.00	231682.	2299.37	75.061	106797.	-1023.	205596.	526.16	-10.48	2238.34
	220.00	254248.	2358.65	76.351	111827.	-1138.	228332.	479.83	-12.48	2309.29
	230.00	277394.	2421.82	77.579	116394.	-1274.	251790.	433.25	-14.92	2382.70
	240.00	301152.	2488.46	78.745	120491.	-1437.	275993.	386.16	-17.83	2458.25
	250.00	325555.	2558.62	79.842	124117.	-1633.	300962.	338.91	-21.39	2535.98
	260.00	350638.	2632.36	80.874	127268.	-1867.	326720.	291.35	-25.59	2616.07
	270.00	376438.	2710.06	81.843	129943.	-2147.	353293.	243.40	-30.42	2698.94
	280.00	402994.	2791.54	82.757	132134.	-2478.	380708.	194.72	-35.85	2784.51
	290.00	430342.	2876.52	83.610	133836.	-2866.	408991.	145.52	-42.03	2872.53
	300.00	458518.	2965.19	84.402	135044.	-3321.	438168.	95.90	-49.04	2963.23
	310.00	487561.	3057.66	85.137	135752.	-3850.	468266.	45.63	-56.85	3056.80
	320.00	517511.	3154.05	85.818	135954.	-4460.	499314.	-5.38	-65.48	3153.36
	330.00	548408.	3254.42	86.447	135642.	-5162.	531343.	-57.20	-74.97	3253.05
	340.00	580293.	3358.90	87.026	134808.	-5963.	564386.	-109.90	-85.37	3356.01
	350.00	613210.	3467.61	87.556	133441.	-6873.	598475.	-163.58	-96.73	3462.40
	360.00	647202.	3580.71	88.040	131533.	-7901.	633646.	-218.35	-109.10	3572.38
	370.00	682316.	3698.34	88.478	129071.	-9058.	669935.	-274.22	-122.51	3686.12
	380.00	718598.	3820.69	88.872	126045.	-10355.	707382.	-331.31	-137.02	3803.83
	390.00	756099.	3947.98	89.223	122441.	-11802.	746026.	-389.73	-152.67	3925.73
	400.00	794870.	4080.47	89.533	118245.	-13412.	785912.	-449.63	-169.55	4052.07
	410.00	834968.	4218.93	89.802	113443.	-15198.	827086.	-511.11	-187.76	4183.64
	420.00	876453.	4363.27	90.036	108017.	-17172.	869602.	-574.57	-207.25	4320.30
	430.00	919384.	4513.50	90.231	101946.	-19348.	913509.	-639.84	-228.25	4462.09

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
	440.00	963824.	4670.27	90.387	95214.	-21742.	958863.	-707.05	-250.87	4609.62
	450.00	1009842.	4833.95	90.508	87798.	-24371.	1005722.	-776.52	-275.16	4763.24
	460.00	1057509.	5005.16	90.594	79676.	-27251.	1054151.	-848.46	-301.26	4923.52
9)	469.00	1101882.	5162.92	90.651	71739.	-30074.	1099133.	-915.73	-325.82	5070.61
	470.00	1106897.	5178.46	90.662	70820.	-30401.	1104211.	-923.50	-328.20	5084.87
	480.00	1157894.	5336.95	90.755	61193.	-33607.	1155782.	-1002.34	-353.21	5230.07
	490.00	1210476.	5501.95	90.819	50764.	-37470.	1208831.	-1083.97	-379.67	5380.74
	500.00	1264713.	5674.28	90.852	39504.	-41406.	1263418.	-1168.46	-407.82	5537.68
	510.00	1320680.	5854.60	90.857	27383.	-45632.	1319608.	-1256.41	-437.68	5701.42
	520.00	1378460.	6043.63	90.838	14362.	-50166.	1377472.	-1348.54	-469.40	5872.53
	530.00	1438139.	6241.96	90.790	400.	-55029.	1437086.	-1444.57	-503.72	6051.57
	540.00	1499814.	6450.44	90.710	-14543.	-60249.	1498533.	-1544.75	-540.82	6239.34
	550.00	1563591.	6670.10	90.600	-30511.	-65855.	1561906.	-1649.61	-580.77	6436.75
	560.00	1629585.	6902.17	90.460	-47553.	-71875.	1627305.	-1759.81	-623.80	6644.84
	570.00	1697924.	7148.38	90.319	-65743.	-78347.	1694840.	-1879.56	-671.16	6864.12
	580.00	1768748.	7409.64	90.115	-85150.	-85308.	1764636.	-2001.96	-721.56	7097.49
10)	584.07	1798297.	7520.56	90.009	-93392.	-88286.	1793699.	-2052.07	-742.85	7196.94
11)	584.27	1799762.	7525.78	90.004	-93803.	-88434.	1795139.	-2054.50	-743.84	7201.60
12)	584.87	1804158.	7526.97	90.003	-95037.	-88881.	1799460.	-2059.68	-743.62	7201.40
13)	594.07	1871564.	7527.20	90.001	-114339.	-95688.	1865616.	-2136.35	-736.17	7180.03

9) EMR SHIFT TO 4.8:1:
10) GUIDANCE CUTOFF SIGNAL:
11) INITIATE TIME BASE FOUR:
12) BEGIN LOX NPV:
13) ORBIT INSERTION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 6D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	140.85	58.681	66.343	2054.35	55.763	48.387	-80.115	28.864	29.027
2)	142.17	59.905	68.699	2049.86	55.774	48.398	-80.097	28.878	29.041
3)	145.57	62.984	74.761	2036.94	55.784	48.425	-80.050	28.914	29.078
4)	148.57	65.634	80.140	2039.11	55.745	48.439	-80.009	28.946	29.110
5)	152.77	69.257	87.750	2047.60	55.689	48.474	-79.950	28.992	29.155
	160.00	75.271	101.101	2073.02	55.598	48.540	-79.848	29.071	29.235
6)	165.10	79.347	110.710	2093.17	55.536	48.588	-79.774	29.129	29.292
	170.00	83.132	120.088	2113.51	55.479	48.636	-79.701	29.184	29.348
7)	171.47	84.241	122.977	2119.83	55.463	48.650	-79.679	29.201	29.365
8)	175.00	86.867	129.815	2136.31	55.421	48.684	-79.626	29.242	29.406
	180.00	90.479	139.706	2160.48	55.362	48.729	-79.549	29.301	29.465
	190.00	97.382	159.960	2209.39	55.248	48.804	-79.392	29.421	29.586
	200.00	103.908	180.833	2261.77	55.131	48.869	-79.230	29.544	29.710
	210.00	110.061	202.345	2317.59	55.010	48.924	-79.062	29.671	29.837
	220.00	115.849	224.518	2376.98	54.886	48.972	-78.889	29.802	29.969
	230.00	121.280	247.377	2440.25	54.760	49.015	-78.710	29.937	30.104
	240.00	126.358	270.945	2506.98	54.634	49.053	-78.525	30.076	30.243
	250.00	131.089	295.247	2577.21	54.505	49.083	-78.335	30.219	30.387
	260.00	135.480	320.308	2651.02	54.374	49.108	-78.137	30.367	30.535
	270.00	139.540	346.156	2728.77	54.241	49.128	-77.934	30.519	30.687
	280.00	143.273	372.821	2810.30	54.109	49.146	-77.723	30.676	30.845
	290.00	146.686	400.332	2895.31	53.976	49.159	-77.505	30.838	31.007
	300.00	149.788	428.716	2984.00	53.842	49.167	-77.280	31.004	31.175
	310.00	152.587	458.006	3076.50	53.708	49.172	-77.047	31.177	31.347
	320.00	155.091	488.233	3172.90	53.575	49.175	-76.807	31.354	31.526
	330.00	157.310	519.431	3273.29	53.444	49.177	-76.558	31.538	31.709
	340.00	159.252	551.638	3377.77	53.315	49.177	-76.301	31.727	31.899
	350.00	160.928	584.889	3486.49	53.188	49.177	-76.034	31.922	32.095
	360.00	162.347	619.225	3599.60	53.063	49.178	-75.759	32.124	32.298
	370.00	163.519	654.687	3717.23	52.942	49.179	-75.473	32.333	32.507
	380.00	164.459	691.317	3839.58	52.825	49.181	-75.178	32.548	32.723
	390.00	165.177	729.163	3966.87	52.713	49.186	-74.872	32.771	32.946
	400.00	165.689	768.272	4099.37	52.605	49.193	-74.555	33.001	33.177
	410.00	166.008	808.698	4237.83	52.502	49.204	-74.226	33.238	33.415
	420.00	166.151	850.499	4382.17	52.406	49.219	-73.885	33.484	33.661
	430.00	166.133	893.733	4532.41	52.316	49.238	-73.532	33.738	33.916

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
	440.00	165.974	938.459	4689.19	52.232	49.261	-73.165	34.000	34.179
	450.00	165.694	984.744	4852.88	52.156	49.290	-72.783	34.272	34.451
	460.00	165.316	1032.658	5024.09	52.088	49.325	-72.387	34.553	34.733
9)	469.00	164.911	1077.236	5181.87	52.040	49.367	-72.017	34.815	34.995
	470.00	164.862	1082.273	5197.41	52.039	49.375	-71.975	34.844	35.025
	480.00	164.315	1133.483	5355.92	52.032	49.457	-71.548	35.144	35.325
	490.00	163.677	1186.269	5520.96	52.036	49.549	-71.105	35.452	35.634
	500.00	162.972	1240.700	5693.32	52.050	49.649	-70.646	35.770	35.953
	510.00	162.227	1296.852	5873.67	52.075	49.759	-70.170	36.097	36.280
	520.00	161.465	1354.806	6062.74	52.113	49.881	-69.676	36.433	36.617
	530.00	160.714	1414.651	6261.11	52.159	50.010	-69.162	36.780	36.965
	540.00	160.009	1476.481	6469.63	52.213	50.147	-68.628	37.137	37.323
	550.00	159.390	1540.401	6689.34	52.280	50.294	-68.072	37.506	37.692
	560.00	158.898	1606.523	6921.46	52.359	50.454	-67.492	37.885	38.072
	570.00	158.562	1674.974	7167.72	52.446	50.620	-66.888	38.277	38.464
	580.00	158.426	1745.896	7429.05	52.554	50.807	-66.256	38.681	38.869
10)	584.07	158.454	1775.476	7540.00	52.606	50.891	-65.991	38.850	39.038
11)	584.27	158.457	1776.942	7545.21	52.609	50.895	-65.978	38.858	39.046
12)	584.87	158.466	1781.343	7546.42	52.635	50.922	-65.939	38.883	39.071
13)	594.07	158.604	1848.827	7527.20	53.043	51.356	-65.329	39.264	39.453

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 6D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	140.85	-64.004	-.097	.000	.005	-.025	-.000	-.005	-.097	.000
2)	142.17	-63.982	-.200	-.002	.035	-.131	-.004	.017	-.200	-.002
3)	145.57	-63.577	-1.017	-.064	.140	-.194	-.057	.422	-1.017	-.067
4)	148.57	-63.504	-.862	-.344	-.064	.211	-.096	.497	-.860	-.348
5)	152.77	-63.815	-.209	-.585	-.038	.038	.008	.185	-.208	-.585
	160.00	-63.873	-.296	-.667	-.011	.005	-.018	.128	-.296	-.667
6)	165.10	-63.931	-.269	-.661	-.009	.000	.022	.069	-.269	-.661
	170.00	-63.964	-.274	-.652	-.006	-.000	-.015	.036	-.273	-.652
7)	171.47	-63.972	-.274	-.680	-.005	-.000	-.023	.029	-.274	-.681
8)	175.00	-63.976	-.315	-.794	-.002	-.008	-.041	.025	-.315	-.794
	180.00	-60.759	-.768	-.045	1.132	-.054	.126	-1.759	-.329	-.028
	190.00	-56.353	-1.047	-.082	-.192	-.048	-.121	.209	-.256	-.085
	200.00	-57.543	-1.456	-.551	-.112	-.041	-.016	.155	-.261	-.555
	210.00	-58.457	-1.845	-.701	-.092	-.037	-.017	.130	-.274	-.705
	220.00	-59.479	-2.198	-.863	-.124	-.030	.074	.194	-.294	-.870
	230.00	-60.822	-2.474	-.152	-.126	-.032	.072	.173	-.289	-.159
	240.00	-61.821	-2.876	.600	-.096	-.042	-.024	.136	-.284	.594
	250.00	-62.847	-3.275	.341	-.107	-.039	-.027	.148	-.292	.333
	260.00	-63.930	-3.663	.060	-.109	-.039	-.029	.151	-.297	.051
	270.00	-65.208	-3.990	-.275	-.127	-.033	-.034	.172	-.307	-.287
	280.00	-66.391	-4.353	-.596	-.107	-.040	-.030	.135	-.298	-.605
	290.00	-67.323	-4.799	-.863	-.101	-.042	-.029	.141	-.305	-.874
	300.00	-68.394	-5.198	-.255	-.110	-.038	.068	.149	-.319	-.268
	310.00	-69.508	-5.574	.417	-.112	-.037	.067	.151	-.325	.402
	320.00	-70.625	-5.951	.400	-.112	-.037	-.034	.151	-.333	.385
	330.00	-71.740	-6.324	.055	-.111	-.038	-.035	.151	-.336	.039
	340.00	-72.854	-6.695	-.297	-.112	-.037	-.036	.151	-.342	-.314
	350.00	-74.019	-7.075	-.672	-.112	-.037	-.037	.103	-.364	-.684
	360.00	-75.117	-7.428	-.604	-.111	-.035	.063	.111	-.368	-.618
	370.00	-76.228	-7.781	.024	-.112	-.035	.062	.112	-.376	.009
	380.00	-77.347	-8.127	.626	-.112	-.034	-.039	.114	-.383	.610
	390.00	-78.480	-8.469	.233	-.114	-.034	-.040	.113	-.388	.216
	400.00	-79.616	-8.808	-.169	-.114	-.033	-.041	.112	-.397	-.186
	410.00	-80.844	-9.096	-.610	-.124	-.029	-.045	.121	-.403	-.629
	420.00	-82.023	-9.415	-.622	-.108	-.036	.060	.099	-.399	-.638
	430.00	-83.081	-9.774	-.015	-.111	-.032	.059	.111	-.414	-.033

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
440.00	-84.220	-10.092	.557	-.116	-.031	.056	.116	-.424	.537
450.00	-85.374	-10.402	.264	-.115	-.031	-.046	.114	-.429	.243
460.00	-86.531	-10.704	-.198	-.116	-.029	-.047	.114	-.437	-.219
9) 469.00	-87.576	-10.969	-.620	-.116	-.029	-.047	.114	-.442	-.642
470.00	-87.687	-11.004	-.666	-.101	-.045	-.042	.066	-.390	-.678
480.00	-88.753	-11.421	-.608	-.121	-.014	.052	.117	-.466	-.630
490.00	-89.906	-11.600	-.073	-.110	-.027	.055	.107	-.455	-.094
500.00	-91.038	-11.864	.465	-.122	-.020	.050	.123	-.473	.439
510.00	-92.389	-11.997	.334	-.144	-.017	-.059	.143	-.474	.304
520.00	-93.642	-12.303	-.185	-.113	-.037	-.047	.109	-.459	-.208
530.00	-94.749	-12.661	-.655	-.111	-.033	-.048	.107	-.470	-.678
540.00	-95.876	-12.956	-.570	-.114	-.027	.051	.111	-.481	-.595
550.00	-97.040	-13.206	-.070	-.118	-.024	.049	.116	-.490	-.096
560.00	-98.233	-13.438	.414	-.120	-.023	.048	.117	-.497	.386
570.00	-99.990	-13.865	.524	.019	.008	-.003	-.040	-.537	.533
580.00	-99.799	-13.746	.492	.021	.017	-.003	-.037	-.547	.501
10) 584.07	-99.780	-13.733	.458	-.000	-.001	-.010	-.019	-.534	.462
11) 584.27	-99.780	-13.734	.455	-.000	-.001	-.010	-.019	-.534	.460
12) 584.87	-99.781	-13.734	.449	-.000	-.001	-.010	-.019	-.534	.453
13) 594.07	-99.781	-13.740	.355	.000	-.001	-.010	-.019	-.541	.359

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 7D

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB/CSM SEPARATION CONDITIONS

FLIGHT TIME: S-IVB/CSM SEPARATION	4440.200	(SEC)
RADIUS:	6535009.	(M)
ALTITUDE:	163017.	(M)
SPACE FIXED VELOCITY:	7811.12	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	90.058	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	47.130	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	45.045	(DEG)
GEOCENTRIC DECLINATION:	-32.434	(DEG)
GEODETIC LATITUDE:	-32.608	(DEG)
LONGITUDE: (POSITIVE EAST)	-151.792	(DEG)
INCLINATION:	51.788	(DEG)
DESCENDING NODE ARGUMENT:	157.470	(DEG)
INERTIAL RANGE ANGLE:	78.722	(DEG)
WEIGHT: (S-IVB/IU/DM/FIXED SLA)	36728.	(LBS)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	1264824.	(M)
YS	602174.	(M)
ZS	-6383099.	(M)
$\dot{X}S$	7657.78	(M/S)
$\dot{Y}S$	111.83	(M/S)
$\dot{Z}S$	1536.04	(M/S)

VEHICLE ATTITUDE ANGLES

PITCH ATTITUDE ANGLE	105.613	(DEG)
YAW ATTITUDE ANGLE	4.353	(DEG)
ROLL ATTITUDE ANGLE	176.799	(DEG)

OSCULATING CONIC PARAMETERS

* PERIGEE ALTITUDE	151.82	(KM)
* APOGEE ALTITUDE	165.83	(KM)
ECCENTRICITY	.0011	
SEMI-MAJOR AXIS	6536.99	(KM)
TRUE ANOMALY	286.638	(DEG)
PERIOD	87.66	(MIN)

* REFERENCED TO EQUATORIAL RADIUS (6378.165 KM)

TABLE 8D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC2)	DYNAMIC PRESSURE (LB/FT2)	A.H.I. (LB-FT/FT2-RAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1)	-17.20	1311641.	0.	0.	.000	0.	0.	.00	.000
2)	.00	1296407.	1630471.	161.	40.532	0.	0.	.01	.000
	5.00	1264785.	1669891.	756.	42.529	3.	102.	.04	6.188
	10.00	1232920.	1681229.	2919.	43.865	12.	1941.	.09	3.305
	15.00	1200940.	1691932.	6600.	45.219	30.	11203.	.15	.257
	20.00	1168875.	1703059.	11580.	46.630	59.	40349.	.21	-2.745
	25.00	1136752.	1714637.	16755.	48.125	99.	110752.	.28	-1.542
	30.00	1104592.	1727518.	22895.	49.714	152.	254448.	.35	-1.263
	35.00	1072401.	1741646.	29831.	51.414	218.	517292.	.44	-.877
	40.00	1040191.	1757195.	37663.	53.236	294.	960269.	.54	-.501
	45.00	1007930.	1774102.	48580.	55.122	380.	1659244.	.65	-.153
	50.00	975651.	1791019.	60199.	57.113	471.	2703670.	.77	.056
	55.00	943376.	1805712.	110971.	57.830	559.	4187206.	.92	.047
3)	57.74	925703.	1812333.	150101.	57.801	600.	5209947.	1.00	.033
	65.00	878758.	1833165.	165800.	61.066	685.	8662053.	1.25	.006
	70.00	846361.	1847080.	144699.	64.727	723.	11709016.	1.47	-.002
4)	73.23	825449.	1854501.	131650.	67.162	731.	13969595.	1.63	.020
	80.00	781602.	1867577.	104236.	72.590	681.	19270863.	2.00	-.169
	85.00	749252.	1874699.	84769.	76.863	587.	23326674.	2.26	-.166
	90.00	717109.	1879483.	65703.	81.378	483.	27184001.	2.52	-.011
	95.00	684983.	1881402.	49076.	86.066	386.	30733733.	2.80	.046
	100.00	652890.	1881419.	35738.	90.954	302.	33899106.	3.11	-.073
	105.00	620845.	1879379.	25614.	96.068	229.	36641880.	3.44	-.221
	110.00	588859.	1876526.	16946.	101.607	169.	38936249.	3.78	-.700
	115.00	556934.	1873206.	8805.	107.711	122.	40805910.	4.13	-1.137
	120.00	525084.	1868553.	2779.	114.332	86.	42301271.	4.51	-1.624
	125.00	493317.	1862520.	-770.	121.536	60.	43481058.	4.91	-2.288
5)	129.00	467987.	1857287.	-2352.	127.865	45.	44235462.	5.26	-2.815
6)	133.07	442315.	1849483.	-4218.	134.845	34.	44860191.	5.73	-2.008
7)	136.07	423450.	1840231.	-6092.	140.287	28.	45242531.	6.13	-1.150
8)	139.47	410775.	645416.	-5825.	51.009	20.	45588580.	6.43	-.278
9)	140.57	409509.	35373.	-5279.	3.194	18.	45678581.	6.46	-.014
10)	140.77	409279.	37844.	-5174.	3.382	17.	45693717.	6.47	.033
11)	140.85	409246.	35902.	-5132.	3.226	17.	45699597.	6.47	.051

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 8D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	-17.20	20910035.	1340.44	90.000	20909952.	44124.	-39089.	.00	888.85	1003.36
2)	.00	20910035.	1340.44	90.000	20909939.	59407.	-21826.	-1.48	888.25	1003.89
	5.00	20910150.	1341.06	87.954	20910046.	63848.	-16807.	45.97	887.82	1004.04
	10.00	20910525.	1343.68	85.593	20910410.	68285.	-11786.	100.91	887.25	1004.03
	15.00	20911193.	1349.87	82.965	20911066.	72720.	-6766.	162.56	886.82	1004.63
	20.00	20912189.	1363.77	80.110	20912047.	77155.	-1732.	231.06	887.03	1009.78
	25.00	20913547.	1387.79	77.087	20913388.	81589.	3346.	306.51	886.46	1022.84
	30.00	20915302.	1423.97	73.975	20915124.	86019.	8511.	389.04	885.47	1045.12
	35.00	20917490.	1474.86	70.879	20917290.	90445.	13815.	478.59	884.82	1078.54
	40.00	20920146.	1542.12	67.901	20919922.	94868.	19318.	575.11	884.45	1124.79
	45.00	20923303.	1626.82	65.146	20923052.	99289.	25087.	678.16	884.21	1185.25
	50.00	20926994.	1729.78	62.695	20926714.	103710.	31196.	787.25	884.02	1261.29
	55.00	20931243.	1850.68	60.698	20930930.	108129.	37730.	898.76	883.63	1355.16
3)	57.74	20933809.	1922.65	59.863	20933476.	110552.	41526.	957.85	883.36	1413.78
	65.00	20941375.	2136.32	58.366	20940983.	116961.	52423.	1111.56	882.84	1596.52
	70.00	20947260.	2312.22	57.738	20946820.	121375.	60783.	1224.09	882.51	1751.90
4)	73.23	20951367.	2439.31	57.492	20950893.	124223.	66620.	1299.78	882.34	1866.08
	80.00	20960809.	2741.82	57.375	20960251.	130197.	80168.	1464.60	881.35	2143.77
	85.00	20968519.	2996.88	57.588	20967887.	134598.	91474.	1590.33	879.16	2383.11
	90.00	20976881.	3279.62	57.977	20976163.	138987.	104049.	1720.14	876.31	2651.24
	95.00	20985919.	3590.57	58.491	20985098.	143361.	118037.	1854.10	873.37	2948.18
	100.00	20995654.	3930.71	59.121	20994709.	147721.	133585.	1990.46	870.60	3275.76
	105.00	21006099.	4300.66	59.838	21005007.	152067.	150849.	2128.59	867.95	3634.76
	110.00	21017265.	4701.85	60.639	21015996.	156399.	169993.	2266.47	864.81	4027.73
	115.00	21029155.	5136.80	61.513	21027672.	160715.	191193.	2403.11	861.58	4457.51
	120.00	21041768.	5607.77	62.440	21040026.	165015.	214638.	2537.85	858.47	4926.40
	125.00	21055100.	6117.30	63.416	21053046.	169299.	240534.	2668.82	854.76	5437.66
5)	129.00	21066278.	6554.78	64.224	21063926.	172712.	263161.	2770.30	851.62	5879.23
6)	133.07	21078109.	7028.91	65.026	21075404.	176170.	288046.	2874.04	848.51	6358.11
7)	136.07	21087156.	7398.47	65.534	21084154.	178712.	307674.	2959.14	846.11	6727.92
8)	139.47	21097615.	7610.15	66.125	21094238.	181585.	330970.	2964.17	844.33	6958.10
9)	140.57	21100991.	7610.25	66.338	21097484.	182514.	338634.	2935.62	844.00	6970.34
10)	140.77	21101602.	7608.38	66.378	21098071.	182683.	340029.	2929.59	843.94	6970.84
11)	140.85	21101842.	7607.63	66.393	21098302.	182749.	340579.	2927.21	843.92	6971.04

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 8D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	-17.20	295.	.00	N/A	295.	0.	-0.	.00	-.00	-.00
2)	.00	295.	.00	N/A	295.	-0.	0.	.00	-.00	-.00
	5.00	411.	47.87	.482	411.	-1.	0.	47.87	-.30	-.06
	10.00	786.	103.24	.563	786.	-3.	-1.	103.24	-.79	-.32
	15.00	1454.	165.33	.538	1454.	-8.	-3.	165.32	-1.18	-.03
	20.00	2450.	234.31	1.320	2450.	-14.	6.	234.26	-.97	4.76
	25.00	3809.	310.66	3.341	3808.	-19.	58.	310.17	-1.58	17.39
	30.00	5567.	395.14	5.818	5563.	-30.	195.	393.19	-2.66	39.17
	35.00	7766.	488.61	8.597	7751.	-46.	468.	483.27	-3.43	72.01
	40.00	10450.	592.19	11.570	10408.	-64.	937.	580.38	-3.96	117.60
	45.00	13669.	706.71	14.641	13566.	-85.	1668.	684.09	-4.37	177.31
	50.00	17475.	833.16	17.748	17259.	-108.	2735.	793.96	-4.75	252.51
	55.00	21923.	969.96	20.963	21512.	-133.	4223.	906.35	-5.33	345.44
3)	57.74	24645.	1046.89	22.769	24080.	-148.	5249.	965.97	-5.68	403.52
	65.00	32854.	1264.65	27.626	31651.	-192.	8808.	1121.33	-6.35	584.73
	70.00	39445.	1439.40	30.965	37540.	-224.	12107.	1235.23	-6.73	738.94
4)	73.23	44160.	1564.49	33.079	41651.	-246.	14672.	1311.93	-6.88	852.31
	80.00	55380.	1860.33	37.382	51099.	-294.	21349.	1479.21	-7.72	1128.14
	85.00	64958.	2109.22	40.397	58814.	-338.	27574.	1607.10	-9.65	1365.99
	90.00	75778.	2385.53	43.198	67178.	-392.	35059.	1739.39	-12.11	1632.53
	95.00	87981.	2690.06	45.766	76217.	-459.	43948.	1876.16	-14.52	1927.75
	100.00	101712.	3023.53	48.148	85947.	-537.	54390.	2015.74	-16.56	2253.50
	105.00	117119.	3386.77	50.355	96380.	-624.	66539.	2157.50	-18.27	2610.57
	110.00	134354.	3781.14	52.432	107523.	-720.	80556.	2299.47	-20.23	3001.50
	115.00	153579.	4209.13	54.403	119375.	-826.	96619.	2440.73	-21.98	3429.16
	120.00	174965.	4673.09	56.274	131930.	-939.	114918.	2580.65	-23.28	3895.83
	125.00	198696.	5175.65	58.067	145178.	-1059.	135655.	2717.44	-24.78	4404.80
5)	129.00	219501.	5607.59	59.448	156263.	-1160.	154146.	2824.06	-25.83	4844.49
6)	133.07	242441.	6076.46	60.766	167972.	-1267.	174818.	2933.51	-26.53	5321.39
7)	136.07	260588.	6442.98	61.604	176906.	-1347.	191334.	3023.12	-27.02	5689.65
8)	139.47	282159.	6650.18	62.409	187214.	-1439.	211098.	3032.03	-26.97	5918.70
9)	140.57	289248.	6648.38	62.651	190536.	-1469.	217619.	3004.28	-26.83	5930.81
10)	140.77	290536.	6646.15	62.695	191137.	-1474.	218805.	2998.39	-26.81	5931.29
11)	140.85	291045.	6645.26	62.713	191373.	-1476.	219274.	2996.06	-26.80	5931.48

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 8D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	-17.20	295.	.000	.00	90.000	N/A	-80.621	28.466	28.627
2)	.00	295.	.000	5.96	90.000	N/A	-80.621	28.466	28.627
	5.00	411.	.000	48.21	89.986	N/A	-80.621	28.466	28.627
	10.00	786.	.001	103.41	89.971	N/A	-80.621	28.466	28.627
	15.00	1454.	.002	165.54	89.943	N/A	-80.621	28.466	28.627
	20.00	2450.	.004	234.40	89.806	32.734	-80.621	28.466	28.627
	25.00	3808.	.012	310.28	89.424	41.360	-80.621	28.466	28.627
	30.00	5564.	.035	394.40	88.783	43.463	-80.620	28.466	28.628
	35.00	7752.	.080	487.52	87.875	44.973	-80.620	28.467	28.628
	40.00	10408.	.158	590.74	86.688	45.964	-80.619	28.468	28.629
	45.00	13567.	.279	705.05	85.231	46.600	-80.617	28.469	28.631
	50.00	17260.	.456	831.64	83.532	47.017	-80.615	28.471	28.633
	55.00	21512.	.702	969.14	81.611	47.274	-80.611	28.474	28.635
3)	57.74	24081.	.871	1046.66	80.503	47.378	-80.609	28.476	28.637
	65.00	31653.	1.458	1266.92	77.449	47.622	-80.601	28.482	28.644
	70.00	37544.	2.001	1444.74	75.247	47.756	-80.593	28.488	28.650
4)	73.23	41656.	2.423	1573.18	73.820	47.833	-80.587	28.493	28.655
	80.00	51111.	3.521	1872.61	70.873	47.938	-80.572	28.505	28.667
	85.00	58832.	4.544	2124.24	68.784	47.948	-80.557	28.517	28.679
	90.00	67209.	5.773	2410.11	66.837	47.949	-80.540	28.531	28.692
	95.00	76264.	7.231	2721.93	65.064	47.964	-80.520	28.547	28.709
	100.00	86018.	8.942	3061.60	63.465	47.995	-80.495	28.566	28.728
	105.00	96486.	10.931	3429.25	62.034	48.037	-80.467	28.588	28.750
	110.00	107679.	13.224	3825.14	60.747	48.074	-80.435	28.614	28.776
	115.00	119598.	15.849	4264.96	59.596	48.117	-80.398	28.643	28.805
	120.00	132245.	18.836	4743.94	58.573	48.169	-80.356	28.676	28.838
	125.00	145617.	22.217	5263.70	57.657	48.217	-80.308	28.713	28.876
5)	129.00	156829.	25.230	5700.04	56.997	48.259	-80.265	28.747	28.909
6)	133.07	168699.	28.594	6172.35	56.390	48.305	-80.218	28.784	28.947
7)	136.07	177776.	31.280	6539.19	55.982	48.340	-80.180	28.814	28.977
8)	139.47	188273.	34.491	6746.13	55.765	48.375	-80.138	28.849	29.012
9)	140.57	191661.	35.550	6743.74	55.762	48.385	-80.119	28.861	29.024
10)	140.77	192273.	35.743	6741.07	55.763	48.386	-80.116	28.863	29.026
11)	140.85	192515.	35.819	6740.01	55.763	48.387	-80.115	28.864	29.027

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 8D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	-17.20	.000	.000	-41.537	-.003	.002	.002	.000	.000	.000
2)	.00	-.047	.042	-41.503	-.003	.002	.002	-.047	.042	.034
	5.00	-.016	-.017	-41.538	-.001	.001	.003	-.001	-.023	-.001
	10.00	-.009	-.021	-41.538	.002	.000	.000	.007	-.022	-.001
	15.00	-.661	-.005	-37.434	-.203	.006	1.001	.155	.113	-.897
	20.00	-2.002	.021	-32.466	-.329	-.002	1.003	.200	.153	-.929
	25.00	-3.845	-.043	-27.468	-.406	-.000	1.000	.282	.098	-.931
	30.00	-6.076	-.028	-22.466	-.481	.002	1.000	.338	.110	-.929
	35.00	-8.613	-.013	-17.465	-.532	.001	1.000	.408	.114	-.928
	40.00	-11.374	-.010	-12.466	-.570	-.001	1.000	.488	.098	-.929
	45.00	-14.299	-.020	-7.468	-.598	-.003	.999	.548	.052	-.931
	50.00	-17.431	-.042	-2.472	-.685	-.007	1.000	.617	-.015	-.935
	55.00	-20.886	-.076	.022	-.699	-.002	-.051	.602	-.076	.021
3)	57.74	-22.814	-.076	-.002	-.704	.004	.004	.602	-.076	-.003
	65.00	-27.954	-.083	-.000	-.711	-.001	.000	.613	-.083	-.001
	70.00	-31.478	-.105	.000	-.697	-.004	-.000	.611	-.105	-.000
4)	73.23	-33.718	-.100	-.000	-.689	.001	-.000	.602	-.100	-.001
	80.00	-38.257	-.122	.004	-.634	.015	.001	.554	-.122	.003
	85.00	-41.287	-.019	.004	-.592	.007	-.001	.609	-.019	.004
	90.00	-44.113	.042	-.000	-.511	.005	-.002	.510	.042	-.000
	95.00	-46.692	.051	-.003	-.512	-.004	.000	.458	.051	-.002
	100.00	-49.222	.018	-.001	-.503	-.008	.001	.438	.018	-.001
	105.00	-51.574	-.033	.001	-.510	-.018	.001	.579	-.033	.000
	110.00	-54.103	-.085	.005	-.504	-.007	.001	.531	-.085	.005
	115.00	-56.598	-.102	.007	-.494	.001	.000	.508	-.102	.006
	120.00	-59.054	-.092	.007	-.490	.002	.000	.516	-.092	.007
	125.00	-61.608	-.178	.007	-.473	.011	-.000	.423	-.178	.006
5)	129.00	-63.529	-.157	.007	-.485	.003	-.000	.470	-.157	.006
6)	133.07	-64.057	-.153	.004	.030	-.005	-.002	-.058	-.153	.004
7)	136.07	-64.048	-.167	.002	.002	-.001	-.001	-.049	-.167	.002
8)	139.47	-64.013	-.084	.001	.010	.005	-.001	-.014	-.084	.001
9)	140.57	-64.006	-.091	.000	.005	-.019	-.000	-.007	-.091	.000
10)	140.77	-64.005	-.095	.000	.005	-.023	-.000	-.006	-.095	.000
11)	140.85	-64.004	-.097	.000	.005	-.025	-.000	-.005	-.097	.000

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 9D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/S2)	DYNAMIC PRESSURE (LB/FT2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
1)	140.85	307882.	9104.	834.	.865	17.	1.098	-63.999	.051
2)	142.17	307811.	9068.	723.	.873	15.	1.122	-63.999	.399
3)	145.57	307319.	165330.	529.	17.254	10.	1.185	-63.999	1.561
4)	148.57	305897.	210049.	388.	22.053	7.	1.241	-63.999	2.291
5)	152.77	303758.	230311.	246.	24.370	4.	1.320	-63.999	2.885
	160.00	299604.	232585.	120.	24.965	2.	1.458	-63.999	4.459
6)	165.10	296810.	232140.	71.	25.157	1.	1.558	-63.999	5.532
	170.00	294130.	232659.	42.	25.446	1.	1.655	-63.999	6.562
7)	171.47	293323.	232788.	36.	25.531	0.	1.684	-63.999	6.869
8)	175.00	282236.	232977.	24.	26.556	0.	1.756	-63.999	7.609
	180.00	279490.	233190.	18.	26.843	0.	1.858	-58.999	11.838
	190.00	274007.	233072.	9.	27.367	0.	2.067	-56.562	17.970
	200.00	268514.	232692.	3.	27.881	0.	2.281	-57.697	18.421
	210.00	263035.	232542.	1.	28.444	0.	2.502	-58.586	19.086
	220.00	257554.	233226.	1.	29.135	0.	2.728	-59.671	19.578
	230.00	252060.	232800.	0.	29.715	0.	2.961	-60.995	19.664
	240.00	246580.	232729.	0.	30.367	0.	3.200	-61.958	20.034
	250.00	241103.	232650.	0.	31.046	0.	3.445	-62.997	20.352
	260.00	235627.	233272.	0.	31.852	0.	3.698	-64.081	20.559
	270.00	230135.	233470.	0.	32.640	0.	3.957	-65.380	20.518
	280.00	224644.	232929.	0.	33.360	0.	4.224	-66.524	20.527
	290.00	219163.	232925.	0.	34.194	0.	4.498	-67.462	20.735
	300.00	213684.	232922.	0.	35.071	0.	4.780	-68.543	20.702
	310.00	208205.	232915.	0.	35.992	0.	5.071	-69.661	20.567
	320.00	202727.	232907.	0.	36.964	0.	5.369	-70.779	20.426
	330.00	197249.	232892.	0.	37.988	0.	5.676	-71.892	20.267
	340.00	191772.	232878.	0.	39.070	0.	5.992	-73.005	20.069
	350.00	186296.	232862.	0.	40.216	0.	6.318	-74.121	19.785
	360.00	180821.	232846.	0.	41.431	0.	6.653	-75.226	19.500
	370.00	175347.	232819.	0.	42.719	0.	6.998	-76.341	19.120
	380.00	169873.	232790.	0.	44.090	0.	7.353	-77.464	18.694
	390.00	164399.	232766.	0.	45.553	0.	7.719	-78.595	18.308
	400.00	158926.	232742.	0.	47.117	0.	8.096	-79.728	17.891
	410.00	153435.	233621.	0.	48.988	0.	8.486	-80.964	17.355
	420.00	147945.	233062.	0.	50.684	0.	8.887	-82.121	16.809
	430.00	142465.	233046.	0.	52.630	0.	9.301	-83.193	16.302

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 9D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/S2)	DYNAMIC PRESSURE (LB/FT2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
440.00	136985.	233031.	0.	54.732	0.	9.728	-84.339	15.687
450.00	131507.	232811.	0.	56.958	0.	10.169	-85.490	15.120
460.00	126029.	232790.	0.	59.428	0.	10.625	-86.646	14.547
9) 469.00	121263.	197590.	0.	52.425	0.	11.047	-87.689	14.022
470.00	120763.	197448.	0.	52.604	0.	11.095	-87.752	13.975
480.00	116144.	196665.	0.	54.479	0.	11.580	-88.870	13.484
490.00	111562.	196553.	0.	56.685	0.	12.079	-90.015	12.834
500.00	106980.	196573.	0.	59.118	0.	12.592	-91.166	12.187
510.00	102399.	196570.	0.	61.763	0.	13.121	-92.536	11.381
520.00	97817.	196561.	0.	64.652	0.	13.666	-93.753	10.711
530.00	93235.	196550.	0.	67.826	0.	14.228	-94.856	10.173
540.00	88654.	196522.	0.	71.321	0.	14.807	-95.988	9.537
550.00	84073.	196473.	0.	75.188	0.	15.405	-97.159	8.804
560.00	79491.	196409.	0.	79.496	0.	16.023	-98.354	8.033
570.00	74911.	196306.	0.	84.312	0.	16.661	-99.951	6.762
580.00	70333.	196162.	0.	89.734	0.	17.321	-99.763	7.413
10) 584.07	68472.	196080.	0.	92.134	0.	17.596	-99.763	7.605
11) 584.27	68436.	137259.	0.	64.529	0.	17.610	-99.763	7.613
12) 584.87	68355.	5556.	0.	2.615	0.	17.651	-99.763	7.654
13) 594.07	68340.	0.	1.	*.000	0.	18.279	-99.781	8.295

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 9D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	140.85	21101852.	7607.64	66.393	21098312.	182749.	340598.	2927.21	843.92	6971.04
2)	142.17	21105851.	7592.08	66.656	21102151.	183864.	349807.	2885.94	843.57	6971.32
3)	145.57	21115916.	7567.63	67.328	21111787.	186731.	373519.	2786.57	842.22	6985.32
4)	148.57	21124577.	7590.65	67.887	21120044.	189253.	394550.	2718.99	839.82	7037.03
5)	152.77	21136416.	7640.01	68.653	21131278.	192775.	424285.	2631.04	837.73	7123.59
	160.00	21156066.	7735.69	69.940	21149767.	198823.	476363.	2482.44	834.64	7278.86
6)	165.10	21169376.	7807.66	70.821	21162167.	203075.	513779.	2378.50	832.35	7389.82
	170.00	21181735.	7879.63	71.646	21173574.	207147.	550240.	2279.16	830.14	7496.99
7)	171.47	21185359.	7901.88	71.890	21176898.	208365.	561269.	2249.54	829.46	7529.36
8)	175.00	21193931.	7959.40	72.463	21184719.	211292.	588003.	2179.84	827.75	7610.20
	180.00	21205719.	8043.10	73.242	21195373.	215424.	626342.	2083.56	824.80	7724.63
	190.00	21228242.	8210.25	74.532	21215364.	223635.	704678.	1918.64	817.05	7941.00
	200.00	21249521.	8387.63	75.738	21233745.	231758.	785185.	1757.27	807.19	8161.66
	210.00	21269575.	8575.30	76.892	21250507.	239772.	867929.	1594.98	795.13	8388.06
	220.00	21288427.	8773.84	77.988	21265645.	247654.	952967.	1432.54	780.90	8620.80
	230.00	21306102.	8984.32	79.034	21279154.	255383.	1040371.	1268.85	764.71	8861.33
	240.00	21322614.	9205.47	80.032	21291015.	262941.	1130215.	1103.10	746.43	9108.60
	250.00	21337982.	9437.40	80.975	21301214.	270303.	1222566.	936.44	725.48	9362.76
	260.00	21352231.	9680.43	81.865	21309740.	277442.	1317494.	768.32	701.88	9624.34
	270.00	21365387.	9935.85	82.706	21316577.	284332.	1415082.	598.50	675.60	9894.77
	280.00	21377467.	10203.18	83.502	21321702.	290946.	1515419.	425.81	646.75	10173.76
	290.00	21388490.	10481.49	84.249	21325087.	297257.	1618583.	250.94	614.83	10460.43
	300.00	21398485.	10771.43	84.945	21326716.	303232.	1724656.	74.23	579.53	10755.58
	310.00	21407481.	11073.50	85.595	21326564.	308837.	1833725.	-105.10	540.96	11059.78
	320.00	21415505.	11388.03	86.201	21324605.	314040.	1945883.	-287.36	498.99	11373.47
	330.00	21422584.	11715.37	86.762	21320807.	318806.	2061227.	-472.82	453.48	11697.04
	340.00	21428749.	12055.89	87.282	21315138.	323098.	2179859.	-661.71	404.24	12030.93
	350.00	21434031.	12410.07	87.760	21307562.	326878.	2301882.	-854.39	351.08	12375.64
	360.00	21438463.	12778.44	88.198	21298038.	330106.	2427410.	-1051.25	293.77	12731.73
	370.00	21442080.	13161.49	88.597	21286524.	332739.	2556557.	-1252.33	232.22	13099.71
	380.00	21444923.	13559.86	88.957	21272977.	334735.	2689447.	-1458.04	166.17	13480.22
	390.00	21447032.	13974.32	89.280	21257348.	336047.	2826207.	-1668.81	95.43	13873.99
	400.00	21448453.	14405.72	89.566	21239583.	336627.	2966974.	-1885.13	19.69	14281.83
	410.00	21449235.	14856.59	89.816	21219627.	336423.	3111901.	-2107.40	-61.46	14706.24
	420.00	21449426.	15326.69	90.033	21197412.	335380.	3261154.	-2336.92	-147.92	15146.77
	430.00	21449079.	15816.06	90.216	21172868.	333444.	3414892.	-2573.20	-240.44	15603.48

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 90 (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
	440.00	21448258.	16326.79	90.363	21145925.	330550.	3573286.	-2816.70	-339.48	16078.40
	450.00	21447031.	16860.15	90.478	21116507.	326632.	3736525.	-3068.52	-445.28	16572.58
	460.00	21445470.	17418.15	90.560	21084525.	321620.	3904810.	-3329.41	-558.42	17087.87
9)	469.00	21443842.	17932.45	90.615	21053472.	316112.	4060756.	-3573.13	-664.79	17560.28
	470.00	21443648.	17983.11	90.626	21049886.	315442.	4078339.	-3601.07	-675.41	17605.91
	480.00	21441506.	18499.85	90.715	21012464.	308139.	4256708.	-3884.70	-786.30	18070.29
	490.00	21439055.	19037.96	90.777	20972158.	299696.	4439804.	-4178.34	-903.27	18551.81
	500.00	21436374.	19600.08	90.809	20928864.	290050.	4627812.	-4482.30	-1027.26	19053.00
	510.00	21433548.	20188.41	90.815	20882472.	279127.	4820937.	-4798.62	-1158.46	19575.57
	520.00	21430654.	20805.35	90.799	20832842.	266855.	5019403.	-5129.71	-1297.46	20121.26
	530.00	21427784.	21452.71	90.754	20779832.	253142.	5223448.	-5474.69	-1446.76	20691.87
	540.00	21425052.	22133.31	90.679	20723299.	237882.	5433335.	-5834.46	-1607.11	21289.90
	550.00	21422585.	22850.60	90.574	20663087.	220961.	5649351.	-6210.89	-1778.93	21918.26
	560.00	21420520.	23608.57	90.441	20599019.	202261.	5871816.	-6606.23	-1963.08	22580.27
	570.00	21418952.	24412.80	90.307	20530840.	181639.	6101074.	-7034.30	-2164.20	23277.02
	580.00	21418023.	25266.52	90.110	20458308.	159938.	6337514.	-7472.90	-2377.76	24018.72
10)	584.07	21417915.	25629.05	90.009	20427555.	149086.	6435823.	-7652.94	-2467.92	24334.96
11)	584.27	21417914.	25646.11	90.004	20426024.	148592.	6440692.	-7661.66	-2472.16	24349.75
12)	584.87	21417913.	25650.04	90.002	20421421.	147108.	6455302.	-7679.87	-2473.24	24348.65
13)	594.07	21417906.	25651.12	90.001	20349329.	124344.	6678917.	-7948.63	-2474.99	24262.59

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 9D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	140.85	291065.	6645.26	62.713	191383.	-1476.	219293.	2996.06	-26.79	5931.48
2)	142.17	299562.	6627.31	63.004	195314.	-1511.	227128.	2955.66	-26.60	5931.67
3)	145.57	321349.	6596.97	63.757	205190.	-1601.	247305.	2858.61	-26.50	5945.39
4)	148.57	340562.	6615.49	64.411	213667.	-1682.	265216.	2793.39	-27.49	5996.75
5)	152.77	367648.	6658.78	65.314	225221.	-1798.	290580.	2708.91	-27.50	6082.79
	160.00	414723.	6744.70	66.833	244296.	-1994.	335128.	2566.47	-26.81	6237.27
6)	165.10	448308.	6810.34	67.874	257135.	-2130.	367229.	2466.98	-26.27	6347.76
	170.00	480862.	6876.64	68.850	268986.	-2257.	398585.	2372.00	-25.65	6454.54
7)	171.47	490678.	6897.26	69.138	272448.	-2294.	408083.	2343.71	-25.45	6486.80
8)	175.00	514415.	6951.06	69.817	280607.	-2383.	431134.	2277.24	-25.01	6567.40
	180.00	548330.	7029.96	70.738	291759.	-2507.	464259.	2185.61	-24.84	6681.53
	190.00	617298.	7189.83	72.269	312818.	-2762.	532160.	2030.08	-26.33	6897.23
	200.00	687860.	7361.20	73.698	332362.	-3040.	602227.	1878.45	-29.50	7117.44
	210.00	760111.	7543.88	75.061	350385.	-3357.	674528.	1726.24	-34.38	7343.64
	220.00	834148.	7738.36	76.351	366888.	-3732.	749121.	1574.26	-40.95	7576.42
	230.00	910085.	7945.59	77.579	381869.	-4181.	826083.	1421.42	-48.94	7817.26
	240.00	988030.	8164.24	78.745	395311.	-4716.	905489.	1266.92	-58.50	8065.13
	250.00	1068093.	8394.42	79.842	407207.	-5358.	987409.	1111.92	-70.18	8320.15
	260.00	1150387.	8636.36	80.874	417547.	-6126.	1071917.	955.86	-83.95	8582.89
	270.00	1235034.	8891.28	81.843	426322.	-7043.	1159098.	798.56	-99.81	8854.78
	280.00	1322160.	9158.61	82.757	433512.	-8129.	1249043.	638.86	-117.62	9135.54
	290.00	1411883.	9437.41	83.610	439094.	-9404.	1341835.	477.43	-137.89	9424.31
	300.00	1504325.	9728.30	84.402	443057.	-10895.	1437559.	314.62	-160.90	9721.88
	310.00	1599611.	10031.71	85.137	445381.	-12630.	1536304.	149.70	-186.51	10028.86
	320.00	1697871.	10347.92	85.818	446044.	-14634.	1638169.	-17.65	-214.83	10345.67
	330.00	1799238.	10677.24	86.447	445020.	-16936.	1743252.	-187.66	-245.97	10672.75
	340.00	1903849.	11020.00	87.026	442282.	-19563.	1851660.	-360.56	-280.09	11010.54
	350.00	2011843.	11376.67	87.556	437800.	-22548.	1963501.	-536.67	-317.35	11359.57
	360.00	2123366.	11747.73	88.040	431538.	-25921.	2078891.	-716.37	-357.95	11720.41
	370.00	2238569.	12133.66	88.478	423461.	-29718.	2197951.	-899.68	-401.93	12093.58
	380.00	2357606.	12535.06	88.872	413532.	-33972.	2320807.	-1086.97	-449.53	12479.75
	390.00	2480641.	12952.69	89.223	401709.	-38721.	2447592.	-1278.64	-500.89	12879.69
	400.00	2607842.	13387.36	89.533	387944.	-44003.	2578450.	-1475.17	-556.27	13294.21
	410.00	2739396.	13841.62	89.802	372190.	-49861.	2713537.	-1676.88	-616.02	13725.86
	420.00	2875502.	14315.18	90.036	354386.	-56337.	2853024.	-1885.06	-679.97	14174.22
	430.00	3016352.	14808.08	90.231	334470.	-63477.	2997078.	-2099.20	-748.86	14639.39

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 9D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
	440.00	3162153.	15322.41	90.387	312382.	-71332.	3145876.	-2319.70	-823.06	15123.42
	450.00	3313129.	15859.43	90.508	288052.	-79956.	3299614.	-2547.63	-902.74	15627.42
	460.00	3469516.	16421.14	90.594	261403.	-89407.	3458500.	-2783.66	-988.40	16153.27
9)	469.00	3615099.	16938.72	90.651	235366.	-98669.	3606079.	-3004.36	-1068.96	16635.85
	470.00	3631552.	16989.70	90.662	232349.	-99742.	3622738.	-3029.84	-1076.77	16682.64
	480.00	3798865.	17509.68	90.755	200769.	-110914.	3791934.	-3288.51	-1158.84	17159.01
	490.00	3971379.	18051.03	90.819	166548.	-122933.	3965980.	-3556.33	-1245.62	17653.35
	500.00	4149322.	18616.41	90.852	129607.	-135846.	4145072.	-3833.54	-1337.98	18168.23
	510.00	4332941.	19208.00	90.857	89840.	-149712.	4329422.	-4122.09	-1435.96	18705.44
	520.00	4522505.	19828.19	90.838	47119.	-164586.	4519264.	-4424.36	-1540.03	19266.82
	530.00	4718303.	20478.87	90.790	1312.	-180542.	4714848.	-4739.41	-1652.61	19854.24
	540.00	4920650.	21162.84	90.710	-47714.	-197669.	4916447.	-5068.07	-1774.33	20470.28
	550.00	5129892.	21883.53	90.600	-100101.	-216060.	5124362.	-5412.10	-1905.43	21117.94
	560.00	5346409.	22644.92	90.460	-156014.	-235812.	5338927.	-5773.64	-2048.58	21800.66
	570.00	5570615.	23452.67	90.319	-215692.	-257043.	5560500.	-6166.52	-2201.97	22520.06
	580.00	5802979.	24309.85	90.115	-279362.	-279883.	5789490.	-6568.11	-2367.33	23285.71
10)	584.07	5899924.	24673.75	90.009	-306404.	-289651.	5884838.	-6732.51	-2437.16	23612.02
11)	584.27	5904730.	24690.87	90.004	-307752.	-290138.	5889562.	-6740.47	-2440.42	23627.30
12)	584.87	5919154.	24694.80	90.003	-311801.	-291603.	5903739.	-6757.47	-2439.70	23626.63
13)	594.07	6140303.	24695.55	90.001	-375128.	-313938.	6120788.	-7009.01	-2415.27	23556.59

9) EMR SHIFT TO 4.8:1:
10) GUIDANCE CUTOFF SIGNAL:
11) INITIATE TIME BASE FOUR:
12) BEGIN LOX NPV:
13) ORBIT INSERTION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 9D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	140.85	192525.	35.822	6740.00	55.763	48.387	-80.115	28.864	29.027
2)	142.17	196538.	37.094	6725.26	55.774	48.398	-80.097	28.878	29.041
3)	145.57	206641.	40.368	6682.88	55.784	48.425	-80.050	28.914	29.078
4)	148.57	215335.	43.272	6690.00	55.745	48.439	-80.009	28.946	29.110
5)	152.77	227222.	47.381	6717.86	55.689	48.474	-79.950	28.992	29.155
	160.00	246954.	54.590	6801.24	55.598	48.540	-79.848	29.071	29.235
6)	165.10	260324.	59.779	6867.35	55.536	48.588	-79.774	29.129	29.292
	170.00	272741.	64.842	6934.07	55.479	48.636	-79.701	29.184	29.348
7)	171.47	276383.	66.375	6954.82	55.463	48.650	-79.679	29.201	29.365
8)	175.00	284997.	70.094	7008.90	55.421	48.684	-79.626	29.242	29.406
	180.00	296847.	75.435	7088.18	55.362	48.729	-79.549	29.301	29.465
	190.00	319496.	86.372	7248.64	55.248	48.804	-79.392	29.421	29.586
	200.00	340905.	97.642	7420.52	55.131	48.869	-79.230	29.544	29.710
	210.00	361093.	109.258	7603.63	55.010	48.924	-79.062	29.671	29.837
	220.00	380083.	121.230	7798.49	54.886	48.972	-78.889	29.802	29.969
	230.00	397901.	133.573	8006.07	54.760	49.015	-78.710	29.937	30.104
	240.00	414561.	146.299	8225.00	54.634	49.053	-78.525	30.076	30.243
	250.00	430081.	159.421	8455.42	54.505	49.083	-78.335	30.219	30.387
	260.00	444489.	172.953	8697.57	54.374	49.108	-78.137	30.367	30.535
	270.00	457808.	186.909	8952.66	54.241	49.128	-77.934	30.519	30.687
	280.00	470056.	201.307	9220.13	54.109	49.146	-77.723	30.676	30.845
	290.00	481254.	216.162	9499.05	53.976	49.159	-77.505	30.838	31.007
	300.00	491430.	231.488	9790.03	53.842	49.167	-77.280	31.004	31.175
	310.00	500612.	247.303	10093.51	53.708	49.172	-77.047	31.177	31.347
	320.00	508830.	263.625	10409.78	53.575	49.175	-76.807	31.354	31.526
	330.00	516109.	280.471	10739.13	53.444	49.177	-76.558	31.538	31.709
	340.00	522482.	297.861	11081.93	53.315	49.177	-76.301	31.727	31.899
	350.00	527979.	315.815	11438.62	53.188	49.177	-76.034	31.922	32.095
	360.00	532633.	334.355	11809.70	53.063	49.178	-75.759	32.124	32.298
	370.00	536481.	353.503	12195.64	52.942	49.179	-75.473	32.333	32.507
	380.00	539563.	373.282	12597.05	52.825	49.181	-75.178	32.548	32.723
	390.00	541920.	393.717	13014.68	52.713	49.186	-74.872	32.771	32.946
	400.00	543599.	414.834	13449.36	52.605	49.193	-74.555	33.001	33.177
	410.00	544647.	436.662	13903.63	52.502	49.204	-74.226	33.238	33.415
	420.00	545115.	459.233	14377.20	52.406	49.219	-73.885	33.484	33.661
	430.00	545055.	482.577	14870.11	52.316	49.238	-73.532	33.738	33.916

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 9D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
440.00	544533.	506.727	15384.47	52.232	49.261	-73.165	34.000	34.179
450.00	543615.	531.719	15921.51	52.156	49.290	-72.783	34.272	34.451
460.00	542376.	557.591	16483.25	52.088	49.325	-72.367	34.553	34.733
9) 469.00	541048.	581.661	17000.88	52.040	49.367	-72.017	34.815	34.995
470.00	540887.	584.381	17051.86	52.039	49.375	-71.975	34.844	35.025
480.00	539091.	612.032	17571.93	52.032	49.457	-71.548	35.144	35.325
490.00	536997.	640.534	18113.37	52.036	49.549	-71.105	35.452	35.634
500.00	534684.	669.925	18678.86	52.050	49.649	-70.646	35.770	35.953
510.00	532239.	700.244	19270.56	52.075	49.759	-70.170	36.097	36.280
520.00	529739.	731.537	19890.88	52.113	49.881	-69.676	36.433	36.617
530.00	527276.	763.850	20541.70	52.159	50.010	-69.162	36.780	36.965
540.00	524965.	797.236	21225.82	52.213	50.147	-68.628	37.137	37.323
550.00	522933.	831.750	21946.66	52.280	50.294	-68.072	37.506	37.692
560.00	521319.	867.453	22708.22	52.359	50.454	-67.492	37.885	38.072
570.00	520217.	904.414	23516.15	52.446	50.620	-66.888	38.277	38.464
580.00	519771.	942.709	24373.53	52.554	50.807	-66.256	38.681	38.869
10) 584.07	519864.	958.680	24737.52	52.606	50.891	-65.991	38.850	39.038
11) 584.27	519873.	959.472	24754.64	52.609	50.895	-65.978	38.858	39.046
12) 584.87	519902.	961.848	24758.60	52.635	50.922	-65.939	38.883	39.071
13) 594.07	520353.	998.287	24695.55	53.043	31.356	-65.329	39.264	39.453

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 9D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1) 140.85	-64.004	-.097	.000	.005	-.025	-.000	-.005	-.097	.000
2) 142.17	-63.982	-.200	-.002	.035	-.131	-.004	.017	-.200	-.002
3) 145.57	-63.577	-1.017	-.064	.140	-.194	-.057	.422	-1.017	-.067
4) 148.57	-63.504	-.862	-.344	-.064	.211	-.096	.497	-.860	-.348
5) 152.77	-63.815	-.209	-.585	-.036	.038	.008	.185	-.208	-.585
160.00	-63.873	-.296	-.667	-.011	.005	-.018	.128	-.296	-.667
6) 165.10	-63.931	-.269	-.661	-.009	.000	.022	.069	-.269	-.661
170.00	-63.964	-.274	-.652	-.006	-.000	-.015	.036	-.273	-.652
7) 171.47	-63.972	-.274	-.680	-.005	-.000	-.023	.029	-.274	-.681
8) 175.00	-63.976	-.315	-.794	-.002	-.008	-.041	.025	-.315	-.794
180.00	-60.759	-.768	-.045	1.132	-.054	.126	-1.759	-.329	-.028
190.00	-56.353	-1.047	-.082	-.192	-.048	-.121	.209	-.256	-.085
200.00	-57.543	-1.456	-.551	-.112	-.041	-.016	.155	-.261	-.555
210.00	-58.457	-1.845	-.701	-.092	-.037	-.017	.130	-.274	-.705
220.00	-59.479	-2.198	-.863	-.124	-.030	.074	.194	-.294	-.870
230.00	-60.822	-2.474	-.152	-.126	-.032	.072	.173	-.289	-.159
240.00	-61.821	-2.876	.600	-.096	-.042	-.024	.136	-.284	.594
250.00	-62.847	-3.275	.341	-.107	-.039	-.027	.148	-.292	.333
260.00	-63.930	-3.663	.060	-.109	-.039	-.029	.151	-.297	.051
270.00	-65.208	-3.990	-.275	-.127	-.033	-.034	.172	-.307	-.287
280.00	-66.391	-4.353	-.596	-.107	-.040	-.030	.135	-.298	-.605
290.00	-67.323	-4.799	-.863	-.101	-.042	-.029	.141	-.305	-.874
300.00	-68.394	-5.198	-.255	-.110	-.038	.068	.149	-.319	-.268
310.00	-69.508	-5.574	.417	-.112	-.037	.067	.151	-.325	.402
320.00	-70.625	-5.951	.400	-.112	-.037	-.034	.151	-.333	.385
330.00	-71.740	-6.324	.055	-.111	-.038	-.035	.151	-.336	.039
340.00	-72.854	-6.695	-.297	-.112	-.037	-.036	.151	-.342	-.314
350.00	-74.019	-7.075	-.672	-.112	-.037	-.037	.103	-.364	-.684
360.00	-75.117	-7.428	-.604	-.111	-.035	.063	.111	-.368	-.618
370.00	-76.228	-7.781	.024	-.112	-.035	.062	.112	-.376	.009
380.00	-77.347	-8.127	.626	-.112	-.034	-.039	.114	-.383	.610
390.00	-78.480	-8.469	.233	-.114	-.034	-.040	.113	-.388	.216
400.00	-79.616	-8.808	-.169	-.114	-.033	-.041	.112	-.397	-.186
410.00	-80.844	-9.096	-.610	-.124	-.029	-.045	.121	-.403	-.629
420.00	-82.023	-9.415	-.622	-.108	-.036	.060	.099	-.399	-.638
430.00	-83.081	-9.774	-.015	-.111	-.032	.059	.111	-.414	-.033

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 9D (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
440.00	-84.220	-10.092	.557	-.116	-.031	.056	.116	-.424	.537
450.00	-85.374	-10.402	.264	-.115	-.031	-.046	.114	-.429	.243
460.00	-86.531	-10.704	-.198	-.116	-.029	-.047	.114	-.437	-.219
9) 469.00	-87.576	-10.969	-.620	-.116	-.029	-.047	.114	-.442	-.642
470.00	-87.687	-11.004	-.666	-.101	-.045	-.042	.066	-.390	-.678
480.00	-88.753	-11.421	-.608	-.121	-.014	.052	.117	-.466	-.630
490.00	-89.906	-11.600	-.073	-.110	-.027	.055	.107	-.455	-.094
500.00	-91.038	-11.864	.465	-.122	-.020	.050	.123	-.473	.439
510.00	-92.389	-11.997	.334	-.144	-.017	-.059	.143	-.474	.304
520.00	-93.642	-12.303	-.185	-.113	-.037	-.047	.109	-.459	-.208
530.00	-94.749	-12.661	-.655	-.111	-.033	-.048	.107	-.470	-.678
540.00	-95.876	-12.956	-.570	-.114	-.027	.051	.111	-.481	-.595
550.00	-97.040	-13.206	-.070	-.118	-.024	.049	.116	-.490	-.096
560.00	-98.233	-13.438	.414	-.120	-.023	.048	.117	-.497	.386
570.00	-99.990	-13.865	.524	.019	.008	-.003	-.040	-.537	.533
580.00	-99.799	-13.746	.492	.021	.017	-.003	-.037	-.547	.501
10) 584.07	-99.780	-13.733	.458	-.000	-.001	-.010	-.019	-.534	.462
11) 584.27	-99.780	-13.734	.455	-.000	-.001	-.010	-.019	-.534	.460
12) 584.87	-99.781	-13.734	.449	-.000	-.001	-.010	-.019	-.534	.453
13) 594.07	-99.781	-13.740	.355	.000	-.001	-.010	-.019	-.541	.359

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS OF POOR QUALITY

FIGURE 1D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
ALTITUDE VS. GROUND RANGE

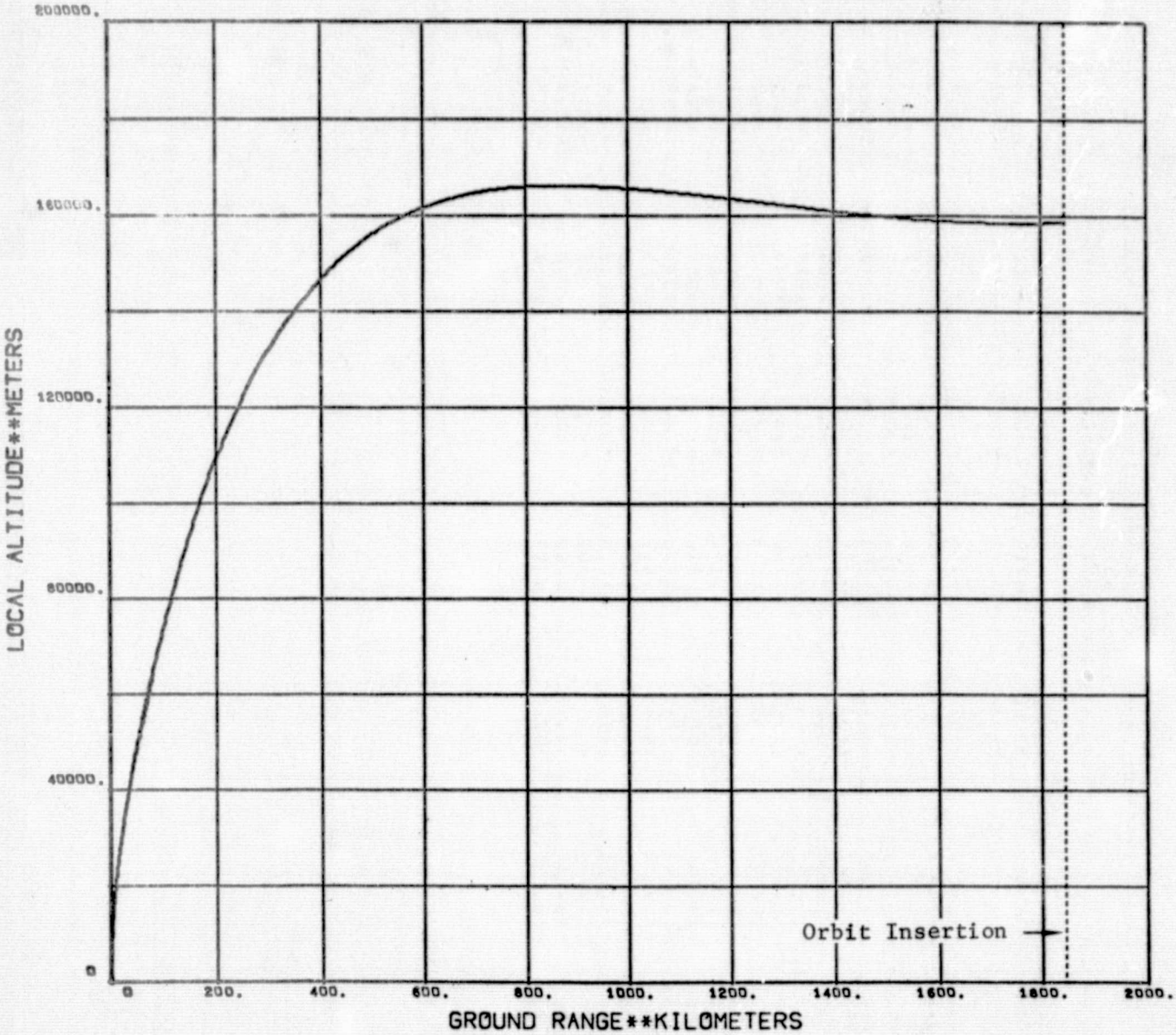


FIGURE 2D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
ALTITUDE HISTORY

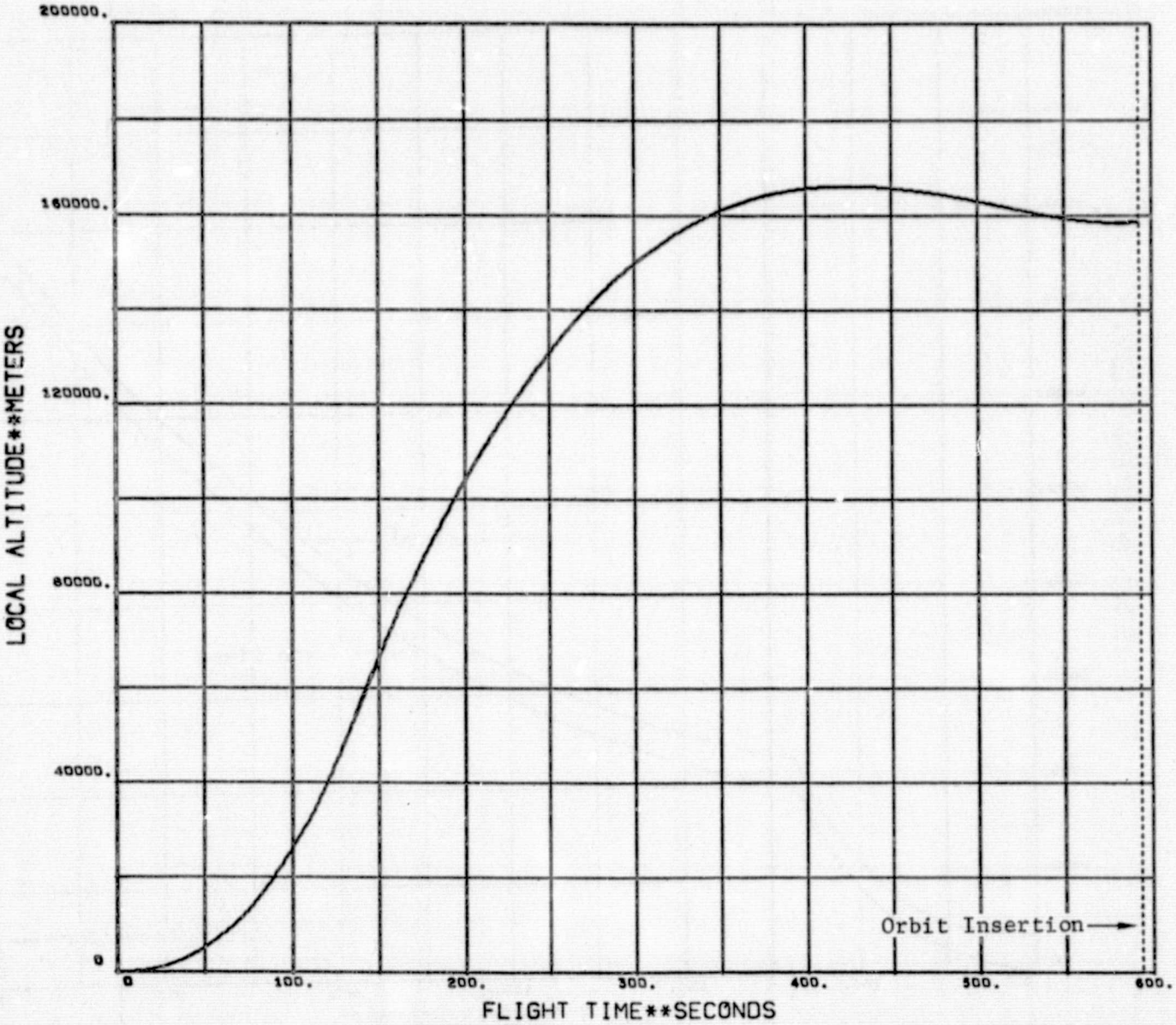


FIGURE 3D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
VELOCITY HISTORIES

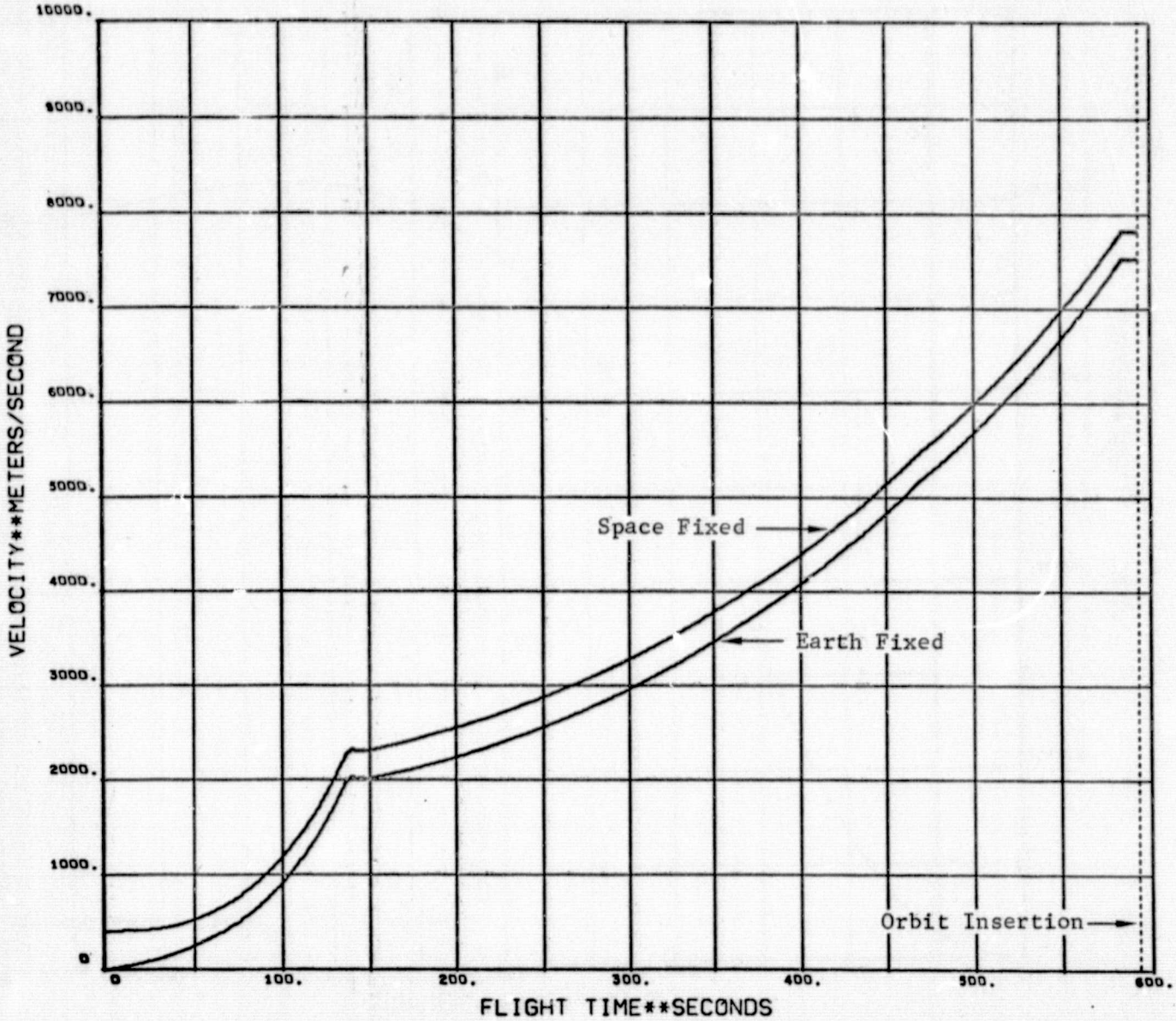


FIGURE 4D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
SPACE FIXED PATH ANGLE HISTORY

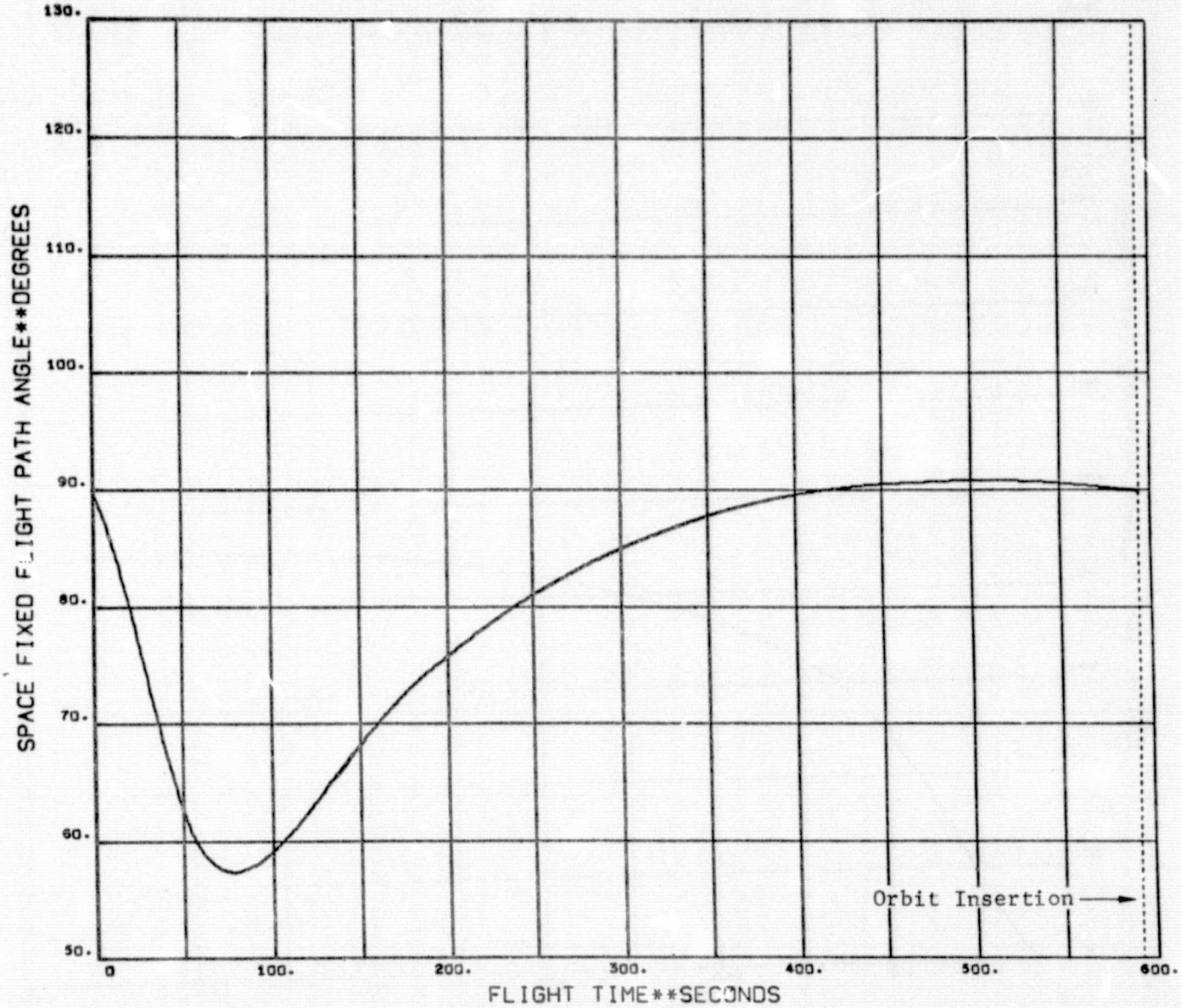


FIGURE 5D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
EARTH FIXED PATH ANGLE HISTORY

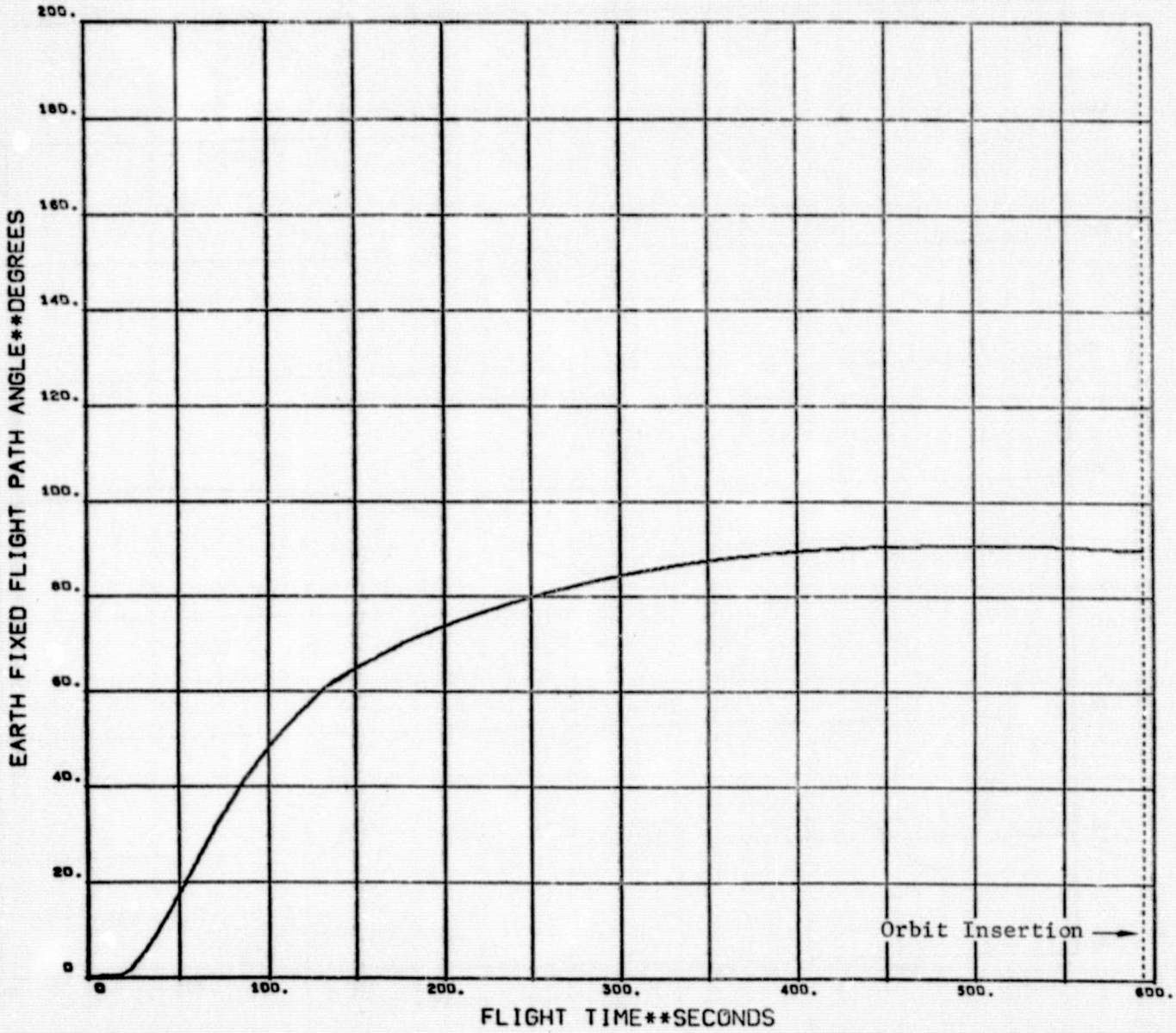


FIGURE 6D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
PITCH ANGLE OF ATTACK HISTORY

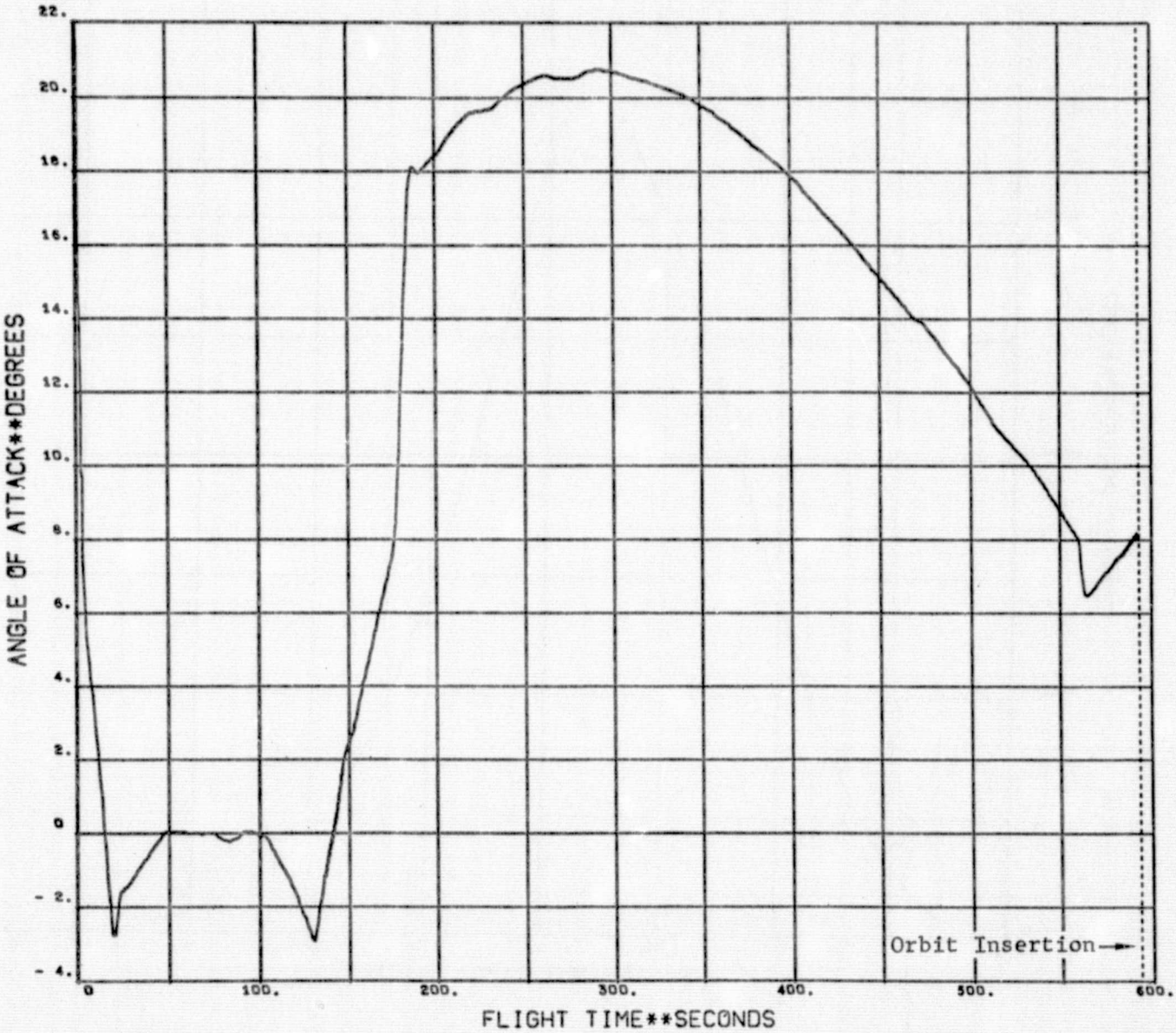


FIGURE 7D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
DYNAMIC PRESSURE HISTORY

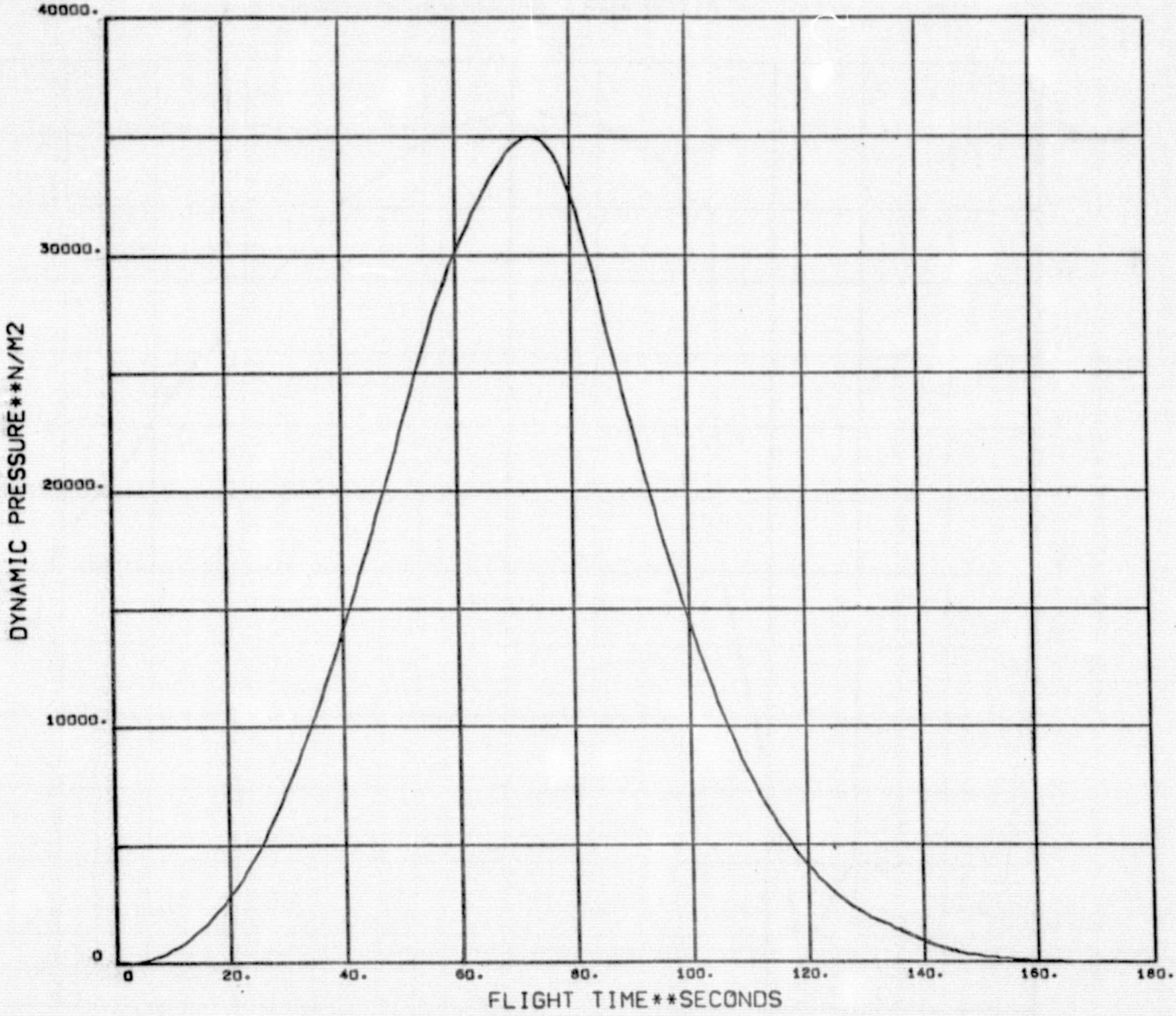


FIGURE 8D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
AERODYNAMIC LOAD INDICATOR HISTORY

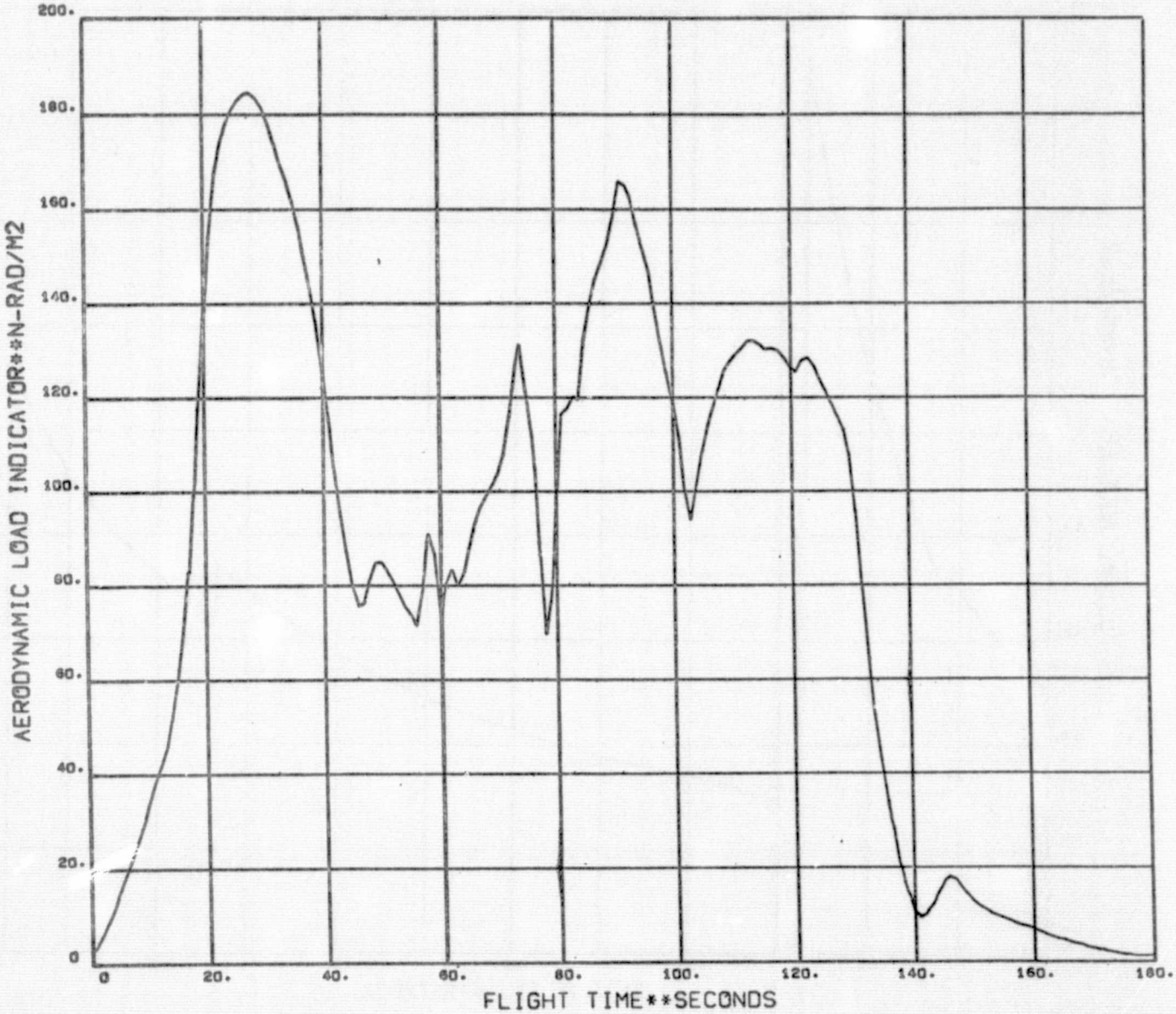


FIGURE 9D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
LONGITUDINAL ACCELERATION HISTORY

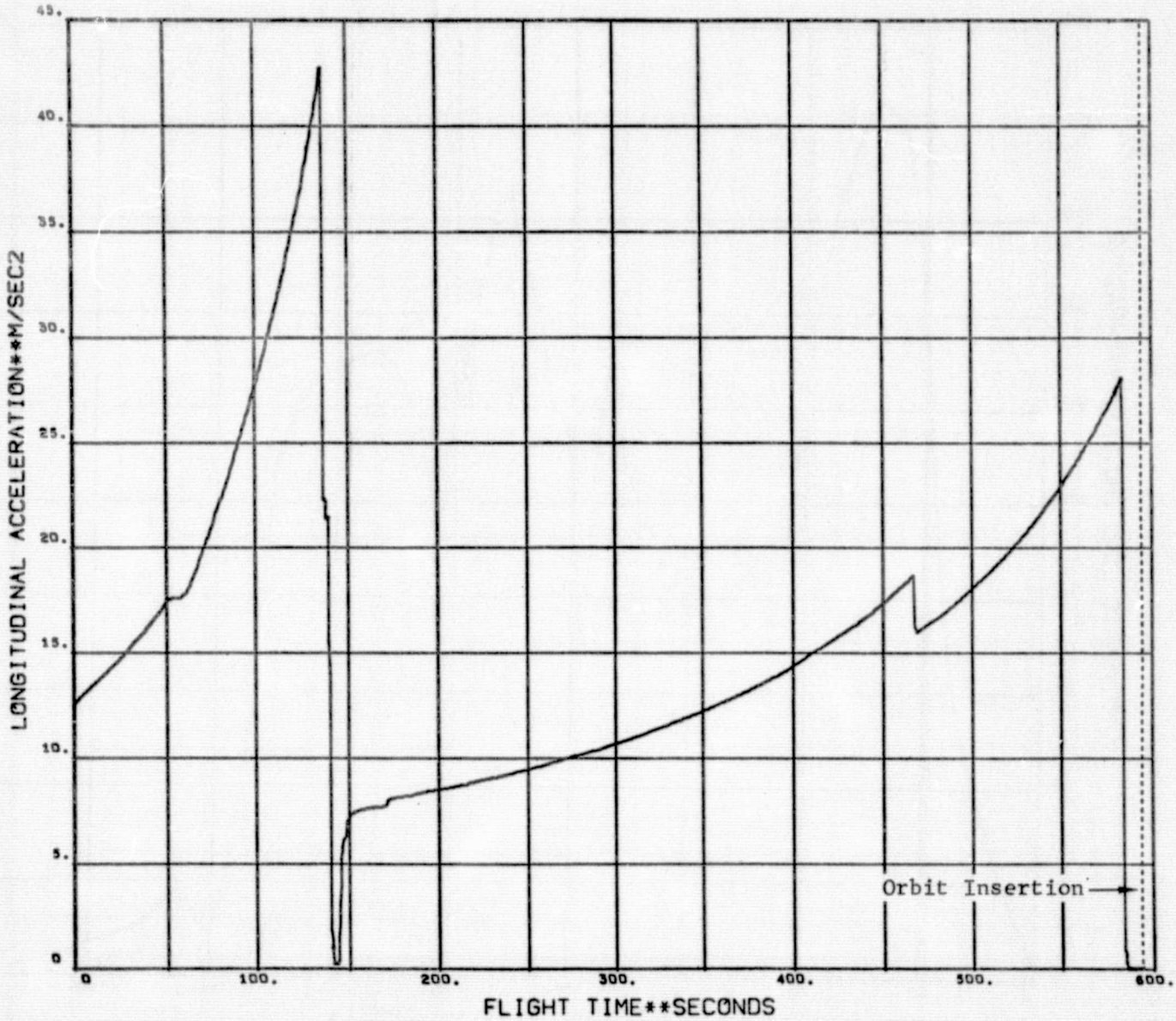


FIGURE 10D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
INERTIAL PITCH ATTITUDE AND PITCH ATTITUDE COMMAND HISTORIES

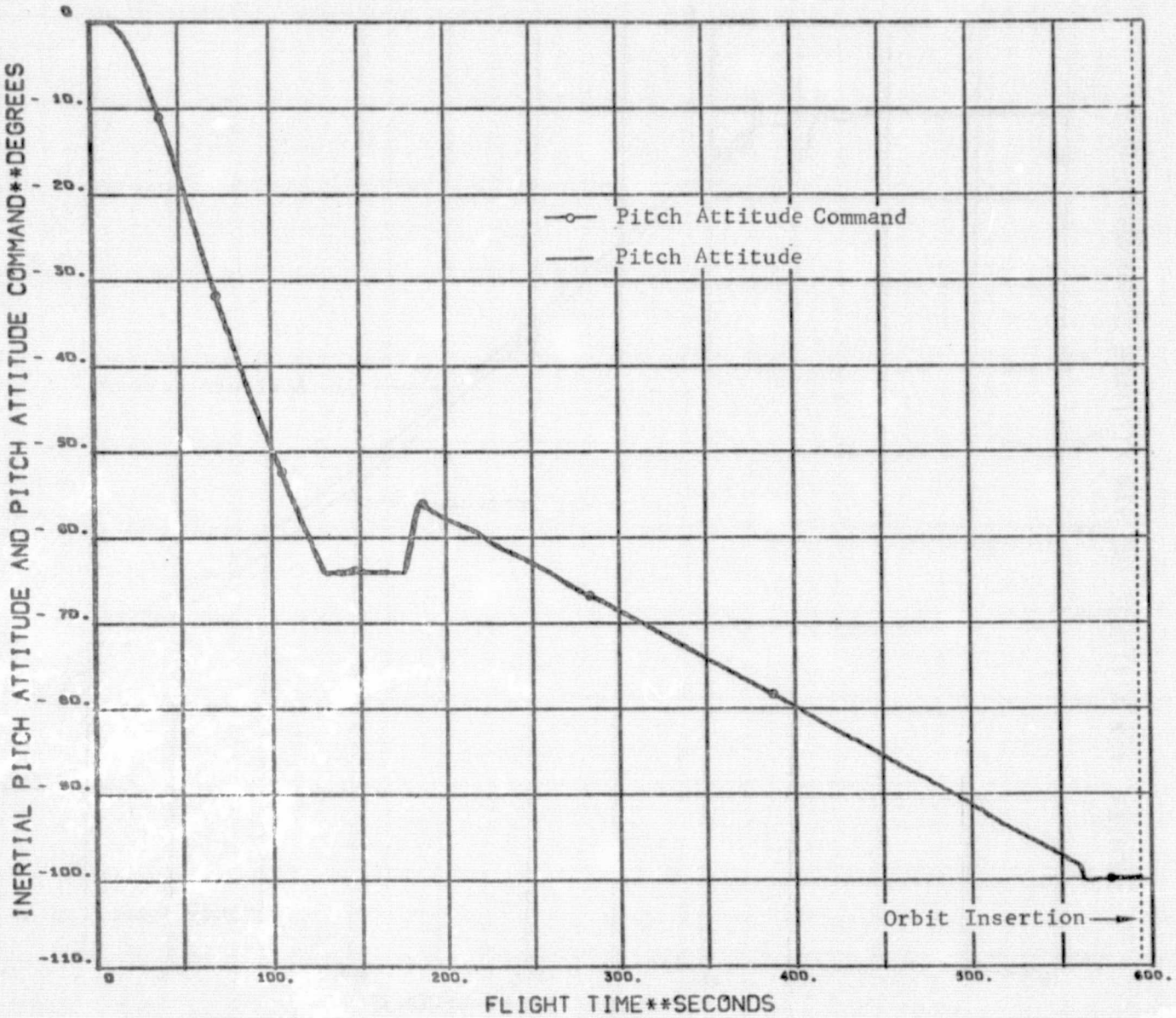


FIGURE 11D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
INERTIAL YAW ATTITUDE AND YAW ATTITUDE COMMAND HISTORIES

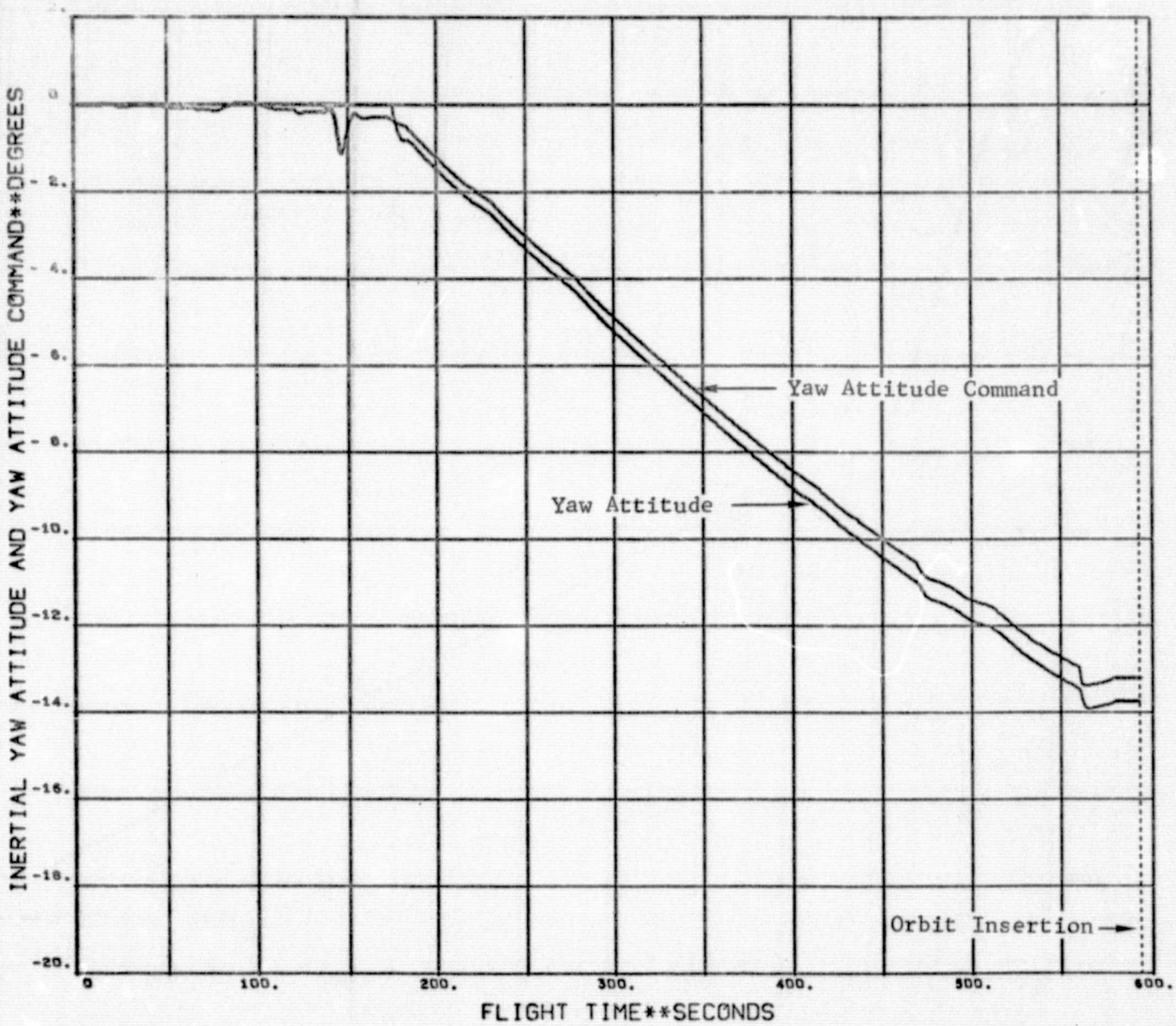


FIGURE 12D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
PITCH, YAW, AND ROLL BODY RATE HISTORIES

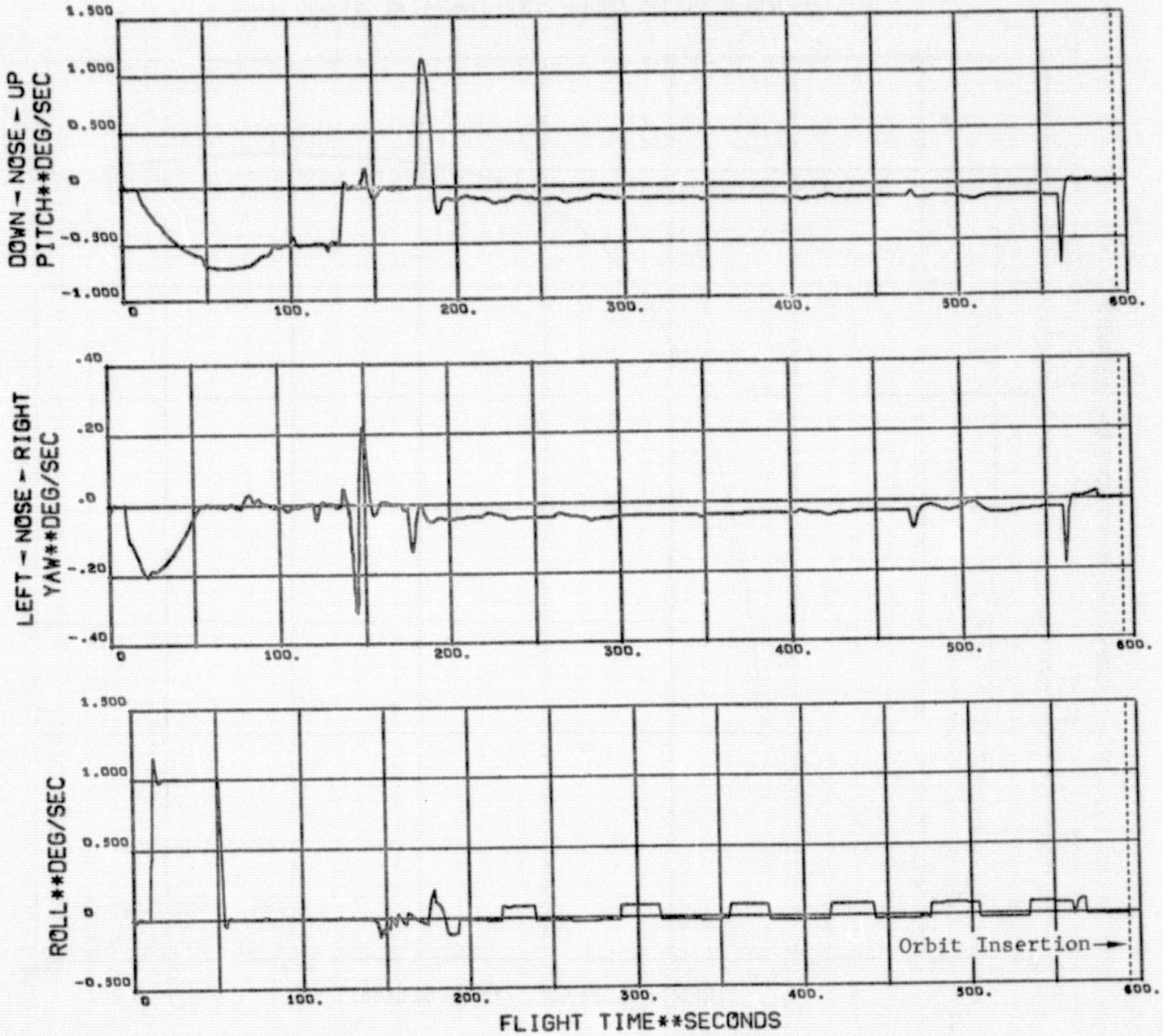


FIGURE 13D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
INERTIAL PATH ANGLE VS. INERTIAL VELOCITY

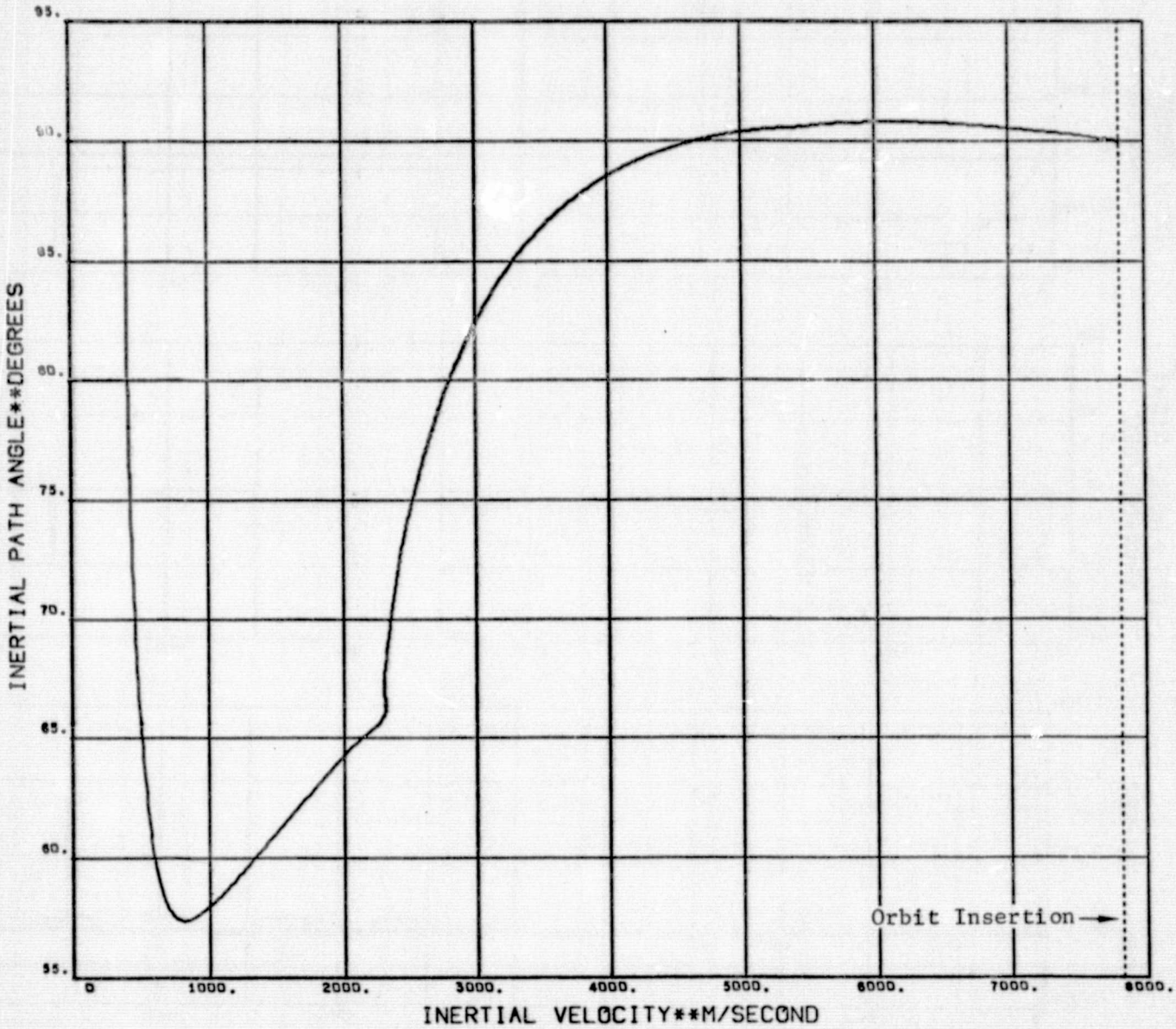
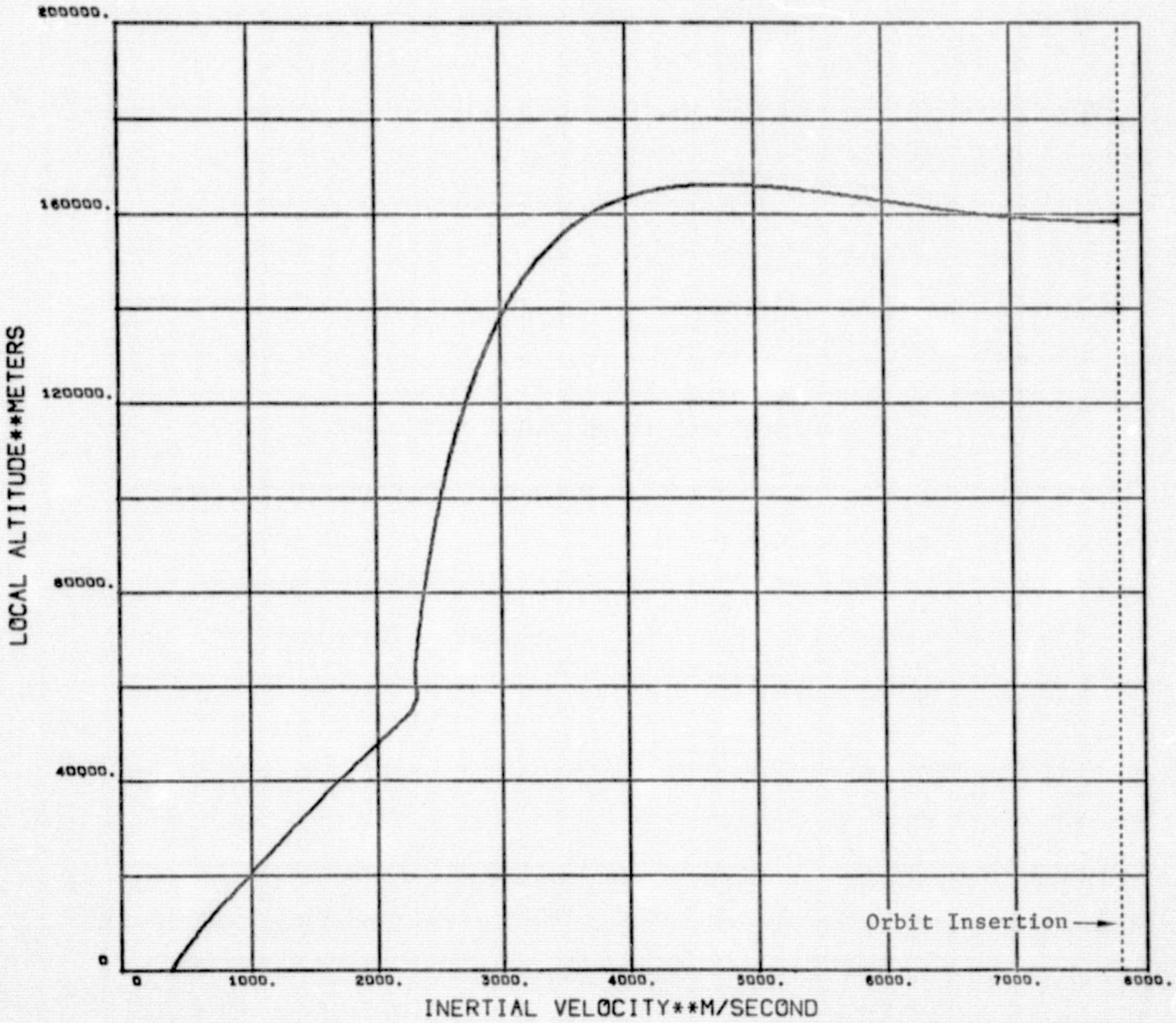


FIGURE 14D
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW OPENING
ALTITUDE VS. INERTIAL VELOCITY



APPENDIX E: "LAUNCH WINDOW CLOSING TRAJECTORY DATA"

PRECEDING PAGE BLANK NOT FILMED

TABLE 1E

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING POWERED FLIGHT SEQUENCE OF EVENTS

FLIGHT TIME (HR: MIN: SEC)	FLIGHT TIME (SEC)	LVDC FLIGHT PROGRAM TIME(SEC)	EVENT
-0:00:17.20	- 17.20	$(0.00)_0$	Guidance Reference Release (GRR); Initiation of Time Base 0.
-0:00:03.30	- 3.30	---	Time for S-IB Mainstage Ignition.
-0:00:00.20	- 0.20	---	Hold Down Arm Release Signal.
0:00:00.00	0.00	---	First Motion.
0:00:00.02	0.20	$(0.00)_1$	Lift-Off Signal; Initiate Time Base 1.
0:00:10.00	10.00	$(9.80)_1$	Initiate Pitch and Roll Maneuvers.
0:00:57.73	57.73	---	Mach One.
0:01:13.21	73.21	---	Maximum Dynamic Pressure.
0:01:40.20	100.20	$(100.00)_1$	Control Gain Switch Point.
0:02:00.20	120.20	$(120.00)_1$	Control Gain Switch Point.
0:02:08.07	128.07	$(127.87)_1$	Enable S-IB Propellant Level Sensors.
0:02:09.00	129.00	$(128.80)_1$	Arrest Attitude Commands.
0:02:13.07	133.07	$(0.00)_2$	Level Sensor Actuation; Initiate Time Base 2.
0:02:16.07	136.07	$(3.00)_2$	Inboard Engine Cutoff (IECO).
0:02:19.47	139.47	$(0.00)_3$	Outboard Engine Cutoff (OECO); Initiate Time Base 3.
0:02:20.57	140.57	$(1.10)_3$	Ullage Rockets Ignition.
0:02:20.77	140.77	$(1.30)_3$	Separation Signal.
0:02:20.85	140.85	---	S-IB/S-IVB Physical Separation.
0:02:22.17	142.17	$(2.70)_3$	J-2 Engine Start Command.
0:02:25.57	145.57	---	90% J-2 Thrust Level.
0:02:28.17	148.17	$(8.70)_3$	Command 5.5:1 EMR.
0:02.28.57	148.57	---	Ullage Burn Out.
0:02:32.77	152.77	$(13.30)_3$	Jettison Ullage Rocket Motors.
0:02:45.35	165.35	---	Dynamic Pressure = 1 PSF.
0:02:51.47	171.47	---	LES Jettison.
0:02:54.47	174.47	$(35.00)_3$	Command Active Guidance Initiation.
0:03:01.47	181.47	$(42.00)_3$	Control Gain Switch Point.
0:05:45.57	345.57	$(206.10)_3$	Control Gain Switch Point.
0:07:47.57	467.57	$(328.10)_3$	Command EMR Shift to 4.8:1.
0:09:43.81	583.81	---	Guidance Cutoff Signal (GCS).
0:09:44.01	584.01	$(0.00)_4$	Initiate Time Base 4; Inertial Attitude Freeze.
0:09:44.61	584.61	$(0.60)_4$	Begin LOX NPV.
0:09:53.81	593.81	---	Orbit Insertion.

TABLE 2E

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
POWERED FLIGHT TRAJECTORY EVENT SUMMARY

EVENT	FLIGHT TIME (SEC)	ALTITUDE (KM)	- - - - - SPACE FIXED - - - - VELOCITY (M/S)	FLIGHT PATH ANGLE (DEG)	AZIMUTH (DEG)	GEODETIC LAT. (DEG)	LONGITUDE POSITIVE EAST (DEG)
GUIDANCE REF. RELEASE	-17.20	.09	408.57	90.000	90.00	28.63	-80.62
FIRST MOTION	.00	.09	408.57	90.000	90.00	28.63	-80.62
MACH ONE	57.73	7.34	573.73	59.170	78.31	28.64	-80.61
MAX. DYN. PRESSURE	73.21	12.69	722.80	56.480	69.69	28.66	-80.59
TILT ARREST	129.00	47.73	1955.00	63.721	47.83	28.97	-80.33
INBOARD ENGINE CUTOFF	136.07	54.10	2210.56	65.120	46.53	29.05	-80.26
OUTBOARD ENGINE CUTOFF	139.47	57.28	2274.62	65.737	46.25	29.09	-80.23
S-IB/S-IVB PHYSICAL SEP.	140.85	58.57	2273.75	66.012	46.24	29.11	-80.21
J-2 ENG. START COMMAND	142.17	59.79	2268.93	66.280	46.25	29.12	-80.20
ULLAGE CASE JETTISON	152.77	69.11	2282.78	68.329	46.11	29.26	-80.08
LES JETTISON	171.47	84.01	2361.44	71.657	45.76	29.51	-79.86
IGM INITIATION	175.00	86.62	2378.78	72.248	45.70	29.56	-79.81
EMR SHIFT, 5.5:1/4.8:1	469.00	164.93	5445.67	90.573	48.61	35.97	-73.12
GUIDANCE CUTOFF SIGNAL	583.81	158.84	7811.68	90.009	53.76	40.10	-67.13
ORBIT INSERTION	593.81	158.99	7818.46	90.001	54.23	40.50	-66.45

TABLE 3E

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IB STAGE END CONDITIONS OF FLIGHT

FLIGHT TIME: OECO + 1.379 SECONDS	140.847	(SEC)
RADIUS:	6431710.	(M)
ALTITUDE:	58572.	(M)
SPACE FIXED VELOCITY:	2273.75	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	66.012	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	46.243	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	37.187	(DEG)
GEOCENTRIC DECLINATION:	28.944	(DEG)
GEODETIC LATITUDE:	29.107	(DEG)
LONGITUDE: (POSITIVE EAST)	-80.211	(DEG)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	6430751.	(M)
YS	61616.	(M)
ZS	92409.	(M)
$\dot{X}S$	891.85	(M/S)
$\dot{Y}S$	309.59	(M/S)
$\dot{Z}S$	2068.51	(M/S)

VEHICLE ATTITUDES AND ATTITUDE RATES

PITCH ATTITUDE ANGLE	-64.007	(DEG)
YAW ATTITUDE ANGLE	-.103	(DEG)
ROLL ATTITUDE ANGLE	.001	(DEG)
PITCH RATE	.004	(DEG/S)
YAW RATE	-.029	(DEG/S)
ROLL RATE	.000	(DEG/S)

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 4E

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE END CONDITIONS OF FLIGHT

FLIGHT TIME: GCS	583.813	(SEC)
RADIUS:	6528180.	(M)
ALTITUDE:	158843.	(M)
SPACE FIXED VELOCITY:	7811.68	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	90.009	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	53.758	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	52.113	(DEG)
GEOCENTRIC DECLINATION:	39.910	(DEG)
GEODETIC LATITUDE:	40.099	(DEG)
LONGITUDE: (POSITIVE EAST)	-67.131	(DEG)
INCLINATION:	51.782	(DEG)
DESCENDING NODE ARGUMENT:	154.806	(DEG)
INERTIAL RANGE ANGLE:	17.447	(DEG)
WEIGHT:	68588.	(LBS)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	6231730.	(M)
YS	264351.	(M)
ZS	1926863.	(M)
$\dot{X}S$	-2328.33	(M/S)
$\dot{Y}S$	939.50	(M/S)
$\dot{Z}S$	7397.20	(M/S)

VEHICLE ATTITUDE ANGLES

PITCH ATTITUDE ANGLE	-100.191	(DEG)
YAW ATTITUDE ANGLE	10.907	(DEG)
ROLL ATTITUDE ANGLE	-.255	(DEG)

OSCULATING CONIC PARAMETERS

* PERIGEE ALTITUDE	141.91	(KM)
* APOGEE ALTITUDE	150.34	(KM)
ECCENTRICITY	.0006	
SEMI-MAJOR AXIS	6524.29	(KM)
TRUE ANOMALY	194.275	(DEG)
PERIOD	8[illegible].41	(MIN)

* REFERENCED TO EQUATORIAL RADIUS (6378.165 KM)

TABLE 4E (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE END CONDITIONS OF FLIGHT

FLIGHT TIME: ORBIT INSERTION	593.813	(SEC)
RADIUS:	6528178.	(M)
ALTITUDE:	158989.	(M)
SPACE FIXED VELOCITY:	7818.46	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	90.001	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	54.230	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	52.614	(DEG)
GEOCENTRIC DECLINATION:	40.313	(DEG)
GEODETIC LATITUDE:	40.503	(DEG)
LONGITUDE: (POSITIVE EAST)	-66.447	(DEG)
INCLINATION:	51.780	(DEG)
DESCENDING NODE ARGUMENT:	154.802	(DEG)
INERTIAL RANGE ANGLE:	18.133	(DEG)
WEIGHT:	68456.	(LBS)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	6207989.	(M)
YS	273740.	(M)
ZS	2000760.	(M)
$\dot{X}S$	-2418.59	(M/S)
$\dot{Y}S$	937.03	(M/S)
$\dot{Z}S$	7375.68	(M/S)

VEHICLE ATTITUDE ANGLES

PITCH ATTITUDE ANGLE	-100.199	(DEG)
YAW ATTITUDE ANGLE	10.962	(DEG)
ROLL ATTITUDE ANGLE	-.150	(DEG)

OSCULATING CONIC PARAMETERS

* PERIGEE ALTITUDE	149.96	(KM)
* APOGEE ALTITUDE	164.93	(KM)
ECCENTRICITY	.0011	
SEMI-MAJOR AXIS	6535.61	(KM)
TRUE ANOMALY	358.920	(DEG)
PERIOD	87.64	(MIN)

* REFERENCED TO EQUATORIAL RADIUS (6378.165 KM)

TABLE 5E

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC2)	DYNAMIC PRESSURE (N/M2)	A.M.I. (KG-M/M2-RAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1)	-17.20	594950.	0.	0.	.000	0.	0.	.00	.000
2)	.00	588040.	7252697.	715.	12.354	2.	0.	.01	.000
	5.00	573697.	7428046.	3362.	12.963	126.	152.	.04	6.188
	10.00	559243.	7478481.	12984.	13.370	575.	2889.	.09	3.306
	15.00	544737.	7526089.	29345.	13.783	1448.	16670.	.15	.303
	20.00	530193.	7575584.	51462.	14.213	2822.	60024.	.21	-2.686
	25.00	515622.	7627089.	74544.	14.669	4752.	164792.	.28	-1.492
	30.00	501035.	7684378.	101840.	15.153	7290.	378624.	.35	-1.231
	35.00	486433.	7747222.	132706.	15.671	10426.	769804.	.44	-.864
	40.00	471823.	7816383.	167592.	16.226	14105.	1429257.	.54	-.500
	45.00	457190.	7891585.	216218.	16.801	18207.	2470248.	.65	-.160
	50.00	442548.	7966823.	267968.	17.408	22556.	4026456.	.77	.051
	55.00	427908.	8032169.	494318.	17.625	26769.	6236661.	.92	.056
3)	57.73	419919.	8061516.	668008.	17.615	28754.	7754417.	1.00	.050
	65.00	398598.	8154263.	737851.	18.612	32811.	12701312.	1.25	.030
	70.00	383903.	8216150.	644117.	19.727	34634.	17439875.	1.47	.022
4)	73.21	374456.	8249025.	586354.	20.466	35039.	20793047.	1.63	.048
	80.00	354529.	8307314.	464077.	22.124	32654.	28705800.	2.00	-.175
	85.00	339855.	8338990.	377211.	23.427	28085.	34745060.	2.25	-.199
	90.00	325275.	8360279.	292266.	24.804	23097.	40481089.	2.52	-.068
	95.00	310703.	8368830.	218371.	26.233	18479.	45753777.	2.80	-.017
	100.00	296146.	8368917.	159092.	27.723	14450.	50456601.	3.11	-.132
	105.00	281610.	8359852.	114135.	29.281	10986.	54535395.	3.44	-.278
	110.00	267102.	8347174.	75914.	30.968	8076.	57948668.	3.77	-.759
	115.00	252621.	8332413.	39642.	32.829	5829.	60731838.	4.13	-1.197
	120.00	238174.	8311724.	12883.	34.846	4134.	62958956.	4.50	-1.686
	125.00	223765.	8284890.	-2951.	37.042	2901.	64716599.	4.90	-2.359
5)	129.00	212276.	8261614.	-10034.	38.972	2175.	65839991.	5.25	-2.891
6)	133.07	200631.	8226902.	-18077.	41.098	1646.	66770427.	5.71	-2.076
7)	136.07	192074.	8185750.	-26624.	42.757	1333.	67340776.	6.11	-1.210
8)	139.47	186324.	2870952.	-25639.	15.546	968.	67858033.	6.41	-.329
9)	140.57	185750.	157343.	-23289.	.973	854.	67992790.	6.44	-.058
10)	140.77	185546.	168337.	-22829.	1.030	835.	68015466.	6.45	-.011
11)	140.85	185631.	159696.	-22650.	.982	827.	68024276.	6.45	.007

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 5E (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	-17.20	6373379.	408.57	90.000	6373353.	10913.	-14274.	-.80	324.57	248.15
2)	.00	6373379.	408.57	90.000	6373349.	16494.	-10004.	-.45	324.42	248.35
	5.00	6373414.	408.75	87.954	6373382.	16116.	-8762.	14.01	324.30	248.42
	10.00	6373528.	409.55	85.593	6373493.	19737.	-7520.	30.76	324.13	248.45
	15.00	6373732.	411.40	82.965	6373693.	21358.	-6277.	49.55	323.98	248.66
	20.00	6374035.	415.42	80.103	6373992.	22978.	-5031.	70.43	324.05	250.22
	25.00	6374449.	422.25	77.065	6374401.	24598.	-3771.	93.42	323.95	254.22
	30.00	6374984.	432.45	73.916	6374930.	26217.	-2484.	118.58	323.72	261.07
	35.00	6375651.	446.75	70.758	6375590.	27835.	-1154.	145.87	323.60	271.29
	40.00	6376460.	465.69	67.688	6376392.	29453.	236.	175.29	323.55	285.40
	45.00	6377422.	489.60	64.813	6377346.	31071.	1707.	206.71	323.52	303.84
	50.00	6378547.	518.81	62.222	6378462.	32688.	3282.	239.97	323.47	327.03
	55.00	6379842.	553.26	60.079	6379748.	34305.	4986.	273.95	323.34	355.65
3)	57.73	6380521.	573.73	59.170	6380521.	35189.	5982.	291.90	323.23	373.47
	65.00	6382929.	635.11	57.492	6382812.	37537.	8891.	338.83	322.97	429.25
	70.00	6384721.	686.00	56.769	6384591.	39151.	11152.	373.13	322.79	476.63
4)	73.41	6385967.	722.80	56.480	6385828.	40189.	12739.	396.11	322.67	511.29
	80.00	6388847.	811.49	56.312	6388685.	42377.	16487.	446.44	322.21	596.14
	85.00	6391195.	886.63	56.529	6391013.	43986.	19647.	484.73	321.49	669.18
	90.00	6393740.	970.34	56.947	6393535.	45591.	23194.	524.24	320.50	751.01
	95.00	6396490.	1062.85	57.506	6396258.	47191.	27173.	565.02	319.47	841.63
	100.00	6399451.	1164.42	58.200	6399187.	48786.	31627.	606.54	318.50	941.57
	105.00	6402628.	1275.27	58.985	6402325.	50376.	36605.	648.62	317.58	1051.07
	110.00	6406023.	1395.78	59.860	6405673.	51962.	42156.	690.60	316.51	1170.94
	115.00	6409637.	1526.72	60.809	6409231.	53541.	48335.	732.21	315.42	1302.02
	120.00	6413470.	1668.77	61.810	6412995.	55116.	55198.	773.25	314.37	1445.01
	125.00	6417520.	1822.69	62.858	6416962.	56685.	62808.	813.14	313.14	1600.92
5)	129.00	6420914.	1955.00	63.721	6420277.	57935.	69479.	844.05	312.11	1735.56
6)	133.07	6424507.	2098.55	64.576	6423774.	59203.	76835.	875.66	311.10	1881.58
7)	136.07	6427253.	2210.56	65.120	6426440.	60135.	82646.	901.59	310.33	1994.34
8)	139.47	6430427.	2274.62	65.737	6429513.	61189.	89557.	903.12	309.74	2064.54
9)	140.57	6431452.	2274.57	65.955	6430502.	61530.	91832.	894.41	309.62	2068.29
10)	140.77	6431637.	2273.99	65.996	6430680.	61592.	92245.	892.57	309.60	2068.45
11)	140.85	6431710.	2273.75	66.012	6430751.	61616.	92409.	891.85	309.59	2068.51

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 5E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	-17.20	90.	.00	N/A	90.	0.	-0.	.00	-.00	-.00
2)	.00	90.	.00	N/A	90.	-0.	0.	.00	-.00	-.00
	5.00	125.	14.59	.482	125.	-0.	0.	14.59	-.09	-.00
	10.00	239.	31.47	.563	239.	-1.	-0.	31.47	-.25	-.05
	15.00	443.	50.39	.595	443.	-3.	-0.	50.39	-.41	.06
	20.00	747.	71.42	1.399	747.	-5.	3.	71.40	-.36	1.51
	25.00	1161.	94.69	3.420	1161.	-7.	19.	94.54	-.51	5.40
	30.00	1697.	120.45	5.912	1696.	-10.	61.	119.84	-.78	12.10
	35.00	2367.	148.95	8.695	2363.	-14.	146.	147.29	-.97	22.16
	40.00	3185.	180.53	11.666	3172.	-20.	289.	176.88	-1.11	36.09
	45.00	4167.	215.45	14.734	4135.	-25.	514.	208.48	-1.24	54.32
	50.00	5327.	254.00	17.839	5260.	-32.	840.	241.96	-1.39	77.28
	55.00	6683.	295.71	21.056	6556.	-39.	1296.	276.19	-1.63	105.66
3)	57.73	7510.	319.09	22.857	7336.	-44.	1608.	294.28	-1.79	123.34
	65.00	10016.	385.57	27.720	9645.	-59.	2698.	341.65	-2.19	178.71
	70.00	12025.	438.86	31.061	11440.	-70.	3706.	376.32	-2.44	225.78
4)	73.21	13457.	476.84	33.167	12687.	-78.	4486.	399.56	-2.60	260.24
	80.00	16884.	567.22	37.483	15570.	-97.	6529.	450.53	-3.11	344.60
	85.00	19804.	643.12	40.506	17919.	-115.	8430.	489.37	-3.84	417.25
	90.00	23103.	727.39	43.316	20466.	-136.	10717.	529.52	-4.80	498.68
	95.00	26823.	820.27	45.890	23217.	-163.	13432.	571.02	-5.76	588.85
	100.00	31010.	921.98	48.277	26178.	-194.	16622.	613.36	-6.61	688.32
	105.00	35706.	1032.76	50.487	29353.	-228.	20332.	656.35	-7.35	797.34
	110.00	40963.	1153.04	52.568	32742.	-267.	24613.	699.37	-8.16	916.68
	115.00	46825.	1283.56	54.541	36347.	-310.	29519.	742.15	-8.91	1047.22
	120.00	53346.	1425.05	56.414	40164.	-356.	35107.	784.48	-9.53	1189.65
	125.00	60582.	1578.31	58.208	44190.	-405.	41439.	825.84	-10.21	1344.98
5)	129.00	66926.	1710.03	59.591	47559.	-447.	47085.	858.04	-10.70	1479.15
6)	133.07	73921.	1853.02	60.909	51116.	-491.	53397.	891.87	-11.08	1624.66
7)	136.07	79454.	1964.78	61.748	53829.	-525.	58439.	918.13	-11.36	1737.03
8)	139.47	86032.	2027.99	62.555	56960.	-564.	64473.	920.63	-11.45	1806.95
9)	140.57	88193.	2027.46	62.799	57968.	-577.	66464.	912.13	-11.43	1810.66
10)	140.77	88586.	2026.78	62.843	58151.	-579.	66826.	910.33	-11.42	1810.81
11)	140.85	88741.	2026.52	62.861	58222.	-580.	66969.	909.61	-11.42	1810.87

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 5E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	-17.20	.090	.000	.00	90.000	N/A	-80.621	28.466	28.627
2)	.00	.090	.000	1.82	90.000	N/A	-80.621	28.466	28.627
	5.00	.125	.001	14.70	89.986	N/A	-80.621	28.466	28.627
	10.00	.239	.001	31.52	89.971	N/A	-80.621	28.466	28.627
	15.00	.443	.004	50.46	89.938	N/A	-80.621	28.466	28.627
	20.00	.747	.007	71.46	89.772	21.191	-80.621	28.466	28.627
	25.00	1.161	.023	94.57	89.323	30.607	-80.621	28.466	28.628
	30.00	1.696	.066	120.21	88.562	32.831	-80.621	28.466	28.628
	35.00	2.363	.152	148.61	87.472	34.275	-80.620	28.467	28.628
	40.00	3.172	.297	180.09	86.029	35.184	-80.619	28.468	28.630
	45.00	4.135	.524	214.95	84.238	35.736	-80.618	28.470	28.631
	50.00	5.260	.853	253.56	82.125	36.077	-80.616	28.472	28.634
	55.00	6.556	1.310	295.48	79.710	36.273	-80.613	28.475	28.637
3)	57.73	7.336	1.624	319.04	78.309	36.346	-80.611	28.478	28.639
	65.00	9.646	2.716	386.28	74.389	36.524	-80.605	28.486	28.647
	70.00	11.441	3.726	440.53	71.539	36.631	-80.598	28.493	28.654
4)	73.21	12.688	4.507	479.56	69.688	36.692	-80.594	28.498	28.660
	80.00	15.574	6.549	570.80	65.829	36.776	-80.581	28.513	28.675
	85.00	17.925	8.448	647.04	63.106	36.784	-80.570	28.527	28.689
	90.00	20.475	10.729	733.59	60.566	36.778	-80.556	28.543	28.705
	95.00	23.232	13.437	828.20	58.254	36.786	-80.539	28.563	28.725
	100.00	26.200	16.614	931.54	56.173	36.813	-80.519	28.586	28.748
	105.00	29.385	20.306	1043.32	54.315	36.852	-80.497	28.612	28.774
	110.00	32.790	24.563	1163.67	52.651	36.889	-80.471	28.643	28.805
	115.00	36.415	29.435	1297.24	51.168	36.931	-80.441	28.678	28.840
	120.00	40.260	34.979	1442.57	49.852	36.981	-80.407	28.718	28.880
	125.00	44.325	41.254	1599.89	48.677	37.028	-80.368	28.763	28.925
5)	129.00	47.732	46.844	1731.87	47.832	37.068	-80.333	28.803	28.966
6)	133.07	51.338	53.088	1875.43	47.055	37.113	-80.295	28.848	29.011
7)	136.07	54.096	58.071	1987.42	46.534	37.146	-80.264	28.883	29.046
8)	139.47	57.264	64.030	2050.68	46.251	37.178	-80.227	28.926	29.089
9)	140.57	58.313	65.995	2050.37	46.242	37.186	-80.215	28.940	29.103
10)	140.77	58.499	66.352	2049.60	46.243	37.187	-80.212	28.943	29.106
11)	140.85	58.572	66.493	2049.29	46.243	37.187	-80.211	28.944	29.107

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 5E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	-17.20	.000	.000	-52.600	-.002	.003	.002	.000	.000	.000
2)	.00	-.038	.050	-52.566	-.002	.003	.002	-.038	.050	.034
	5.00	-.019	-.013	-52.601	-.001	.001	.003	-.001	-.023	-.001
	10.00	-.013	-.019	-52.601	.002	-.000	.000	.007	-.022	-.001
	15.00	-.662	-.005	-48.497	-.201	.006	1.001	.130	.140	-.897
	20.00	-1.997	.027	-43.529	-.329	.000	1.083	.166	.196	-.929
	25.00	-3.852	-.030	-38.531	-.406	-.001	1.000	.244	.156	-.931
	30.00	-6.081	-.014	-33.529	-.481	.002	1.000	.299	.181	-.929
	35.00	-8.616	-.003	-28.528	-.531	.000	1.000	.371	.198	-.928
	40.00	-11.375	-.005	-23.529	-.570	-.003	1.000	.457	.194	-.929
	45.00	-14.303	-.022	-18.531	-.599	-.004	.999	.524	.153	-.931
	50.00	-17.439	-.047	-13.534	-.686	-.007	1.000	.601	.097	-.935
	55.00	-20.898	-.077	-8.535	-.699	-.005	1.000	.596	.012	-.935
3)	57.73	-22.818	-.079	-5.802	-.703	.005	1.000	.597	-.021	-.935
	65.00	-27.964	-.082	.059	-.712	.003	-.022	.603	-.082	.058
	70.00	-31.493	-.085	-.000	-.698	-.003	-.000	.596	-.085	-.001
4)	73.21	-33.722	-.078	-.001	-.689	.003	-.000	.589	-.078	-.001
	80.00	-38.272	-.085	.004	-.632	.014	.001	.539	-.085	.003
	85.00	-41.288	-.000	.004	-.591	.004	-.001	.608	-.000	.004
	90.00	-44.104	.058	.001	-.510	.006	-.002	.518	.058	.001
	95.00	-46.682	.065	-.002	-.513	-.005	.000	.468	.065	-.001
	100.00	-49.216	.025	-.000	-.504	-.009	.001	.444	.025	-.000
	105.00	-51.572	-.029	.001	-.512	-.020	.001	.581	-.029	.001
	110.00	-54.106	-.088	.005	-.504	-.008	.001	.528	-.088	.005
	115.00	-56.601	-.108	.007	-.494	.001	.000	.504	-.108	.006
	120.00	-59.057	-.097	.007	-.489	.002	-.000	.513	-.097	.007
	125.00	-61.610	-.184	.007	-.473	.012	-.000	.421	-.184	.007
5)	129.00	-63.529	-.160	.007	-.484	.003	-.000	.470	-.160	.006
6)	133.07	-64.055	-.154	.005	.030	-.005	-.002	-.056	-.154	.005
7)	136.07	-64.049	-.170	.003	.001	-.002	-.001	-.050	-.170	.003
8)	139.47	-64.015	-.087	.001	.010	.005	-.001	-.016	-.087	.001
9)	140.57	-64.008	-.096	.001	.004	-.022	.000	-.009	-.096	.001
10)	140.77	-64.007	-.100	.001	.004	-.027	.000	-.008	-.100	.001
11)	140.85	-64.007	-.103	.001	.004	-.029	.000	-.008	-.103	.001

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 6E

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/S2)	DYNAMIC PRESSURE (N/M2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
1) 140.85	139653.	40499.	3764.	.263	827.	1.053	-63.999	.007
2) 142.17	139621.	40337.	3265.	.266	709.	1.076	-63.999	.347
3) 145.57	139397.	735425.	2403.	5.259	477.	1.137	-63.999	1.483
4) 148.57	138753.	934345.	1758.	6.722	340.	1.191	-63.999	2.251
5) 152.77	137783.	1024475.	1116.	7.428	211.	1.267	-63.999	2.904
160.00	135898.	1034592.	546.	7.609	91.	1.401	-63.999	4.474
6) 165.35	134568.	1032549.	316.	7.671	46.	1.502	-63.999	5.605
170.00	133415.	1034917.	196.	7.756	27.	1.591	-63.999	6.585
7) 171.47	133049.	1035491.	165.	7.782	22.	1.620	-63.999	6.893
8) 175.00	128020.	1036335.	111.	8.094	14.	1.689	-63.999	7.636
180.00	126774.	1037282.	87.	8.182	7.	1.769	-58.999	11.067
190.00	124288.	1036754.	46.	8.341	2.	1.992	-55.716	18.907
200.00	121796.	1035066.	16.	8.498	1.	2.201	-56.874	19.229
210.00	119311.	1034398.	7.	8.670	0.	2.416	-57.794	19.824
220.00	116825.	1037443.	3.	8.880	0.	2.638	-58.907	20.267
230.00	114333.	1035546.	2.	9.057	0.	2.865	-60.254	20.349
240.00	111847.	1035230.	1.	9.256	0.	3.100	-61.251	20.700
250.00	109363.	1034881.	1.	9.463	0.	3.341	-62.321	20.954
260.00	106879.	1037645.	0.	9.709	0.	3.588	-63.436	21.094
270.00	104388.	1038526.	0.	9.949	0.	3.843	-64.760	20.986
280.00	101897.	1036118.	0.	10.168	0.	4.106	-65.936	20.921
290.00	99411.	1036101.	0.	10.422	0.	4.376	-66.914	21.081
300.00	96925.	1036088.	0.	10.690	0.	4.654	-68.031	21.071
310.00	94440.	1036058.	0.	10.970	0.	4.940	-69.186	20.943
320.00	91955.	1036020.	0.	11.267	0.	5.235	-70.338	20.743
330.00	89471.	1035957.	0.	11.579	0.	5.539	-71.487	20.504
340.00	86987.	1035893.	0.	11.909	0.	5.852	-72.639	20.222
350.00	84503.	1035824.	0.	12.258	0.	6.174	-73.793	19.846
360.00	82019.	1035750.	0.	12.628	0.	6.506	-74.937	19.510
370.00	79536.	1035633.	0.	13.021	0.	6.848	-76.092	19.189
380.00	77053.	1035502.	0.	13.439	0.	7.201	-77.256	18.822
390.00	74570.	1035393.	0.	13.885	0.	7.565	-78.428	18.345
400.00	72088.	1035286.	0.	14.361	0.	7.941	-79.604	17.835
410.00	69597.	1039200.	0.	14.932	0.	8.326	-80.879	17.204
420.00	67107.	1036712.	0.	15.449	0.	8.728	-82.080	16.596
430.00	64621.	1036641.	0.	16.042	0.	9.141	-83.197	16.078

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/S2)	DYNAMIC PRESSURE (N/M2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
	440.00	62135.	1036573.	0.	16.682	0.	9.568	-84.383	15.461
	450.00	59650.	1035595.	0.	17.361	0.	10.006	-85.572	14.901
	460.00	57166.	1035502.	0.	18.114	0.	10.464	-86.772	14.314
9)	469.00	55604.	878924.	0.	15.979	0.	10.867	-87.658	13.695
	470.00	54777.	878292.	0.	16.034	0.	10.935	-87.928	13.637
	480.00	52682.	874810.	0.	16.605	0.	11.420	-89.088	13.091
	490.00	50604.	874311.	0.	17.277	0.	11.920	-90.273	12.442
	500.00	48525.	874399.	0.	18.019	0.	12.435	-91.456	11.805
	510.00	46447.	874388.	0.	18.825	0.	12.965	-92.639	10.961
	520.00	44369.	874345.	0.	19.706	0.	13.512	-94.086	10.195
	530.00	42291.	874300.	0.	20.673	0.	14.076	-95.227	9.600
	540.00	40213.	874175.	0.	21.739	0.	14.658	-96.399	9.025
	550.00	38135.	873955.	0.	22.917	0.	15.259	-97.606	8.348
	560.00	36057.	873673.	0.	24.230	0.	15.880	-98.818	7.604
	570.00	33979.	873214.	0.	25.696	0.	16.523	-100.382	6.370
	580.00	31902.	872571.	0.	27.351	0.	17.188	-100.170	7.021
10)	583.81	31111.	872236.	0.	28.036	0.	17.447	-100.170	7.195
11)	584.01	31094.	610577.	0.	19.636	0.	17.461	-100.170	7.204
12)	584.61	31058.	24713.	0.	.796	0.	17.502	-100.170	7.242
13)	593.81	31051.	0.	4.	-.000	0.	18.133	-100.199	7.877

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 6E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	140.85	6431713.	2273.75	66.012	6430754.	61616.	92415.	891.85	309.59	2068.51
2)	142.17	6432926.	2268.93	66.280	6431924.	62025.	95147.	879.27	309.47	2068.61
3)	145.57	6435980.	2261.26	66.967	6434859.	63077.	102163.	848.97	309.00	2072.93
4)	148.57	6438606.	2268.04	67.541	6437375.	64002.	108425.	820.35	308.16	2088.75
5)	152.77	6442195.	2282.78	68.329	6440797.	65295.	117253.	801.54	307.47	2115.20
	160.00	6448150.	2311.46	69.651	6446430.	67515.	132721.	756.25	306.44	2162.64
6)	165.35	6452375.	2334.16	70.602	6450389.	69153.	144391.	723.02	305.64	2198.22
	170.00	6455921.	2354.74	71.407	6453682.	70572.	154680.	694.29	304.94	2229.30
7)	171.47	6457018.	2361.44	71.657	6454695.	71019.	157960.	685.26	304.72	2239.19
8)	175.00	6459611.	2378.78	72.248	6457077.	72095.	165911.	664.01	304.15	2263.89
	180.00	6463175.	2404.06	73.049	6460322.	73613.	177319.	634.66	303.23	2298.86
	190.00	6469979.	2454.49	74.365	6466413.	76636.	200640.	584.92	301.49	2364.63
	200.00	6476406.	2508.01	75.563	6472022.	79645.	224618.	536.76	300.27	2431.42
	210.00	6482469.	2564.82	76.749	6477147.	82644.	249274.	488.33	299.65	2500.01
	220.00	6488169.	2625.12	77.857	6481788.	85640.	274625.	439.85	299.78	2570.58
	230.00	6493515.	2689.18	78.915	6485943.	88641.	300693.	390.99	300.63	2643.57
	240.00	6498511.	2756.63	79.923	6489606.	91655.	327503.	341.50	302.15	2718.65
	250.00	6503164.	2827.50	80.876	6492773.	94687.	355073.	291.72	304.34	2795.89
	260.00	6507481.	2901.88	81.776	6495439.	97744.	383428.	241.48	307.19	2875.45
	270.00	6511469.	2980.15	82.625	6497601.	100832.	412592.	190.72	310.72	2957.76
	280.00	6515133.	3062.14	83.428	6499251.	103960.	442592.	139.08	314.91	3042.73
	290.00	6518481.	3147.60	84.181	6500381.	107133.	473454.	86.76	319.79	3130.11
	300.00	6521519.	3236.71	84.883	6500985.	110358.	505203.	33.85	325.38	3220.14
	310.00	6524258.	3329.63	85.537	6501056.	113643.	537867.	-19.88	331.69	3313.01
	320.00	6526704.	3426.44	86.146	6500585.	116994.	571473.	-74.54	338.76	3408.84
	330.00	6528867.	3527.26	86.711	6499562.	120421.	606054.	-130.21	346.62	3507.77
	340.00	6530756.	3632.18	87.232	6497977.	123929.	641640.	-186.96	355.30	3609.92
	350.00	6532379.	3741.36	87.712	6495819.	127529.	678264.	-244.90	364.85	3715.46
	360.00	6533747.	3854.96	88.152	6493075.	131229.	715961.	-304.18	375.31	3824.57
	370.00	6534870.	3973.12	88.551	6489732.	135039.	754768.	-364.80	386.71	3937.39
	380.00	6535761.	4096.03	88.911	6485775.	138967.	794722.	-426.89	399.09	4054.13
	390.00	6536431.	4223.93	89.234	6481189.	143024.	835864.	-490.60	412.53	4175.01
	400.00	6536895.	4357.08	89.520	6475957.	147221.	878237.	-556.08	427.07	4300.29
	410.00	6537167.	4496.25	89.770	6470062.	151569.	921888.	-623.46	442.84	4430.73
	420.00	6537261.	4641.34	89.988	6463481.	156082.	966869.	-693.15	459.85	4566.19
	430.00	6537193.	4792.40	90.171	6456192.	160771.	1013229.	-765.03	478.20	4706.72

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
	440.00	6536982.	4950.07	90.319	6448173.	165651.	1061023.	-839.25	498.00	4852.92
	450.00	6536649.	5114.72	90.434	6439398.	170736.	1110308.	-916.14	519.32	5005.13
	460.00	6536215.	5286.95	90.517	6429840.	176043.	1161148.	-995.92	542.29	5163.90
9)	469.00	6535756.	5445.67	90.573	6420544.	181022.	1206287.	-1076.56	563.99	5309.53
	470.00	6535701.	5461.30	90.584	6419469.	181587.	1213604.	-1079.12	566.12	5323.61
	480.00	6535090.	5620.81	90.675	6408245.	187358.	1267553.	-1166.10	586.43	5466.94
	490.00	6534384.	5786.88	90.739	6396136.	193360.	1322961.	-1250.31	612.09	5615.61
	500.00	6533605.	5960.35	90.775	6383108.	199605.	1379886.	-1349.85	637.28	5770.40
	510.00	6532781.	6141.84	90.764	6369126.	206111.	1438392.	-1447.33	664.21	5931.80
	520.00	6531932.	6332.07	90.771	6354146.	212896.	1498546.	-1549.46	693.06	6100.33
	530.00	6531088.	6531.70	90.729	6338123.	219980.	1560425.	-1656.03	724.21	6276.64
	540.00	6530283.	6741.56	90.657	6321010.	227388.	1624109.	-1767.33	757.81	6461.49
	550.00	6529555.	6962.69	90.556	6302758.	235145.	1689687.	-1884.00	794.01	6655.77
	560.00	6528945.	7196.31	90.428	6283310.	243278.	1757260.	-2006.73	833.04	6860.46
	570.00	6528482.	7444.18	90.297	6262585.	251819.	1826933.	-2137.66	875.78	7076.06
	580.00	6528210.	7707.12	90.103	6240509.	260803.	1898830.	-2275.89	921.39	7305.55
10)	583.81	6528180.	7811.68	90.009	6231730.	264351.	1926863.	-2328.33	939.50	7397.20
11)	584.01	6528180.	7816.92	90.004	6231264.	264539.	1928343.	-2331.03	940.41	7401.77
12)	584.61	6528180.	7818.13	90.003	6229864.	265103.	1932784.	-2336.60	940.41	7401.29
13)	593.81	6528178.	7818.46	90.001	6207989.	273740.	2000760.	-2418.59	937.03	7375.68

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 6E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
1)	140.85	88747.	2626.52	62.861	58225.	-580.	66975.	909.61	-11.42	1810.87
2)	142.17	91338.	2621.07	63.154	59419.	-595.	69367.	897.25	-11.38	1810.95
3)	145.57	97982.	2011.88	63.911	62417.	-633.	75527.	867.54	-11.43	1815.19
4)	148.57	103847.	2017.59	64.568	64989.	-666.	80995.	847.52	-11.65	1830.91
5)	152.77	112101.	2030.87	65.475	68494.	-718.	88740.	821.59	-11.94	1857.22
	160.00	126457.	2057.21	67.001	74277.	-804.	102341.	777.85	-11.85	1904.44
6)	165.35	137205.	2078.34	68.098	78354.	-868.	112629.	745.80	-11.77	1939.88
	170.00	146629.	2097.64	69.027	81756.	-922.	121717.	718.11	-11.67	1970.86
7)	171.47	149622.	2103.96	69.316	82804.	-939.	124617.	709.42	-11.63	1980.72
8)	175.00	156862.	2120.44	69.998	85273.	-980.	131656.	688.98	-11.56	2005.35
	180.00	167207.	2144.61	70.924	88646.	-1038.	141771.	660.80	-11.55	2040.23
	190.00	188244.	2193.36	72.447	95010.	-1153.	162504.	613.43	-11.42	2105.81
	200.00	209767.	2245.42	73.854	100916.	-1264.	183893.	567.73	-10.64	2172.43
	210.00	231806.	2300.90	75.197	106364.	-1364.	205959.	521.86	-9.10	2240.92
	220.00	254389.	2359.95	76.469	111353.	-1443.	228718.	476.05	-6.65	2311.42
	230.00	277550.	2422.85	77.678	115884.	-1494.	252195.	429.99	-3.32	2384.39
	240.00	301322.	2489.22	78.828	119952.	-1507.	276413.	383.41	.87	2459.52
	250.00	325738.	2559.09	79.910	123552.	-1474.	301393.	336.66	5.90	2536.85
	260.00	350832.	2632.54	80.928	126684.	-1386.	327158.	289.59	11.78	2616.54
	270.00	376641.	2709.94	81.885	129344.	-1235.	353733.	242.14	18.52	2699.03
	280.00	403204.	2791.11	82.786	131525.	-1013.	381147.	193.96	26.14	2784.24
	290.00	430556.	2875.79	83.629	133221.	-710.	409426.	145.24	34.63	2871.91
	300.00	458733.	2964.17	84.411	134429.	-317.	438595.	96.10	44.05	2962.28
	310.00	487776.	3056.37	85.137	135141.	174.	468681.	46.30	54.41	3055.54
	320.00	517722.	3152.50	85.811	135353.	774.	499715.	-4.25	65.75	3151.81
	330.00	548613.	3252.65	86.433	135054.	1493.	531720.	-55.62	78.12	3251.24
	340.00	580490.	3356.92	87.005	134238.	2340.	564751.	-107.88	91.56	3353.94
	350.00	613397.	3465.46	87.530	132894.	3327.	598818.	-161.13	106.11	3460.08
	360.00	647376.	3578.42	88.009	131012.	4466.	633965.	-215.49	121.85	3569.85
	370.00	682475.	3695.95	88.442	128580.	5768.	670220.	-270.98	138.80	3683.39
	380.00	718741.	3818.23	88.832	125588.	7246.	707646.	-327.70	157.02	3800.90
	390.00	756223.	3945.50	89.180	122022.	8913.	746260.	-385.78	176.61	3922.62
	400.00	794974.	4078.01	89.488	117866.	10783.	786114.	-445.38	197.62	4048.80
	410.00	835051.	4216.53	89.755	113110.	12871.	827255.	-506.56	220.21	4180.20
	420.00	876514.	4360.98	89.987	107731.	15193.	869735.	-569.76	244.40	4316.68
	430.00	919421.	4511.38	90.181	101709.	17765.	913606.	-634.84	270.29	4458.30

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 908 J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6E (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
	440.00	963838.	4668.38	90.338	95027.	20605.	958921.	-701.92	298.03	4605.67
	450.00	1009832.	4832.34	90.460	87663.	23732.	1005740.	-771.31	327.71	4759.12
	460.00	1057476.	5003.89	90.547	79593.	27166.	1054126.	-843.20	359.50	4919.21
9)	469.00	1101628.	5161.99	90.605	71705.	30537.	1099069.	-910.46	389.48	5066.11
	470.00	1106841.	5177.56	90.616	70790.	30928.	1104142.	-918.24	392.52	5080.34
	480.00	1157816.	5336.44	90.711	61215.	35010.	1155666.	-997.18	424.13	5225.26
	490.00	1210376.	5501.89	90.778	50837.	39417.	1208666.	-1078.99	457.54	5375.61
	500.00	1264593.	5674.72	90.814	39626.	44167.	1263200.	-1163.75	492.96	5532.19
	510.00	1320540.	5855.58	90.822	27551.	49284.	1319333.	-1252.03	530.65	5695.49
	520.00	1378301.	6045.16	90.807	14571.	54789.	1377135.	-1344.50	570.82	5866.05
	530.00	1437963.	6244.12	90.762	648.	60710.	1436681.	-1440.92	613.90	6044.50
	540.00	1499623.	6453.30	90.686	-14261.	67077.	1498054.	-1541.54	660.06	6231.62
	550.00	1563387.	6673.74	90.581	-30199.	73922.	1561346.	-1646.95	709.51	6428.29
	560.00	1629370.	6906.65	90.446	-47218.	81280.	1626657.	-1757.81	762.55	6635.54
	570.00	1697701.	7153.78	90.309	-65391.	89190.	1694095.	-1878.17	820.23	6853.92
	580.00	1768521.	7415.99	90.107	-84787.	97696.	1763784.	-2001.07	881.57	7086.28
10)	583.61	1796219.	7520.28	90.009	-92507.	101104.	1790983.	-2048.21	905.91	7179.05
11)	584.01	1797682.	7525.50	90.004	-92917.	101285.	1792423.	-2050.64	907.13	7183.67
12)	584.61	1802074.	7526.70	90.003	-94149.	101830.	1796730.	-2055.81	907.73	7183.37
13)	593.61	1869415.	7526.93	90.001	-113415.	110206.	1862714.	-2132.27	913.05	7160.62

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 6E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	140.85	58.575	66.499	2049.29	46.243	37.187	-80.211	28.944	29.107
2)	142.17	59.794	68.859	2044.54	46.252	37.196	-80.197	28.961	29.124
3)	145.57	62.861	74.934	2032.67	46.253	37.216	-80.159	29.004	29.168
4)	148.57	65.500	80.322	2035.60	46.195	37.223	-80.126	29.043	29.206
5)	152.77	69.106	87.947	2045.13	46.111	37.251	-80.078	29.097	29.261
	160.00	75.091	101.324	2070.68	45.971	37.307	-79.995	29.193	29.357
6)	165.35	79.339	111.429	2091.93	45.872	37.349	-79.932	29.265	29.430
	170.00	82.906	120.349	2111.33	45.788	37.386	-79.876	29.329	29.494
7)	171.47	84.009	123.194	2117.68	45.763	37.398	-79.858	29.349	29.514
8)	175.00	86.618	130.095	2134.23	45.698	37.427	-79.815	29.399	29.563
	180.00	90.204	140.007	2158.49	45.608	37.466	-79.752	29.469	29.634
	190.00	97.055	160.302	2207.39	45.454	37.546	-79.625	29.614	29.780
	200.00	103.532	181.211	2259.59	45.324	37.644	-79.493	29.763	29.929
	210.00	109.643	202.756	2315.20	45.218	37.763	-79.356	29.916	30.083
	220.00	115.393	224.956	2374.38	45.136	37.904	-79.215	30.074	30.241
	230.00	120.792	247.837	2437.41	45.076	38.066	-79.068	30.236	30.404
	240.00	125.843	271.423	2503.91	45.038	38.246	-78.917	30.403	30.571
	250.00	130.552	295.739	2573.90	45.019	38.441	-78.759	30.574	30.743
	260.00	134.926	320.809	2647.47	45.018	38.651	-78.596	30.751	30.920
	270.00	138.974	346.661	2724.99	45.035	38.876	-78.426	30.932	31.102
	280.00	142.700	373.327	2806.28	45.068	39.113	-78.250	31.118	31.289
	290.00	146.111	400.834	2891.08	45.118	39.363	-78.067	31.310	31.481
	300.00	149.215	429.210	2979.57	45.184	39.625	-77.877	31.507	31.678
	310.00	152.021	458.488	3071.90	45.265	39.898	-77.680	31.709	31.881
	320.00	154.538	488.700	3168.15	45.362	40.182	-77.474	31.917	32.090
	330.00	156.772	519.881	3268.42	45.473	40.477	-77.260	32.131	32.304
	340.00	158.735	552.065	3372.81	45.600	40.784	-77.037	32.351	32.525
	350.00	160.435	585.292	3481.47	45.742	41.101	-76.805	32.576	32.751
	360.00	161.881	619.601	3594.56	45.898	41.429	-76.563	32.808	32.984
	370.00	163.086	655.033	3712.22	46.070	41.768	-76.311	33.047	33.223
	380.00	164.061	691.633	3834.63	46.256	42.118	-76.048	33.292	33.468
	390.00	164.818	729.445	3962.03	46.457	42.479	-75.774	33.543	33.721
	400.00	165.371	768.519	4094.68	46.673	42.852	-75.487	33.802	33.980
	410.00	165.734	808.909	4233.34	46.905	43.237	-75.188	34.067	34.246
	420.00	165.923	850.674	4377.93	47.153	43.634	-74.876	34.340	34.520
	430.00	165.953	893.870	4528.48	47.416	44.043	-74.549	34.621	34.801

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6E (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
	440.00	165.844	938.558	4685.63	47.697	44.466	-74.208	34.909	35.090
	450.00	165.614	984.806	4849.75	47.995	44.903	-73.850	35.205	35.386
	460.00	165.287	1032.683	5021.45	48.310	45.354	-73.475	35.509	35.691
9)	469.00	164.928	1077.229	5179.70	48.609	45.770	-73.123	35.790	35.972
	470.00	164.884	1082.262	5195.28	48.642	45.815	-73.083	35.821	36.004
	480.00	164.387	1133.437	5354.33	48.983	46.270	-72.673	36.141	36.325
	490.00	163.797	1186.189	5519.94	49.341	46.740	-72.245	36.468	36.652
	500.00	163.139	1240.589	5692.94	49.716	47.224	-71.799	36.802	36.987
	510.00	162.436	1296.710	5873.96	50.110	47.726	-71.333	37.144	37.329
	520.00	161.714	1354.636	6063.73	50.524	48.246	-70.845	37.493	37.679
	530.00	160.999	1414.454	6262.86	50.962	48.788	-70.335	37.850	38.037
	540.00	160.326	1476.261	6472.23	51.423	49.351	-69.801	38.215	38.402
	550.00	159.734	1540.160	6692.87	51.909	49.938	-69.241	38.588	38.776
	560.00	159.263	1606.264	6925.97	52.422	50.549	-68.654	38.969	39.157
	570.00	158.942	1674.703	7173.31	52.967	51.191	-68.036	39.358	39.547
	580.00	158.816	1745.616	7435.73	53.535	51.855	-67.387	39.756	39.945
10)	583.81	158.843	1773.341	7540.11	53.758	52.113	-67.131	39.910	40.099
11)	584.01	158.846	1774.806	7545.34	53.770	52.127	-67.117	39.918	40.107
12)	584.61	158.854	1779.202	7546.54	53.798	52.157	-67.077	39.942	40.132
13)	593.81	158.989	1846.619	7526.93	54.230	52.614	-66.447	40.313	40.503

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 6E (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1) 140.85	-64.007	-.103	.001	.004	-.029	.000	-.008	-.103	.001
2) 142.17	-63.991	-.222	-.001	.027	-.152	-.003	.008	-.222	-.001
3) 145.57	-63.630	-1.172	-.057	.133	-.221	-.053	.369	-1.172	-.060
4) 148.57	-63.534	-.964	-.332	-.048	.254	-.090	.468	-.963	-.336
5) 152.77	-63.802	-.193	-.587	-.037	.042	.010	.198	-.192	-.587
160.00	-63.870	-.301	-.668	-.011	.006	-.020	.130	-.300	-.668
6) 165.35	-63.930	-.269	-.655	-.009	.000	.017	.070	-.269	-.655
170.00	-63.962	-.274	-.664	-.006	-.001	-.019	.039	-.274	-.664
7) 171.47	-63.970	-.274	-.698	-.005	.000	-.027	.031	-.274	-.698
8) 175.00	-63.974	-.315	-.759	-.002	-.008	.056	.027	-.315	-.759
180.00	-60.757	-.564	-.016	1.132	.009	.131	-1.757	-.420	-.006
190.00	-55.432	-.136	-.028	-.225	.037	-.134	.284	-.383	-.028
200.00	-56.713	.255	-.562	-.115	.039	-.027	.162	-.383	-.560
210.00	-57.660	.750	-.822	-.095	.052	-.028	.137	-.406	-.820
220.00	-58.710	1.237	-.241	-.126	.047	.067	.198	-.407	-.236
230.00	-60.075	1.684	.413	-.129	.042	.067	.177	-.404	.419
240.00	-61.108	2.094	.482	-.100	.040	-.030	.141	-.407	.487
250.00	-62.167	2.480	.178	-.110	.037	-.031	.153	-.408	.185
260.00	-63.281	2.846	-.128	-.112	.036	-.030	.156	-.410	-.120
270.00	-64.584	3.192	-.450	-.129	.034	-.032	.177	-.411	-.440
280.00	-65.796	3.529	-.757	-.110	.034	-.029	.142	-.415	-.748
290.00	-66.768	3.863	-.354	-.104	.033	.072	.148	-.418	-.343
300.00	-67.875	4.180	.360	-.114	.032	.071	.155	-.427	.372
310.00	-69.026	4.494	.518	-.116	.031	-.029	.157	-.430	.532
320.00	-70.180	4.799	.234	-.115	.031	-.028	.156	-.436	.248
330.00	-71.330	5.101	-.044	-.115	.029	-.028	.157	-.438	-.029
340.00	-72.481	5.396	-.317	-.115	.029	-.027	.158	-.443	-.302
350.00	-73.686	5.699	-.590	-.116	.028	-.027	.108	-.434	-.579
360.00	-74.823	5.978	-.747	-.115	.029	.074	.117	-.442	-.735
370.00	-75.974	6.254	-.004	-.116	.027	.074	.118	-.450	.009
380.00	-77.134	6.529	.653	-.116	.028	-.026	.118	-.456	.677
390.00	-78.307	6.801	.406	-.118	.027	-.025	.118	-.459	.421
400.00	-79.484	7.064	.154	-.118	.027	-.025	.118	-.467	.169
410.00	-80.752	7.318	-.099	-.128	.025	-.025	.127	-.470	-.082
420.00	-81.974	7.574	-.345	-.113	.027	-.024	.106	-.479	-.331
430.00	-83.081	7.839	-.580	-.116	.026	-.024	.117	-.480	-.564

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 6E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
	440.00	-84.263	8.087	-.814	-.120	.024	-.023	.122	-.485	-.797
	450.00	-85.453	8.330	-.063	-.119	.024	.077	.118	-.492	-.045
	460.00	-86.649	8.567	.684	-.120	.024	-.024	.119	-.501	.703
9)	469.00	-87.734	8.780	.469	-.121	.024	-.024	.120	-.506	.489
	470.00	-87.850	8.806	.446	-.107	.032	-.023	.075	-.532	.458
	480.00	-88.962	9.112	.215	-.125	.011	-.023	.124	-.495	.236
	490.00	-90.158	9.240	-.015	-.114	.017	-.023	.113	-.510	.004
	500.00	-91.328	9.442	-.242	-.125	.020	-.023	.127	-.516	-.220
	510.00	-92.693	9.619	-.469	-.145	.019	-.023	.146	-.521	-.444
	520.00	-93.973	9.860	-.692	-.116	.027	-.022	.115	-.532	-.672
	530.00	-95.115	10.109	-.458	-.115	.023	.078	.113	-.535	-.437
	540.00	-96.278	10.326	.327	-.116	.020	.079	.117	-.538	.350
	550.00	-97.480	10.519	.580	-.122	.019	-.022	.121	-.541	.604
	560.00	-98.695	10.696	.359	-.121	.017	-.022	.118	-.544	.382
	570.00	-100.423	10.975	.153	.020	-.003	-.030	-.041	-.524	.145
	580.00	-100.212	10.916	-.145	.024	-.009	-.030	-.040	-.525	-.153
10)	583.81	-100.191	10.907	-.255	-.000	-.000	-.029	-.019	-.534	-.259
11)	584.01	-100.191	10.907	-.261	-.000	-.000	-.029	-.019	-.534	-.265
12)	584.61	-100.191	10.907	-.278	-.000	-.000	-.029	-.019	-.534	-.282
13)	593.81	-100.199	10.962	-.150	-.001	.007	.021	-.027	-.479	-.155

9) EMR SHIFT TO 4.6:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 7E

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB/CSM SEPARATION CONDITIONS

FLIGHT TIME: S-IVB/CSM SEPARATION	4440.200	(SEC)
RADIUS:	6535530.	(M)
ALTITUDE:	163134.	(M)
SPACE FIXED VELOCITY:	7810.95	(M/S)
SPACE FIXED FLIGHT PATH ANGLE:	90.061	(DEG)
SPACE FIXED FLIGHT AZIMUTH:	46.332	(DEG)
EARTH FIXED FLIGHT AZIMUTH:	44.188	(DEG)
GEOCENTRIC DECLINATION:	-31.229	(DEG)
GEODETIC LATITUDE:	-31.400	(DEG)
LONGITUDE: (POSITIVE EAST)	-153.254	(DEG)
INCLINATION:	51.790	(DEG)
DESCENDING NODE ARGUMENT:	154.498	(DEG)
INERTIAL RANGE ANGLE:	78.777	(DEG)
WEIGHT: (S-IVB/IU/DM/FIXED SLA)	36844.	(LBS)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

XS	1259192.	(M)
YS	-830068.	(M)
ZS	-6359133.	(M)
$\dot{X}S$	7663.00	(M/S)
$\dot{Y}S$	191.14	(M/S)
$\dot{Z}S$	1500.91	(M/S)

VEHICLE ATTITUDE ANGLES

PITCH ATTITUDE ANGLE	105.766	(DEG)
YAW ATTITUDE ANGLE	-7.138	(DEG)
ROLL ATTITUDE ANGLE	-178.030	(DEG)

OSCULATING CONIC PARAMETERS

* PERIGEE ALTITUDE	152.27	(KM)
* APOGEE ALTITUDE	166.90	(KM)
ECCENTRICITY	.0011	
SEMI-MAJOR AXIS	6537.75	(KM)
TRUE ANOMALY	287.744	(DEG)
PERIOD	87.68	(MIN)

* REFERENCED TO EQUATORIAL RADIUS (6378.165 KM)

TABLE 8E

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-1B STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC2)	DYNAMIC PRESSURE (LB/FT2)	A.H.I. (LB-FT/FT2-KAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1)	-17.20	1311641.	0.	0.	.000	0.	0.	.00	.000
2)	.00	1296407.	1630471.	161.	40.532	0.	0.	.01	.000
	5.00	1264785.	1669891.	756.	42.529	3.	102.	.04	6.188
	10.00	1232920.	1681229.	2919.	43.865	12.	1941.	.09	3.306
	15.00	1200940.	1691932.	6597.	45.219	30.	11202.	.15	.303
	20.00	1168875.	1703059.	11569.	46.630	59.	40334.	.21	-2.686
	25.00	1136752.	1714638.	16758.	48.125	99.	110735.	.28	-1.492
	30.00	1104592.	1727517.	22894.	49.714	152.	254424.	.35	-1.231
	35.00	1072401.	1741645.	29833.	51.414	218.	517284.	.44	-.864
	40.00	1040191.	1757193.	37676.	53.235	295.	960416.	.54	-.500
	45.00	1007930.	1774099.	48608.	55.121	380.	1659930.	.65	-.160
	50.00	975651.	1791013.	60242.	57.112	471.	2705653.	.77	.051
	55.00	943376.	1805703.	111127.	57.624	559.	4190842.	.92	.056
3)	57.73	925763.	1812301.	150174.	57.793	601.	5210727.	1.00	.050
	65.00	878758.	1833151.	165876.	61.062	685.	8669281.	1.25	.030
	70.00	846361.	1847064.	144803.	64.723	723.	11719054.	1.47	.022
4)	73.21	825535.	1854455.	131818.	67.146	732.	13972281.	1.63	.048
	80.00	781602.	1867558.	104329.	72.585	682.	19289406.	2.00	-.175
	85.00	749252.	1874680.	84800.	76.862	587.	23347601.	2.25	-.199
	90.00	717109.	1879465.	65704.	81.378	482.	27202034.	2.52	-.068
	95.00	684983.	1881388.	49092.	86.065	386.	30745116.	2.80	-.017
	100.00	652890.	1881407.	35765.	90.953	302.	33905268.	3.11	-.132
	105.00	620845.	1879369.	25659.	96.066	229.	36646091.	3.44	-.278
	110.00	588859.	1876519.	17066.	101.600	169.	38939704.	3.77	-.759
	115.00	556934.	1873201.	8912.	107.706	122.	40809908.	4.13	-1.197
	120.00	525084.	1868550.	2896.	114.325	86.	42306462.	4.50	-1.686
	125.00	493317.	1862517.	-663.	121.530	61.	43487544.	4.90	-2.359
5)	129.00	467987.	1857285.	-2256.	127.860	45.	44242428.	5.25	-2.891
6)	133.07	442315.	1849481.	-4064.	134.835	34.	44867652.	5.71	-2.076
7)	136.07	423450.	1840230.	-5985.	140.280	28.	45250909.	6.11	-1.210
8)	139.47	410775.	645416.	-5764.	51.005	20.	45598490.	6.41	-.329
9)	140.57	409509.	35372.	-5236.	3.191	18.	45689043.	6.44	-.058
10)	140.77	409279.	37844.	-5132.	3.379	17.	45704280.	6.45	-.011
11)	140.85	409246.	35901.	-5092.	3.223	17.	45710200.	6.45	.007

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 8E (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	-17.20	20910035.	1340.44	90.000	20909952.	35804.	-46829.	-.00	1064.87	814.15
2)	.00	20910035.	1340.44	90.000	20909939.	54115.	-32820.	-1.48	1064.38	814.79
	5.00	20910150.	1341.06	87.954	20910046.	59436.	-28746.	45.97	1063.99	815.02
	10.00	20910525.	1343.68	85.593	20910410.	64755.	-24670.	100.91	1063.42	815.12
	15.00	20911193.	1349.75	82.965	20911066.	70071.	-20594.	162.56	1062.94	815.81
	20.00	20912189.	1362.94	80.103	20912047.	75386.	-16505.	231.06	1063.15	820.92
	25.00	20913547.	1385.35	77.065	20913388.	80701.	-12371.	306.51	1062.81	834.07
	30.00	20915302.	1418.80	73.916	20915124.	86013.	-8149.	389.04	1062.08	856.52
	35.00	20917489.	1465.74	70.758	20917290.	91323.	-3788.	478.59	1061.69	890.04
	40.00	20920145.	1527.85	67.688	20919922.	96631.	773.	575.11	1061.52	936.34
	45.00	20923301.	1606.31	64.813	20923052.	101938.	5599.	678.18	1061.42	996.65
	50.00	20926991.	1702.14	62.222	20926714.	107245.	10767.	787.29	1061.27	1072.92
	55.00	20931239.	1815.14	60.079	20930930.	112550.	16359.	898.80	1060.83	1166.85
3)	57.73	20933795.	1882.32	59.170	20933468.	115449.	19627.	957.69	1060.48	1225.30
	65.00	20941367.	2083.70	57.492	20940984.	123152.	29169.	1111.64	1059.60	1408.29
	70.00	20947247.	2250.65	56.769	20946822.	128449.	36589.	1224.19	1059.02	1563.74
4)	73.21	20951334.	2371.40	56.480	20950878.	131852.	41796.	1299.58	1058.62	1677.48
	80.00	20960784.	2662.36	56.312	20960254.	139032.	54093.	1464.70	1057.13	1955.83
	85.00	20968486.	2908.89	56.529	20967890.	144312.	64460.	1590.32	1054.75	2195.46
	90.00	20976836.	3183.54	56.947	20976165.	149578.	76097.	1719.96	1051.50	2463.95
	95.00	20985859.	3487.03	57.508	20985099.	154827.	89149.	1853.75	1048.12	2761.24
	100.00	20995574.	3820.29	58.200	20994708.	160060.	103763.	1989.98	1044.94	3089.13
	105.00	21005997.	4183.95	58.985	21005003.	165277.	120096.	2128.01	1041.92	3448.40
	110.00	21017135.	4579.34	59.860	21015989.	170478.	138308.	2265.76	1038.43	3841.65
	115.00	21028992.	5008.92	60.809	21027660.	175661.	158578.	2402.28	1034.85	4271.71
	120.00	21041567.	5474.96	61.810	21040010.	180826.	181096.	2536.90	1031.40	4740.64
	125.00	21054855.	5979.94	62.858	21053025.	185974.	206063.	2667.78	1027.35	5252.35
5)	129.00	21065992.	6414.03	63.721	21063901.	190077.	227950.	2769.20	1023.99	5694.10
6)	133.07	21077778.	6885.01	64.576	21075375.	194235.	252082.	2872.91	1020.68	6173.16
7)	136.07	21086788.	7252.48	65.120	21084121.	197294.	271156.	2957.98	1018.14	6543.10
8)	139.47	21097202.	7462.66	65.737	21094201.	200752.	293824.	2962.98	1016.19	6773.44
9)	140.57	21100563.	7462.50	65.955	21097446.	201869.	301285.	2934.42	1015.81	6785.73
10)	140.77	21101171.	7460.58	65.996	21098033.	202072.	302642.	2928.39	1015.75	6786.29
11)	140.85	21101410.	7459.82	66.012	21098264.	202153.	303178.	2926.01	1015.72	6786.44

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 8E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	-17.20	295.	.00	N/A	295.	0.	-0.	.00	-.00	-.00
2)	.00	295.	.00	N/A	295.	-0.	0.	.00	-.00	-.00
	5.00	411.	47.87	.482	411.	-1.	0.	47.87	-.31	-.00
	10.00	786.	103.24	.563	786.	-3.	-0.	103.24	-.84	-.17
	15.00	1454.	165.33	.595	1454.	-9.	-1.	165.32	-1.33	.21
	20.00	2450.	234.32	1.399	2450.	-16.	9.	234.26	-1.20	4.97
	25.00	3809.	310.67	3.420	3808.	-22.	62.	310.16	-1.66	17.71
	30.00	5567.	395.17	5.912	5563.	-33.	202.	393.17	-2.57	39.70
	35.00	7766.	488.67	8.695	7751.	-47.	477.	483.82	-3.20	72.69
	40.00	10451.	592.28	11.666	10407.	-64.	950.	580.31	-3.64	118.40
	45.00	13670.	706.85	14.734	13566.	-84.	1685.	684.00	-4.06	178.23
	50.00	17477.	833.34	17.839	17258.	-105.	2758.	793.82	-4.55	253.56
	55.00	21926.	970.19	21.056	21509.	-130.	4251.	906.12	-5.34	346.67
3)	57.73	24639.	1046.87	22.857	24067.	-145.	5277.	965.49	-5.87	404.65
	65.00	32860.	1265.00	27.720	31645.	-192.	8850.	1120.89	-7.18	586.32
	70.00	39453.	1439.82	31.061	37532.	-230.	12158.	1234.63	-8.01	740.76
4)	73.21	44149.	1564.44	33.167	41623.	-257.	14718.	1310.89	-8.54	853.80
	80.00	55393.	1860.94	37.483	51083.	-319.	21421.	1478.11	-10.21	1130.57
	85.00	64973.	2109.97	40.506	58791.	-376.	27658.	1605.56	-12.60	1368.94
	90.00	75796.	2386.45	43.316	67147.	-447.	35160.	1737.28	-15.75	1636.08
	95.00	88004.	2691.18	45.890	76173.	-533.	44069.	1873.43	-18.89	1931.92
	100.00	101739.	3024.86	48.277	85887.	-635.	54533.	2012.34	-21.67	2258.28
	105.00	117151.	3388.32	50.487	96301.	-749.	66707.	2153.39	-24.10	2615.93
	110.00	134392.	3782.93	52.568	107422.	-877.	80753.	2294.53	-26.76	3007.48
	115.00	153624.	4211.16	54.541	119247.	-1017.	96847.	2434.87	-29.23	3435.76
	120.00	175018.	4675.36	56.414	131771.	-1168.	115180.	2573.77	-31.26	3903.04
	125.00	198759.	5178.19	58.208	144982.	-1329.	135954.	2709.44	-33.50	4412.65
5)	129.00	219572.	5610.34	59.591	156033.	-1467.	154479.	2815.08	-35.11	4852.84
6)	133.07	242522.	6079.45	60.909	167703.	-1612.	175186.	2923.47	-36.35	5330.26
7)	136.07	260677.	6446.13	61.748	176606.	-1723.	191728.	3012.25	-37.26	5698.91
8)	139.47	282256.	6653.51	62.555	186876.	-1850.	211525.	3020.44	-37.56	5928.30
9)	140.57	289348.	6651.77	62.799	190185.	-1891.	218056.	2992.55	-37.50	5940.48
10)	140.77	290637.	6649.55	62.843	190783.	-1899.	219244.	2986.63	-37.48	5940.97
11)	140.85	291146.	6648.67	62.861	191018.	-1902.	219714.	2984.29	-37.47	5941.16

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 8E (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	VELOCITY VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	-17.20	295.	.000	.00	90.000	N/A	-80.621	28.466	28.627
2)	.00	295.	.000	5.96	90.000	N/A	-80.621	28.466	28.627
	5.00	411.	.000	48.21	89.986	N/A	-80.621	28.466	28.627
	10.00	786.	.001	103.41	89.971	N/A	-80.621	28.466	28.627
	15.00	1454.	.002	165.55	89.938	N/A	-80.621	28.466	28.627
	20.00	2450.	.004	234.44	89.772	21.191	-80.621	28.466	28.627
	25.00	3809.	.013	310.25	89.323	30.607	-80.621	28.466	28.628
	30.00	5564.	.036	394.39	88.562	32.831	-80.621	28.466	28.628
	35.00	7752.	.082	487.56	87.472	34.279	-80.620	28.467	28.628
	40.00	10408.	.161	590.84	86.029	35.184	-80.619	28.468	28.630
	45.00	13566.	.283	705.21	84.236	35.736	-80.618	28.470	28.631
	50.00	17259.	.460	831.88	82.125	36.077	-80.616	28.472	28.634
	55.00	21510.	.707	969.41	79.710	36.273	-80.613	28.475	28.637
3)	57.73	24069.	.877	1046.72	78.309	36.346	-80.611	28.478	28.639
	65.00	31648.	1.467	1267.32	74.389	36.524	-80.605	28.486	28.647
	70.00	37536.	2.012	1445.32	71.539	36.631	-80.598	28.493	28.654
4)	73.21	41629.	2.433	1573.35	69.688	36.692	-80.594	28.498	28.660
	80.00	51094.	3.536	1872.72	65.829	36.776	-80.581	28.513	28.675
	85.00	58810.	4.561	2122.85	63.106	36.784	-80.570	28.527	28.689
	90.00	67177.	5.793	2406.78	60.566	36.778	-80.556	28.543	28.705
	95.00	76220.	7.255	2717.21	58.254	36.786	-80.539	28.563	28.725
	100.00	85959.	8.971	3056.22	56.173	36.813	-80.519	28.586	28.748
	105.00	96409.	10.965	3422.96	54.315	36.852	-80.497	28.612	28.774
	110.00	107579.	13.263	3817.81	52.651	36.889	-80.471	28.643	28.805
	115.00	119472.	15.894	4256.04	51.168	36.931	-80.441	28.676	28.840
	120.00	132088.	18.887	4732.84	49.852	36.981	-80.407	28.718	28.880
	125.00	145423.	22.276	5248.97	48.677	37.028	-80.368	28.763	28.925
5)	129.00	156601.	25.294	5681.98	47.832	37.068	-80.333	28.803	28.966
6)	133.07	168433.	28.665	6153.00	47.055	37.113	-80.295	28.848	29.011
7)	136.07	177480.	31.356	6520.41	46.534	37.146	-80.264	28.883	29.046
8)	139.47	187939.	34.573	6727.96	46.251	37.178	-80.227	28.926	29.089
9)	140.57	191315.	35.634	6726.94	46.242	37.186	-80.215	28.940	29.103
10)	140.77	191925.	35.827	6724.41	46.243	37.187	-80.212	28.943	29.106
11)	140.85	192166.	35.904	6723.40	46.243	37.187	-80.211	28.944	29.107

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

TABLE 8E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1)	-17.20	.000	.000	-52.600	-.002	.003	.002	.000	.000	.000
2)	.00	-.038	.050	-52.566	-.002	.003	.002	-.038	.050	.034
	5.00	-.019	-.013	-52.601	-.001	.001	.003	-.001	-.023	-.001
	10.00	-.013	-.019	-52.601	.002	-.000	.000	.007	-.022	-.001
	15.00	-.662	-.005	-48.497	-.201	.006	1.001	.130	.140	-.897
	20.00	-1.997	.027	-43.529	-.329	.000	1.083	.166	.196	-.929
	25.00	-3.852	-.030	-38.531	-.406	-.001	1.000	.244	.156	-.931
	30.00	-6.081	-.014	-33.529	-.481	.002	1.000	.299	.181	-.929
	35.00	-8.616	-.003	-28.528	-.531	.000	1.000	.371	.198	-.928
	40.00	-11.375	-.005	-23.529	-.570	-.003	1.000	.457	.194	-.929
	45.00	-14.303	-.022	-18.531	-.599	-.004	.999	.524	.153	-.931
	50.00	-17.439	-.047	-13.534	-.686	-.007	1.000	.601	.097	-.935
	55.00	-20.898	-.077	-8.535	-.699	-.005	1.000	.596	.012	-.935
3)	57.73	-22.818	-.079	-5.802	-.703	.005	1.000	.597	-.021	-.935
	65.00	-27.964	-.082	.059	-.712	.003	-.022	.603	-.082	.058
	70.00	-31.493	-.085	-.000	-.698	-.003	-.000	.596	-.085	-.001
4)	73.21	-33.722	-.078	-.001	-.689	.003	-.000	.589	-.078	-.001
	80.00	-38.272	-.085	.004	-.632	.014	.001	.539	-.085	.003
	85.00	-41.288	-.000	.004	-.591	.004	-.001	.608	-.000	.004
	90.00	-44.104	.058	.001	-.510	.006	-.002	.518	.058	.001
	95.00	-46.682	.065	-.002	-.513	-.005	.000	.468	.065	-.001
	100.00	-49.216	.025	-.000	-.504	-.009	.001	.444	.025	-.000
	105.00	-51.572	-.029	.001	-.512	-.020	.001	.581	-.029	.001
	110.00	-54.106	-.088	.005	-.504	-.008	.001	.528	-.088	.005
	115.00	-56.601	-.108	.007	-.494	.001	.000	.509	-.108	.006
	120.00	-59.057	-.097	.007	-.489	.002	-.000	.513	-.097	.007
	125.00	-61.610	-.184	.007	-.473	.012	-.000	.421	-.184	.007
5)	129.00	-63.529	-.160	.007	-.484	.003	-.000	.470	-.160	.006
6)	133.07	-64.055	-.154	.005	.030	-.005	-.002	-.056	-.154	.005
7)	136.07	-64.049	-.170	.003	.001	-.002	-.001	-.050	-.170	.003
8)	139.47	-64.015	-.087	.001	.010	.005	-.001	-.016	-.087	.001
9)	140.57	-64.008	-.096	.001	.004	-.022	.000	-.009	-.096	.001
10)	140.77	-64.007	-.100	.001	.004	-.027	.000	-.008	-.100	.001
11)	140.85	-64.007	-.103	.001	.004	-.029	.000	-.008	-.103	.001

1) GUIDANCE REFERENCE RELEASE;
2) FIRST MOTION;
3) MACH ONE;
4) MAXIMUM DYNAMIC PRESSURE;
5) TILT ARREST;
6) LSA; INITIATE TIME BASE TWO;
7) IECO;
8) OECO; INITIATE TIME BASE THREE;
9) INITIATE ULLAGE BURN;
10) SEPARATION SIGNAL;
11) S-IB/S-IVB PHYSICAL SEPARATION.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 9E

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/S2)	DYNAMIC PRESSURE (LB/FT2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
1)	140.85	307882.	9104.	846.	.863	17.	1.053	-63.999	.007
2)	142.17	307811.	9068.	734.	.872	15.	1.076	-63.999	.347
3)	145.57	307319.	165330.	540.	17.252	10.	1.137	-63.999	1.483
4)	148.57	305897.	210049.	395.	22.053	7.	1.191	-63.999	2.251
5)	152.77	303758.	230311.	251.	24.369	4.	1.267	-63.999	2.904
	160.00	299604.	232585.	123.	24.965	2.	1.401	-63.999	4.474
6)	165.35	296672.	232126.	71.	25.167	1.	1.502	-63.999	5.605
	170.00	294130.	232658.	44.	25.446	1.	1.591	-63.999	6.585
7)	171.47	293323.	232788.	37.	25.531	0.	1.620	-63.999	6.893
8)	175.00	282236.	232977.	25.	26.556	0.	1.689	-63.999	7.636
	180.00	279490.	233190.	19.	26.843	0.	1.789	-58.999	11.867
	190.00	274007.	233072.	10.	27.367	0.	1.992	-55.716	18.907
	200.00	268514.	232692.	4.	27.881	0.	2.201	-56.874	19.229
	210.00	263035.	232542.	2.	28.444	0.	2.416	-57.794	19.824
	220.00	257554.	233226.	1.	29.135	0.	2.638	-58.907	20.267
	230.00	252060.	232800.	0.	29.715	0.	2.865	-60.254	20.349
	240.00	246580.	232729.	0.	30.367	0.	3.100	-61.251	20.700
	250.00	241103.	232650.	0.	31.046	0.	3.341	-62.321	20.954
	260.00	235627.	233272.	0.	31.852	0.	3.588	-63.436	21.094
	270.00	230135.	233470.	0.	32.640	0.	3.843	-64.760	20.986
	280.00	224644.	232929.	0.	33.360	0.	4.106	-65.936	20.921
	290.00	219163.	232925.	0.	34.194	0.	4.376	-66.914	21.081
	300.00	213684.	232922.	0.	35.071	0.	4.654	-68.031	21.071
	310.00	208205.	232915.	0.	35.992	0.	4.940	-69.186	20.943
	320.00	202727.	232907.	0.	36.964	0.	5.235	-70.338	20.743
	330.00	197249.	232892.	0.	37.988	0.	5.539	-71.487	20.504
	340.00	191772.	232878.	0.	39.070	0.	5.852	-72.639	20.222
	350.00	186296.	232862.	0.	40.216	0.	6.174	-73.793	19.846
	360.00	180821.	232846.	0.	41.431	0.	6.506	-74.937	19.510
	370.00	175347.	232819.	0.	42.719	0.	6.848	-76.092	19.169
	380.00	169873.	232790.	0.	44.090	0.	7.201	-77.256	18.822
	390.00	164399.	232766.	0.	45.553	0.	7.565	-78.428	18.345
	400.00	158926.	232742.	0.	47.117	0.	7.941	-79.604	17.835
	410.00	153435.	233621.	0.	48.988	0.	8.326	-80.879	17.204
	420.00	147945.	233062.	0.	50.684	0.	8.728	-82.080	16.596
	430.00	142465.	233046.	0.	52.630	0.	9.141	-83.197	16.078

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 9E (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/S2)	DYNAMIC PRESSURE (LB/FT2)	INERTIAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
	440.00	136985.	233031.	0.	54.732	0.	9.568	-84.383	15.461
	450.00	131507.	232811.	0.	56.958	0.	10.008	-85.572	14.901
	460.00	126029.	232790.	0.	59.428	0.	10.464	-86.772	14.314
9)	467.00	121263.	197590.	0.	52.425	0.	10.887	-87.858	13.695
	470.00	120763.	197448.	0.	52.604	0.	10.935	-87.928	13.637
	480.00	116144.	196665.	0.	54.479	0.	11.420	-89.088	13.091
	490.00	111562.	196553.	0.	56.685	0.	11.920	-90.273	12.442
	500.00	106980.	196573.	0.	59.118	0.	12.435	-91.456	11.805
	510.00	102399.	196570.	0.	61.763	0.	12.965	-92.839	10.961
	520.00	97817.	196561.	0.	64.652	0.	13.512	-94.086	10.195
	530.00	93235.	196550.	0.	67.826	0.	14.076	-95.227	9.600
	540.00	88654.	196522.	0.	71.321	0.	14.658	-96.399	9.025
	550.00	84073.	196473.	0.	75.188	0.	15.259	-97.606	8.348
	560.00	79491.	196409.	0.	79.496	0.	15.880	-98.818	7.604
	570.00	74911.	196300.	0.	84.312	0.	16.523	-100.382	6.370
	580.00	70333.	196162.	0.	89.734	0.	17.188	-100.170	7.021
10)	583.81	68588.	196086.	0.	91.982	0.	17.447	-100.170	7.195
11)	584.01	68552.	137263.	0.	64.422	0.	17.461	-100.170	7.204
12)	584.61	68470.	5556.	0.	2.611	0.	17.502	-100.170	7.242
13)	593.81	68456.	0.	1.	-.000	0.	18.133	-100.199	7.677

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

TABLE 9E (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1) 140.85	21101420.	7459.82	66.012	21098273.	202153.	303197.	2926.01	1015.72	6786.44
2) 142.17	21105401.	7444.00	66.280	21102111.	203494.	312163.	2884.74	1015.32	6786.79
3) 145.57	21115418.	7418.82	66.967	21111743.	206945.	335247.	2785.33	1013.77	6800.97
4) 148.57	21124035.	7441.08	67.541	21119996.	209982.	355726.	2717.68	1011.03	6852.86
5) 152.77	21135812.	7489.43	68.329	21131225.	214222.	384667.	2629.72	1008.75	6939.63
160.00	21155346.	7583.52	69.651	21149705.	221506.	435436.	2481.13	1005.39	7095.28
6) 165.35	21169209.	7658.02	70.602	21162692.	226880.	473723.	2372.10	1002.77	7211.99
170.00	21180844.	7725.51	71.407	21173498.	231535.	507480.	2277.84	1000.47	7313.96
7) 171.47	21184442.	7747.50	71.657	21176820.	233003.	518241.	2248.22	999.74	7346.41
8) 175.00	21192948.	7804.41	72.248	21184636.	236531.	544329.	2178.51	997.88	7427.46
180.00	21204641.	7887.32	73.049	21195283.	241514.	581755.	2082.22	994.84	7542.18
190.00	21226964.	8052.78	74.365	21215265.	251432.	656266.	1919.02	989.13	7757.98
200.00	21248057.	8228.37	75.583	21233667.	261301.	736936.	1761.03	985.14	7977.11
210.00	21267942.	8418.78	76.749	21250483.	271140.	817827.	1602.13	983.11	8202.14
220.00	21286642.	8612.58	77.857	21265709.	280971.	901000.	1443.07	983.53	8433.67
230.00	21304182.	8822.77	78.915	21279342.	290818.	986527.	1282.79	986.31	8673.12
240.00	21320574.	9044.05	79.923	21291359.	300704.	1074484.	1120.42	991.31	8919.46
250.00	21335839.	9276.57	80.876	21301748.	310651.	1164939.	957.09	996.49	9172.88
260.00	21350002.	9520.60	81.776	21310497.	320681.	1257966.	792.27	1007.84	9433.90
270.00	21363086.	9777.38	82.625	21317590.	330815.	1353648.	625.73	1019.41	9703.94
280.00	21375109.	10046.40	83.428	21323003.	341076.	1452075.	456.31	1033.17	9982.71
290.00	21386091.	10326.76	84.181	21326709.	351486.	1553328.	284.65	1049.18	10269.38
300.00	21396061.	10619.14	84.883	21326691.	362067.	1657491.	111.07	1067.50	10569.76
310.00	21405045.	10923.98	85.537	21328923.	372844.	1764655.	-65.21	1088.22	10869.44
320.00	21413072.	11241.61	86.146	21327378.	383840.	1874913.	-244.55	1111.42	11183.86
330.00	21420168.	11572.36	86.711	21324022.	395080.	1988366.	-427.19	1137.21	11508.42
340.00	21426364.	11916.60	87.232	21318823.	406592.	2105117.	-613.37	1165.69	11843.57
350.00	21431689.	12274.80	87.712	21311743.	418403.	2225275.	-803.49	1197.02	12189.84
360.00	21436177.	12647.49	88.152	21302740.	430543.	2348953.	-997.95	1231.33	12547.79
370.00	21439862.	13035.15	88.551	21291770.	443040.	2476272.	-1196.84	1268.72	12917.94
380.00	21442784.	13438.42	88.911	21278788.	455928.	2607355.	-1400.56	1309.34	13300.95
390.00	21444984.	13858.05	89.234	21263743.	469238.	2742337.	-1609.58	1353.44	13697.55
400.00	21446505.	14294.88	89.520	21246578.	483008.	2881355.	-1824.41	1401.15	14108.58
410.00	21447397.	14751.46	89.770	21227236.	497275.	3024567.	-2045.47	1452.90	14536.53
420.00	21447706.	15227.49	89.988	21205645.	512080.	3172143.	-2274.10	1508.71	14980.95
430.00	21447483.	15723.10	90.171	21181731.	527464.	3324243.	-2509.94	1568.90	15441.98

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 9E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- SPACE FIXED ----- RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS --- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
	440.00	21446792.	16240.38	90.319	21155422.	543474.	3481046.	-2753.45	1633.86	15921.65
	450.00	21445699.	16780.56	90.434	21126634.	560158.	3642743.	-3005.72	1703.80	16421.02
	460.00	21444274.	17345.63	90.517	21095277.	577568.	3809540.	-3267.45	1779.16	16941.94
9)	469.00	21442770.	17866.36	90.573	21064776.	593903.	3964196.	-3512.35	1850.35	17419.72
	470.00	21442589.	17917.65	90.584	21061250.	595757.	3981639.	-3540.43	1857.34	17465.91
	480.00	21440584.	18440.98	90.675	21024427.	614692.	4158637.	-3825.99	1930.54	17936.17
	490.00	21438267.	18985.84	90.739	20984699.	634382.	4340423.	-4121.74	2008.18	18423.92
	500.00	21435713.	19554.95	90.775	20941957.	654873.	4527185.	-4428.66	2090.81	18931.76
	510.00	21433007.	20150.39	90.784	20896084.	676218.	4719132.	-4746.47	2179.16	19461.28
	520.00	21430224.	20774.52	90.771	20846936.	698477.	4916491.	-5083.53	2273.81	20013.20
	530.00	21427455.	21429.45	90.729	20794365.	721720.	5119504.	-5433.16	2376.01	20592.64
	540.00	21424814.	22117.98	90.657	20738222.	746024.	5328440.	-5798.34	2486.25	21199.12
	550.00	21422426.	22848.46	90.556	20678340.	771474.	5543593.	-6181.09	2605.02	21836.50
	560.00	21420424.	23609.94	90.428	20614533.	798156.	5765288.	-6583.77	2733.06	22508.08
	570.00	21418903.	24423.16	90.297	20546539.	826178.	5993876.	-7019.89	2873.30	23215.43
	580.00	21418011.	25285.82	90.103	20474110.	855653.	6229756.	-7466.84	3022.93	23968.33
10)	583.81	21417915.	25628.88	90.009	20445308.	867294.	6321730.	-7638.87	3082.36	24269.04
11)	584.01	21417914.	25646.07	90.004	20443779.	867910.	6326585.	-7647.75	3085.33	24284.02
12)	584.61	21417914.	25650.02	90.003	20439185.	869762.	6341156.	-7666.01	3085.34	24282.43
13)	593.81	21417906.	25651.11	90.001	20367419.	898096.	6564174.	-7935.00	3074.26	24198.44

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 9E (CONT'D)

ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY

LAUNCH WINDOW CLOSING

S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
1)	140.85	291166.	6648.67	62.861	191028.	-1902.	219733.	2984.29	-37.47	5941.16
2)	142.17	299665.	6630.80	63.154	194944.	-1951.	227581.	2943.75	-37.35	5941.42
3)	145.57	321464.	6600.66	63.911	204779.	-2078.	247791.	2846.27	-37.49	5955.34
4)	148.57	340706.	6619.38	64.568	213218.	-2192.	265732.	2760.58	-38.88	6006.92
5)	152.77	367785.	6662.94	65.475	224717.	-2357.	291140.	2695.60	-39.18	6093.24
	160.00	414886.	6749.37	67.001	243691.	-2639.	335765.	2552.00	-38.89	6248.18
6)	165.35	450149.	6818.69	68.098	257067.	-2847.	369517.	2446.84	-38.62	6364.44
	170.00	481065.	6882.02	69.027	268229.	-3025.	399334.	2356.00	-38.29	6466.07
7)	171.47	490887.	6902.76	69.316	271667.	-3082.	408850.	2327.48	-38.17	6498.42
8)	175.00	514640.	6956.82	69.998	279767.	-3216.	431942.	2260.44	-37.92	6579.24
	180.00	548578.	7036.11	70.924	290834.	-3405.	465126.	2167.99	-37.88	6693.67
	190.00	617598.	7196.07	72.447	311712.	-3784.	533150.	2012.56	-37.47	6908.81
	200.00	688213.	7366.86	73.854	331089.	-4147.	603325.	1862.65	-34.90	7127.41
	210.00	760519.	7548.87	75.197	348963.	-4474.	675717.	1712.15	-29.85	7352.09
	220.00	834609.	7742.60	76.469	365333.	-4735.	750388.	1561.85	-21.83	7583.41
	230.00	910596.	7949.00	77.678	380198.	-4901.	827412.	1410.72	-10.88	7822.81
	240.00	988588.	8166.74	78.828	393542.	-4944.	906866.	1257.90	2.67	8069.28
	250.00	1068693.	8395.98	79.910	405356.	-4835.	988821.	1104.53	19.37	8322.99
	260.00	1151023.	8636.95	80.928	415630.	-4548.	1073352.	950.09	38.64	8584.45
	270.00	1235699.	8890.87	81.885	424356.	-4053.	1160542.	794.42	60.77	8855.10
	280.00	1322846.	9157.19	82.786	431512.	-3323.	1250484.	636.34	85.75	9134.65
	290.00	1412584.	9435.00	83.629	437077.	-2329.	1343261.	476.51	113.63	9422.28
	300.00	1505031.	9724.95	84.411	441039.	-1041.	1438959.	315.29	144.52	9718.76
	310.00	1600315.	10027.47	85.137	443377.	572.	1537668.	151.92	178.51	10024.73
	320.00	1698564.	10342.86	85.811	444070.	2540.	1639466.	-13.94	215.72	10340.60
	330.00	1799913.	10671.42	86.433	443091.	4897.	1744515.	-182.48	256.30	10666.78
	340.00	1904496.	11013.52	87.005	440412.	7677.	1852858.	-353.93	300.38	11003.73
	350.00	2012456.	11369.62	87.530	436003.	10917.	1964627.	-528.65	348.14	11351.98
	360.00	2123937.	11740.22	88.009	429828.	14653.	2079938.	-707.00	399.76	11712.10
	370.00	2239091.	12125.81	88.442	421852.	18925.	2198911.	-889.04	455.37	12084.60
	380.00	2358073.	12527.01	88.832	412035.	23774.	2321674.	-1075.12	515.17	12470.15
	390.00	2481047.	12944.55	89.180	400336.	29243.	2448361.	-1265.67	579.44	12869.49
	400.00	2608183.	13379.30	89.488	386706.	35378.	2579113.	-1461.16	648.37	13283.46
	410.00	2739668.	13833.77	89.755	371097.	42228.	2714070.	-1661.93	722.48	13714.56
	420.00	2875701.	14307.66	89.987	353447.	49846.	2853462.	-1869.28	801.83	14162.35
	430.00	3016475.	14801.11	90.161	333692.	58284.	2997394.	-2082.80	886.78	14626.98

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 9E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	----- EARTH FIXED ----- POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---- X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
	440.00	3162199.	15316.20	90.336	311770.	67601.	3146066.	-2302.89	977.80	15110.48
	450.00	3313097.	15854.14	90.460	287610.	77861.	3299671.	-2530.55	1075.18	15613.91
	460.00	3469408.	16416.95	90.547	261133.	89128.	3458419.	-2766.40	1179.45	16139.15
9)	469.00	3614923.	16935.65	90.605	235251.	100188.	3605868.	-2987.08	1277.63	16621.09
	470.00	3631368.	16986.73	90.616	232251.	101471.	3622513.	-3012.59	1287.80	16667.78
	480.00	3798608.	17508.01	90.711	200838.	114862.	3791555.	-3271.58	1391.49	17143.24
	490.00	3971051.	18050.81	90.778	166788.	129320.	3965439.	-3539.99	1501.12	17636.52
	500.00	4148926.	18817.85	90.814	130007.	144906.	4144356.	-3818.09	1617.33	18150.23
	510.00	4332481.	19211.21	90.822	90389.	161692.	4328519.	-4107.70	1740.97	18685.99
	520.00	4521985.	19833.22	90.807	47807.	179753.	4518158.	-4411.08	1872.78	19245.56
	530.00	4717727.	20485.96	90.762	2125.	199179.	4713520.	-4727.42	2014.10	19831.02
	540.00	4920023.	21172.25	90.686	-46787.	220069.	4914876.	-5057.56	2165.54	20444.94
	550.00	5129222.	21895.48	90.581	-99078.	242527.	5122527.	-5403.39	2327.80	21090.20
	560.00	5345703.	22659.61	90.446	-154915.	266665.	5336800.	-5767.10	2501.82	21770.15
	570.00	5569884.	23470.40	90.309	-214537.	292617.	5558053.	-6161.97	2691.05	22486.62
	580.00	5802234.	24330.66	90.107	-278171.	320525.	5786692.	-6565.21	2892.30	23248.96
10)	583.81	5893106.	24672.83	90.009	-303502.	331707.	5875930.	-6719.85	2972.13	23553.31
11)	584.01	5897907.	24689.97	90.004	-304847.	332301.	5880642.	-6727.84	2976.15	23568.48
12)	584.61	5912318.	24693.89	90.003	-308889.	334088.	5894783.	-6744.79	2978.12	23567.49
13)	593.81	6133251.	24694.66	90.001	-372096.	361567.	6111267.	-6995.62	2995.58	23492.84

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 9E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
1)	140.85	192175.	35.907	6723.40	46.243	37.187	-80.211	28.944	29.107
2)	142.17	196174.	37.181	6707.82	46.252	37.196	-80.197	28.961	29.124
3)	145.57	206236.	40.461	6668.87	46.253	37.216	-80.159	29.004	29.168
4)	148.57	214894.	43.370	6678.47	46.195	37.223	-80.126	29.043	29.206
5)	152.77	226727.	47.488	6709.74	46.111	37.251	-80.078	29.097	29.261
	160.00	246362.	54.710	6793.56	45.971	37.307	-79.995	29.193	29.357
6)	165.35	260300.	60.167	6863.29	45.872	37.349	-79.932	29.265	29.430
	170.00	272002.	64.983	6926.95	45.788	37.386	-79.876	29.329	29.494
7)	171.47	275621.	66.519	6947.78	45.763	37.398	-79.858	29.349	29.514
8)	175.00	284179.	70.246	7002.07	45.698	37.427	-79.815	29.399	29.563
	180.00	295946.	75.598	7081.66	45.608	37.466	-79.752	29.469	29.634
	190.00	318422.	86.556	7242.11	45.454	37.546	-79.625	29.614	29.780
	200.00	339672.	97.846	7413.35	45.324	37.644	-79.493	29.763	29.929
	210.00	359720.	109.479	7595.79	45.218	37.763	-79.356	29.916	30.083
	220.00	378587.	121.467	7789.95	45.136	37.904	-79.215	30.074	30.241
	230.00	396300.	133.821	7996.77	45.076	38.066	-79.068	30.236	30.404
	240.00	412870.	146.557	8214.92	45.038	38.246	-78.917	30.403	30.571
	250.00	428319.	159.686	8444.56	45.019	38.441	-78.759	30.574	30.743
	260.00	442672.	173.223	8685.94	45.018	38.651	-78.596	30.751	30.920
	270.00	455951.	187.182	8940.25	45.035	38.876	-78.426	30.932	31.102
	280.00	468177.	201.580	9206.96	45.068	39.113	-78.250	31.118	31.289
	290.00	479368.	216.433	9485.17	45.118	39.363	-78.067	31.310	31.481
	300.00	489552.	231.755	9775.51	45.184	39.625	-77.877	31.507	31.678
	310.00	498758.	247.564	10078.41	45.265	39.898	-77.680	31.709	31.881
	320.00	507014.	263.877	10394.20	45.362	40.182	-77.474	31.917	32.090
	330.00	514345.	280.713	10723.16	45.473	40.477	-77.260	32.131	32.304
	340.00	520784.	298.091	11065.66	45.600	40.784	-77.037	32.351	32.525
	350.00	526361.	316.033	11422.16	45.742	41.101	-76.805	32.576	32.751
	360.00	531107.	334.558	11793.18	45.898	41.429	-76.563	32.808	32.984
	370.00	535059.	353.690	12179.19	46.070	41.768	-76.311	33.047	33.223
	380.00	538256.	373.452	12580.82	46.256	42.118	-76.048	33.292	33.468
	390.00	540740.	393.869	12998.80	46.457	42.479	-75.774	33.543	33.721
	400.00	542554.	414.967	13433.99	46.673	42.852	-75.487	33.802	33.980
	410.00	543747.	436.776	13888.92	46.905	43.237	-75.188	34.067	34.246
	420.00	544368.	459.327	14363.29	47.153	43.634	-74.876	34.340	34.520
	430.00	544466.	482.651	14857.22	47.416	44.043	-74.549	34.621	34.801

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGM INITIATION;

TABLE 9E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR AZIMUTH SPACE FIXED (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
	440.00	544106.	506.781	15372.80	47.697	44.466	-74.208	34.909	35.090
	450.00	543354.	531.753	15911.25	47.995	44.903	-73.850	35.205	35.386
	460.00	542281.	557.604	16474.58	48.310	45.354	-73.475	35.509	35.691
9)	469.00	541103.	581.657	16993.76	48.609	45.770	-73.123	35.790	35.972
	470.00	540959.	584.375	17044.89	48.642	45.815	-73.083	35.821	36.004
	480.00	539327.	612.007	17566.69	48.983	46.270	-72.673	36.141	36.325
	490.00	537392.	640.491	18110.03	49.341	46.740	-72.245	36.468	36.652
	500.00	535231.	669.864	18677.61	49.716	47.224	-71.799	36.802	36.987
	510.00	532928.	700.167	19271.53	50.110	47.726	-71.333	37.144	37.329
	520.00	530558.	731.445	19894.11	50.524	48.246	-70.845	37.493	37.679
	530.00	528212.	763.744	20547.46	50.962	48.788	-70.335	37.850	38.037
	540.00	526005.	797.117	21234.36	51.423	49.351	-69.801	38.215	38.402
	550.00	524062.	831.620	21958.22	51.909	49.938	-69.241	38.588	38.776
	560.00	522516.	867.313	22723.01	52.422	50.549	-68.654	38.969	39.157
	570.00	521462.	904.267	23534.48	52.967	51.191	-68.036	39.358	39.547
	580.00	521048.	942.557	24395.45	53.535	51.855	-67.367	39.756	39.945
10)	583.81	521138.	957.528	24737.88	53.758	52.113	-67.131	39.910	40.099
11)	584.01	521147.	958.318	24755.04	53.770	52.127	-67.117	39.918	40.107
12)	584.61	521176.	960.692	24758.99	53.798	52.157	-67.077	39.942	40.132
13)	593.81	521617.	997.094	24694.66	54.230	52.614	-66.447	40.313	40.503

9) EMR SHIFT TO 4.8:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

ORIGINAL PAGE IS OF POOR QUALITY

TABLE 9E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
1) 140.85	-64.007	-.103	.001	.004	-.029	.000	-.008	-.103	.001
2) 142.17	-63.991	-.222	-.001	.027	-.152	-.003	.008	-.222	-.001
3) 145.57	-63.630	-1.172	-.057	.133	-.221	-.053	.369	-1.172	-.060
4) 148.57	-63.534	-.964	-.332	-.048	.254	-.090	.468	-.963	-.336
5) 152.77	-63.602	-.193	-.587	-.037	.042	.010	.198	-.192	-.587
160.00	-63.870	-.301	-.668	-.011	.006	-.020	.130	-.300	-.668
6) 165.35	-63.930	-.269	-.655	-.009	.000	.017	.070	-.269	-.655
170.00	-63.962	-.274	-.664	-.006	-.001	-.019	.039	-.274	-.664
7) 171.47	-63.970	-.274	-.698	-.005	.000	-.027	.031	-.274	-.698
8) 175.00	-63.974	-.315	-.759	-.002	-.008	.056	.027	-.315	-.759
180.00	-60.757	-.564	-.016	1.132	.009	.131	-1.757	-.420	-.006
190.00	-55.432	-.136	-.028	-.225	.037	-.134	.284	-.383	-.028
200.00	-56.713	.255	-.562	-.115	.039	-.027	.162	-.383	-.560
210.00	-57.660	.750	-.822	-.095	.052	-.028	.137	-.406	-.820
220.00	-58.710	1.237	-.241	-.126	.047	.067	.198	-.407	-.236
230.00	-60.075	1.684	.413	-.129	.042	.067	.177	-.404	.419
240.00	-61.108	2.094	.482	-.100	.040	-.030	.141	-.407	.487
250.00	-62.167	2.480	.178	-.110	.037	-.031	.153	-.408	.185
260.00	-63.261	2.846	-.128	-.112	.036	-.030	.156	-.410	-.120
270.00	-64.564	3.192	-.450	-.129	.034	-.032	.177	-.411	-.440
280.00	-65.796	3.529	-.757	-.110	.034	-.029	.142	-.415	-.748
290.00	-66.768	3.863	-.354	-.104	.033	.072	.148	-.418	-.343
300.00	-67.875	4.180	.360	-.114	.032	.071	.155	-.427	.372
310.00	-69.026	4.494	.518	-.116	.031	-.029	.157	-.430	.532
320.00	-70.180	4.799	.234	-.115	.031	-.028	.156	-.436	.248
330.00	-71.330	5.101	-.044	-.115	.029	-.028	.157	-.438	-.029
340.00	-72.481	5.396	-.317	-.115	.029	-.027	.158	-.443	-.302
350.00	-73.686	5.699	-.590	-.116	.028	-.027	.108	-.434	-.579
360.00	-74.823	5.978	-.747	-.115	.029	.074	.117	-.442	-.735
370.00	-75.974	6.254	-.004	-.116	.027	.074	.118	-.450	.009
380.00	-77.134	6.529	.663	-.116	.028	-.026	.118	-.456	.677
390.00	-78.307	6.801	.406	-.118	.027	-.025	.118	-.459	.421
400.00	-79.484	7.064	.154	-.118	.027	-.025	.118	-.467	.169
410.00	-80.752	7.316	-.099	-.128	.025	-.025	.127	-.470	-.082
420.00	-81.974	7.574	-.345	-.113	.027	-.024	.106	-.479	-.331
430.00	-83.081	7.839	-.580	-.116	.026	-.024	.117	-.480	-.564

1) S-IB/S-IVB PHYSICAL SEPARATION;
2) J-2 ENGINE START COMMAND;
3) 90% J-2 THRUST LEVEL;
4) TERMINATE ULLAGE BURN;
5) JETTISON ULLAGE ROCKETS;
6) DYNAMIC PRESSURE = 1 PSF;
7) LES JETTISON;
8) IGN INITIATION;

TABLE 9E (CONT'D)
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
S-IVB STAGE FLIGHT DATA

	FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE PITCH (DEG)	YAW (DEG)	ROLL (DEG)	VEHICLE ATTITUDE RATE PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	VEHICLE ATTITUDE ERROR PITCH (DEG)	YAW (DEG)	ROLL (DEG)
	440.00	-84.263	8.087	-.814	-.120	.024	-.023	.122	-.485	-.797
	450.00	-85.453	8.330	-.063	-.119	.024	.077	.118	-.492	-.045
	460.00	-86.649	8.567	.684	-.120	.024	-.024	.119	-.501	.703
9)	467.00	-87.734	8.780	.469	-.121	.024	-.024	.120	-.506	.489
	470.00	-87.850	8.806	.446	-.107	.032	-.023	.095	-.532	.458
	480.00	-88.962	9.112	.215	-.125	.011	-.023	.124	-.495	.236
	490.00	-90.158	9.240	-.015	-.114	.017	-.023	.113	-.510	.004
	500.00	-91.328	9.442	-.242	-.125	.020	-.023	.127	-.516	-.220
	510.00	-92.693	9.619	-.469	-.145	.019	-.023	.146	-.521	-.444
	520.00	-93.973	9.860	-.692	-.116	.027	-.022	.115	-.532	-.672
	530.00	-95.115	10.109	-.458	-.115	.023	.078	.113	-.535	-.437
	540.00	-96.278	10.326	.327	-.118	.020	.079	.117	-.538	.350
	550.00	-97.480	10.519	.580	-.122	.019	-.022	.121	-.541	.604
	560.00	-98.695	10.696	.359	-.121	.017	-.022	.118	-.544	.382
	570.00	-100.423	10.975	.153	.020	-.003	-.030	-.041	-.524	.145
	580.00	-100.212	10.916	-.145	.024	-.009	-.030	-.040	-.525	-.153
10)	583.81	-100.191	10.907	-.255	-.000	-.000	-.029	-.019	-.534	-.259
11)	584.01	-100.191	10.907	-.261	-.000	-.000	-.029	-.019	-.534	-.265
12)	584.61	-100.191	10.907	-.278	-.000	-.000	-.029	-.019	-.534	-.282
13)	593.81	-100.199	10.962	-.150	-.001	.007	.021	-.027	-.479	-.155

9) EMR SHIFT TO 4.6:1;
10) GUIDANCE CUTOFF SIGNAL;
11) INITIATE TIME BASE FOUR;
12) BEGIN LOX NPV;
13) ORBIT INSERTION.

FIGURE 1E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
ALTITUDE VS. GROUND RANGE

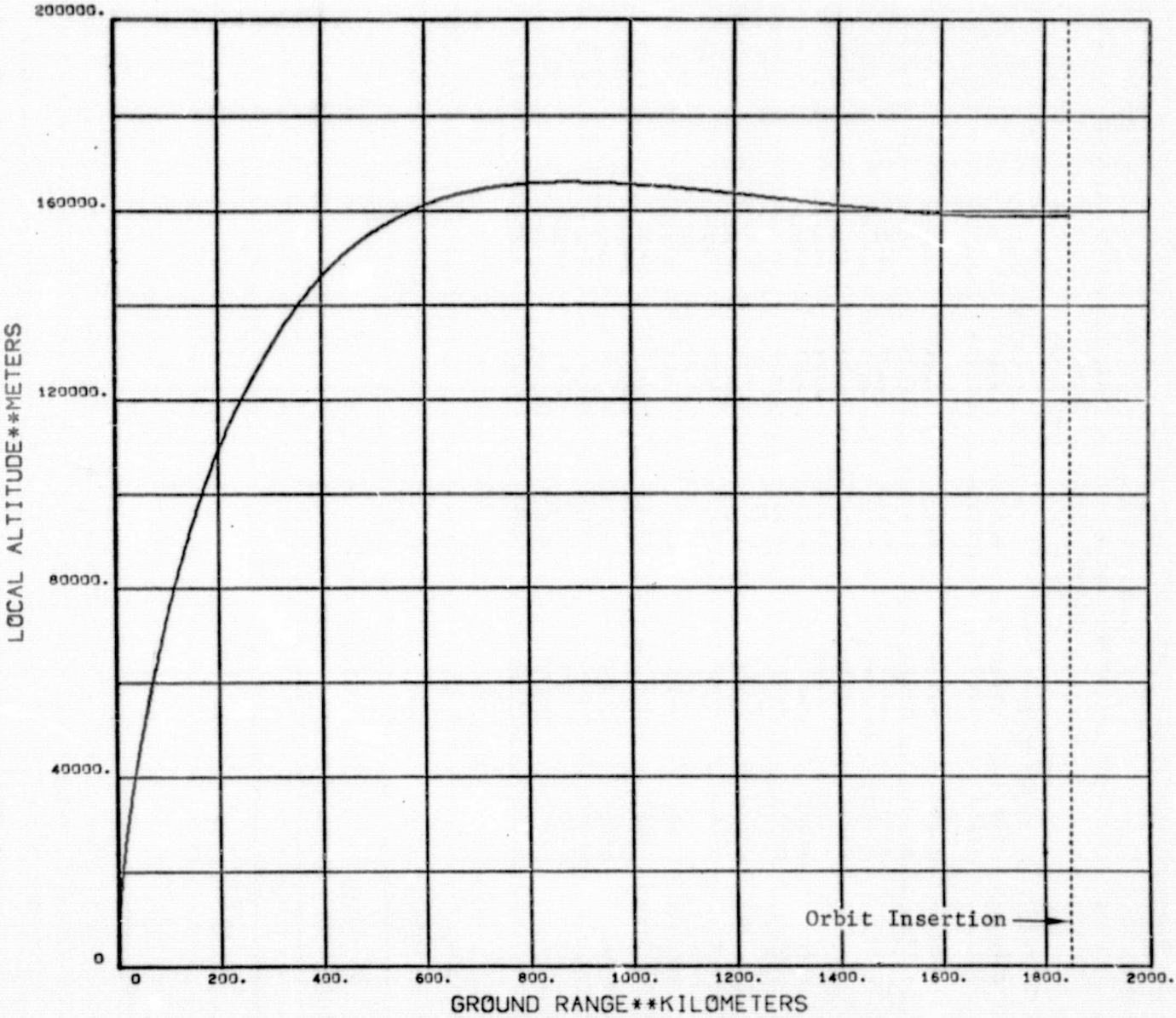


FIGURE 2E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
ALTITUDE HISTORY

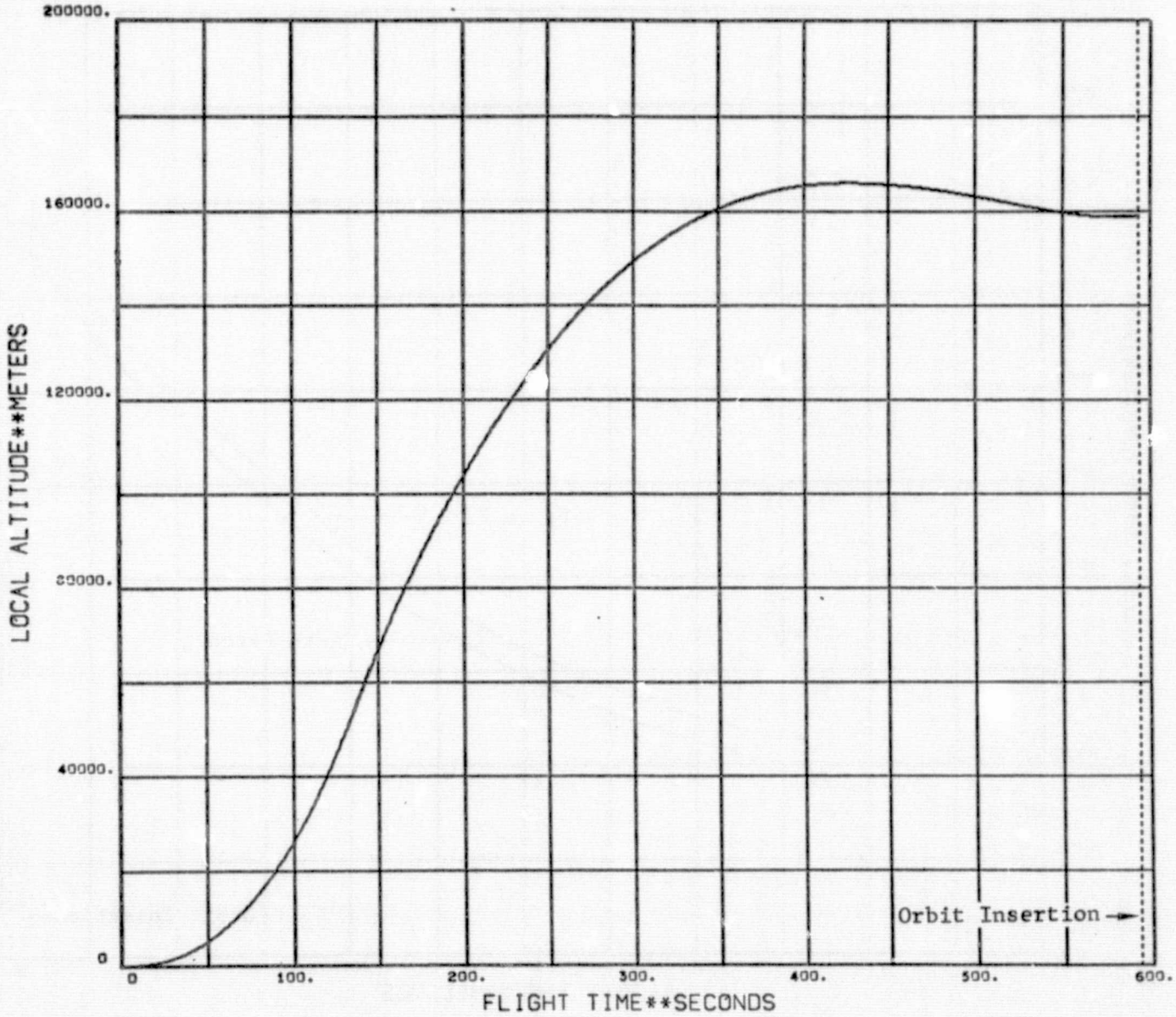


FIGURE 3E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
VELOCITY HISTORIES

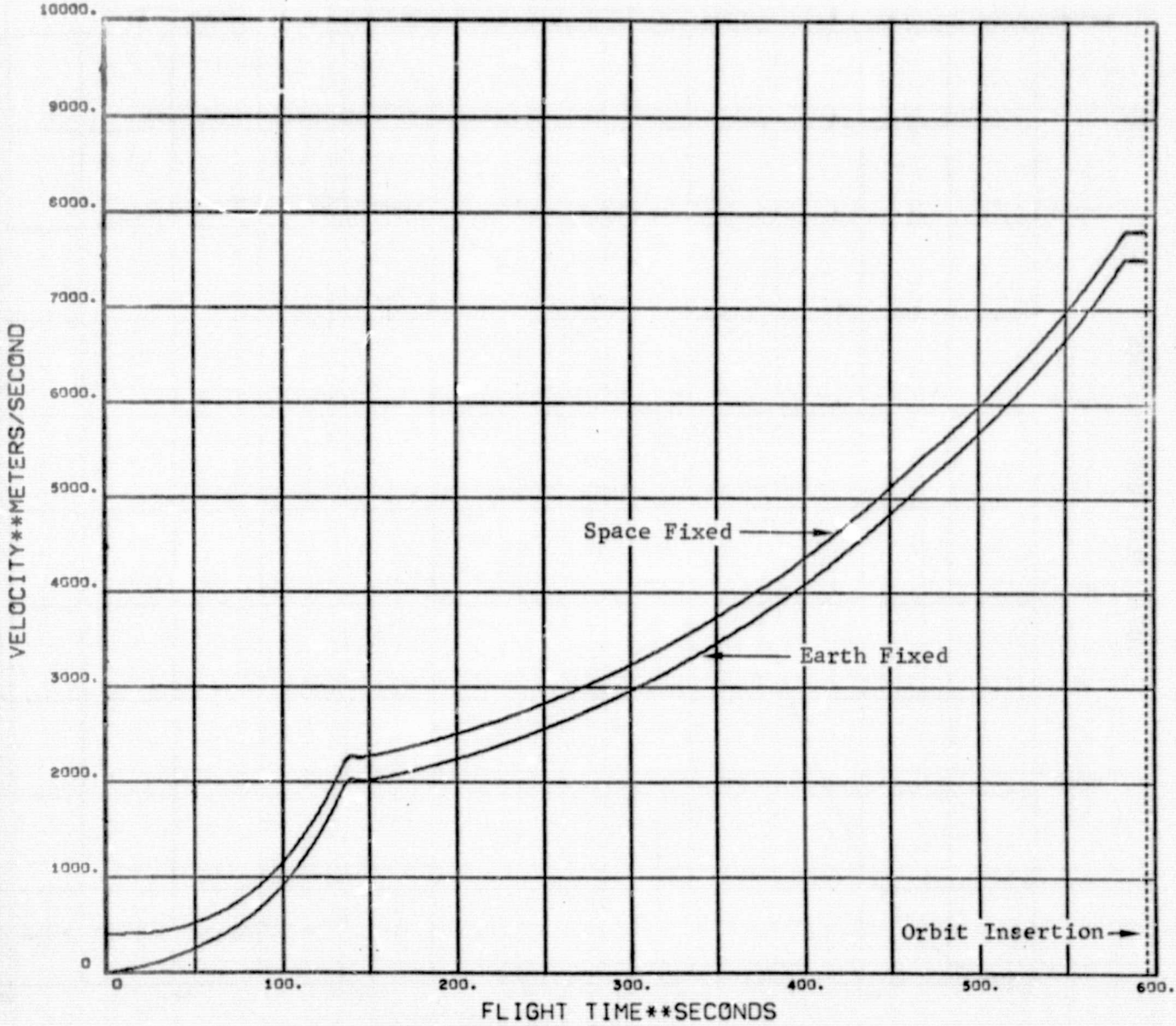


FIGURE 4E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
SPACE FIXED PATH ANGLE HISTORY

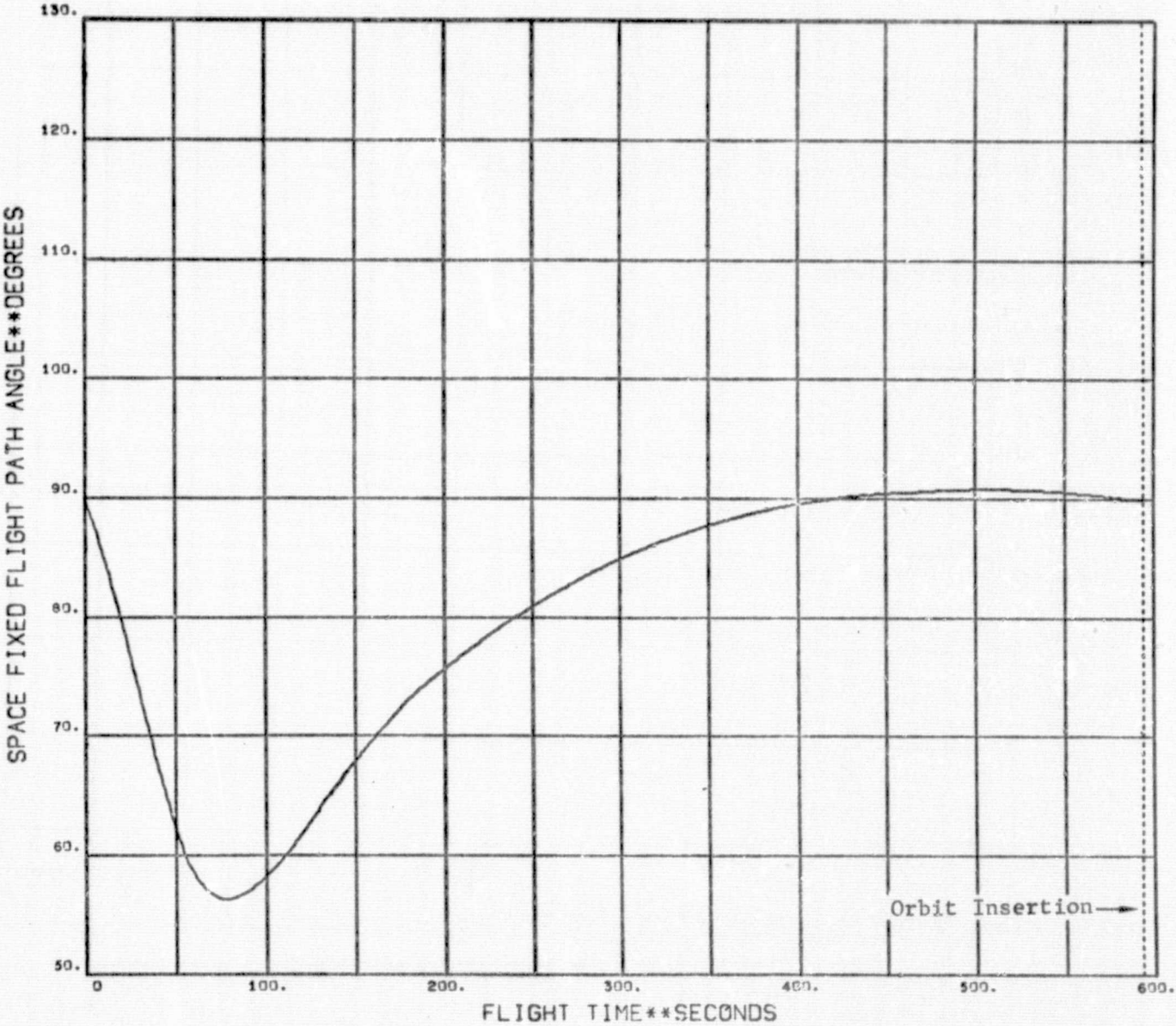


FIGURE 5E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
EARTH FIXED PATH ANGLE HISTORY

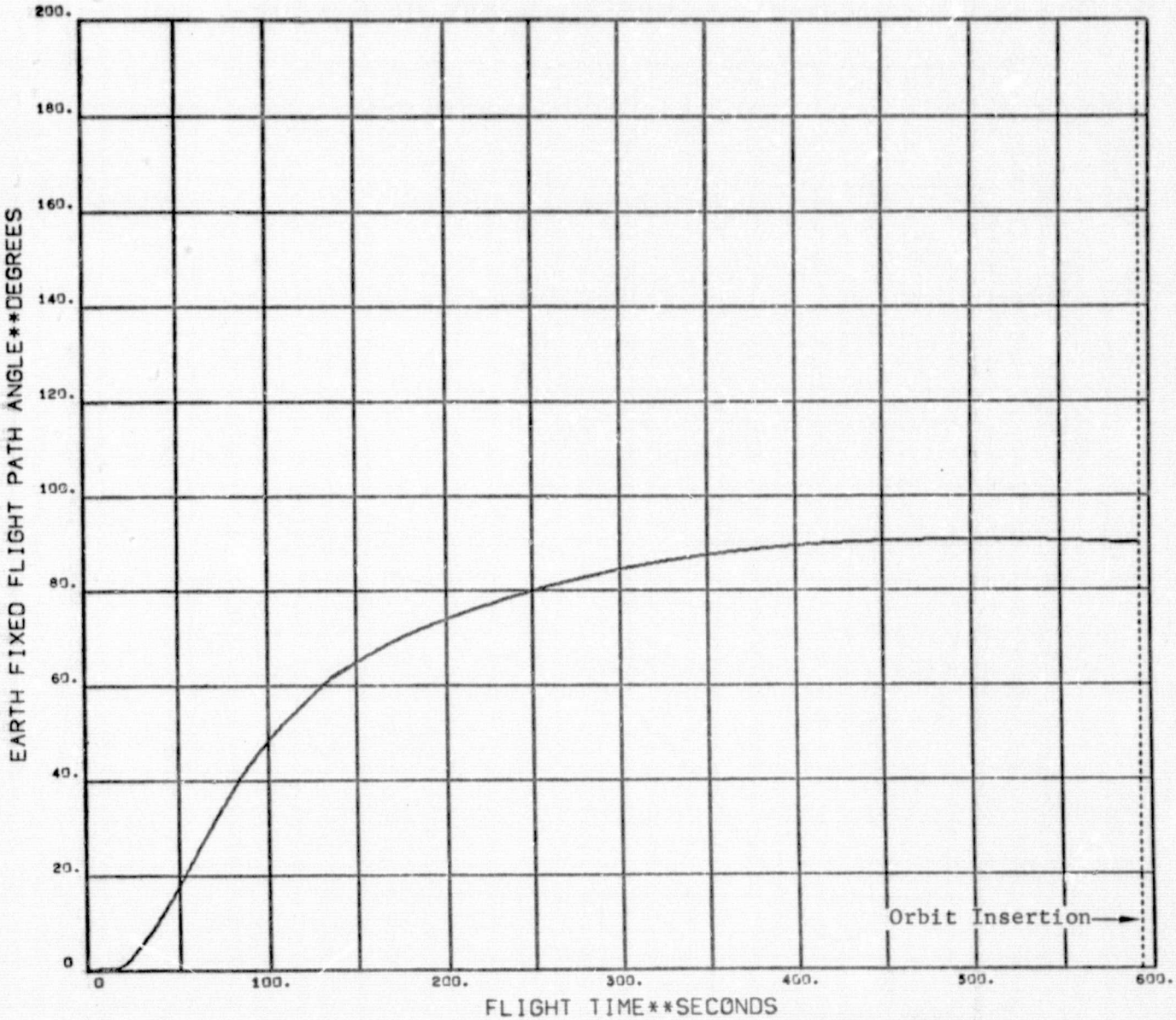


FIGURE 6E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
PITCH ANGLE OF ATTACK HISTORY

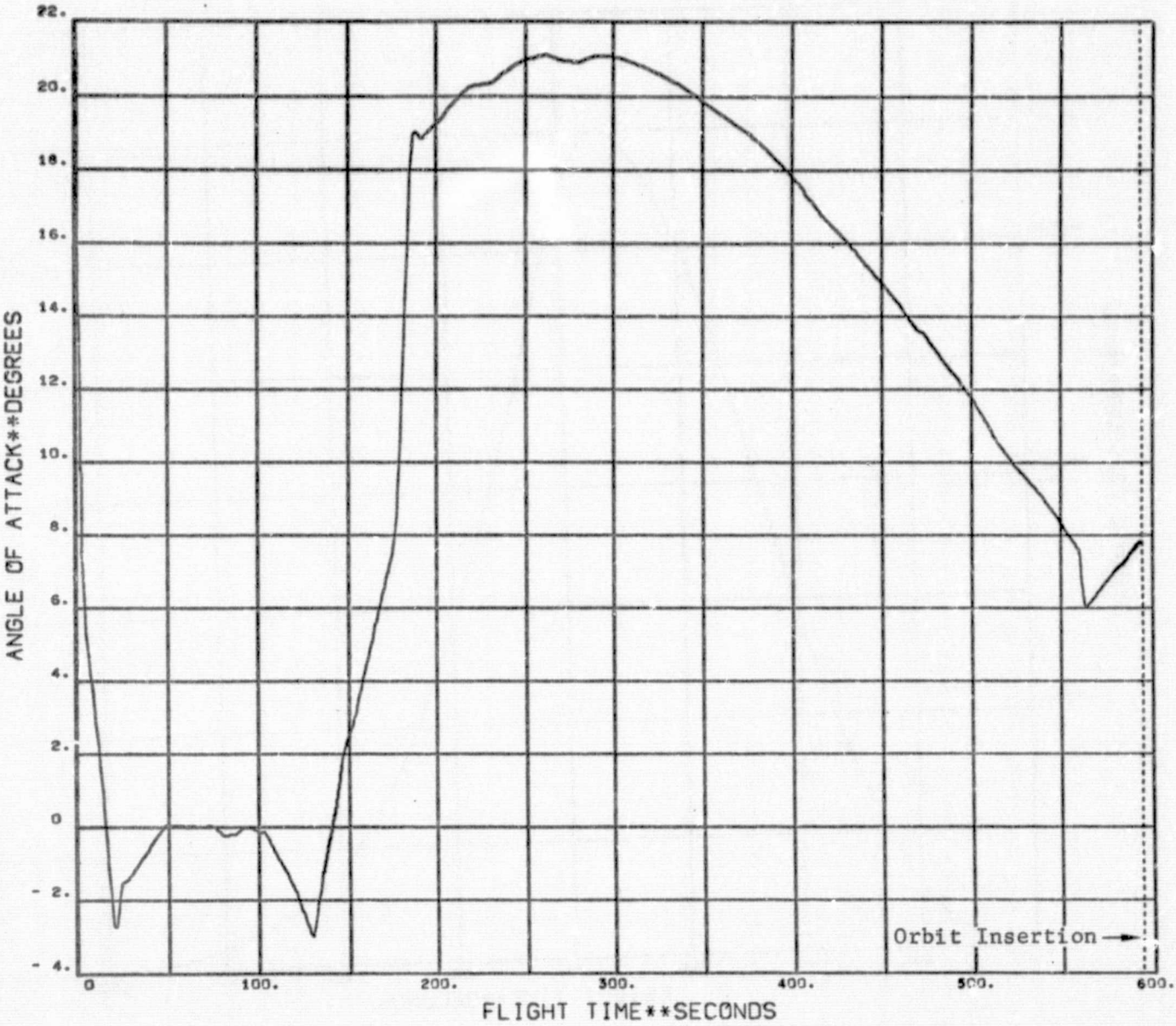


FIGURE 7E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
DYNAMIC PRESSURE HISTORY

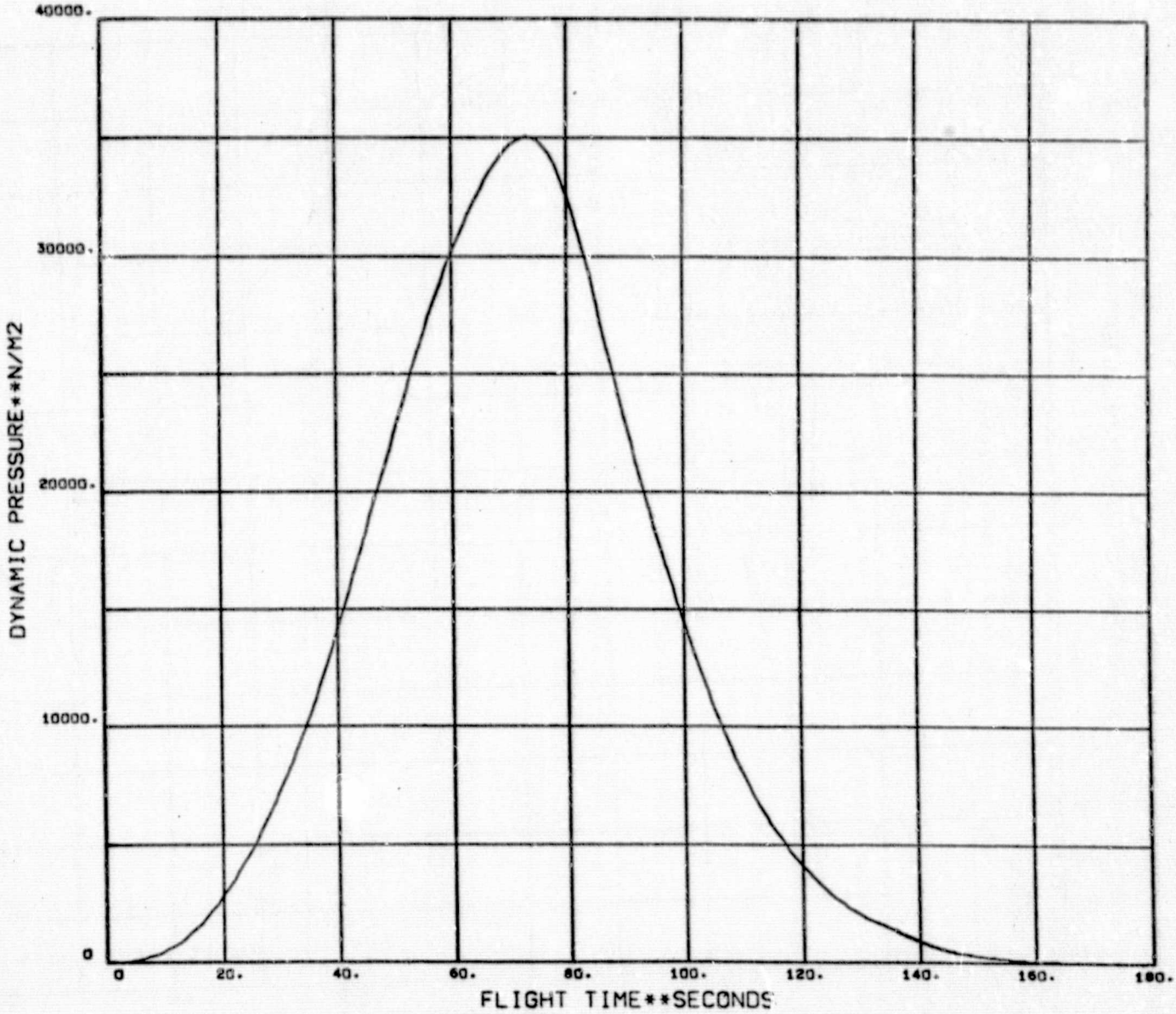


FIGURE 8E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
AERODYNAMIC LOAD INDICATOR HISTORY

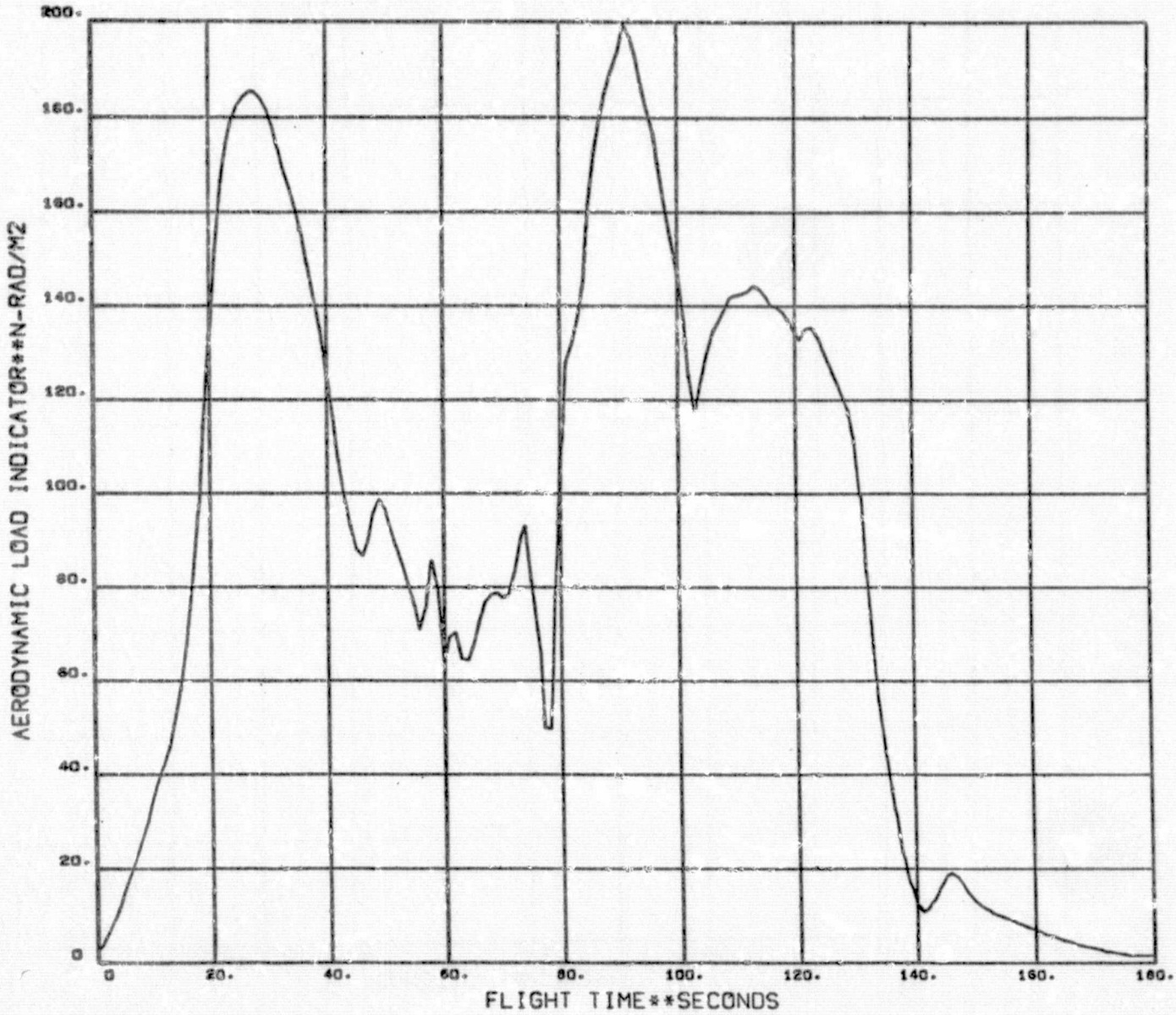
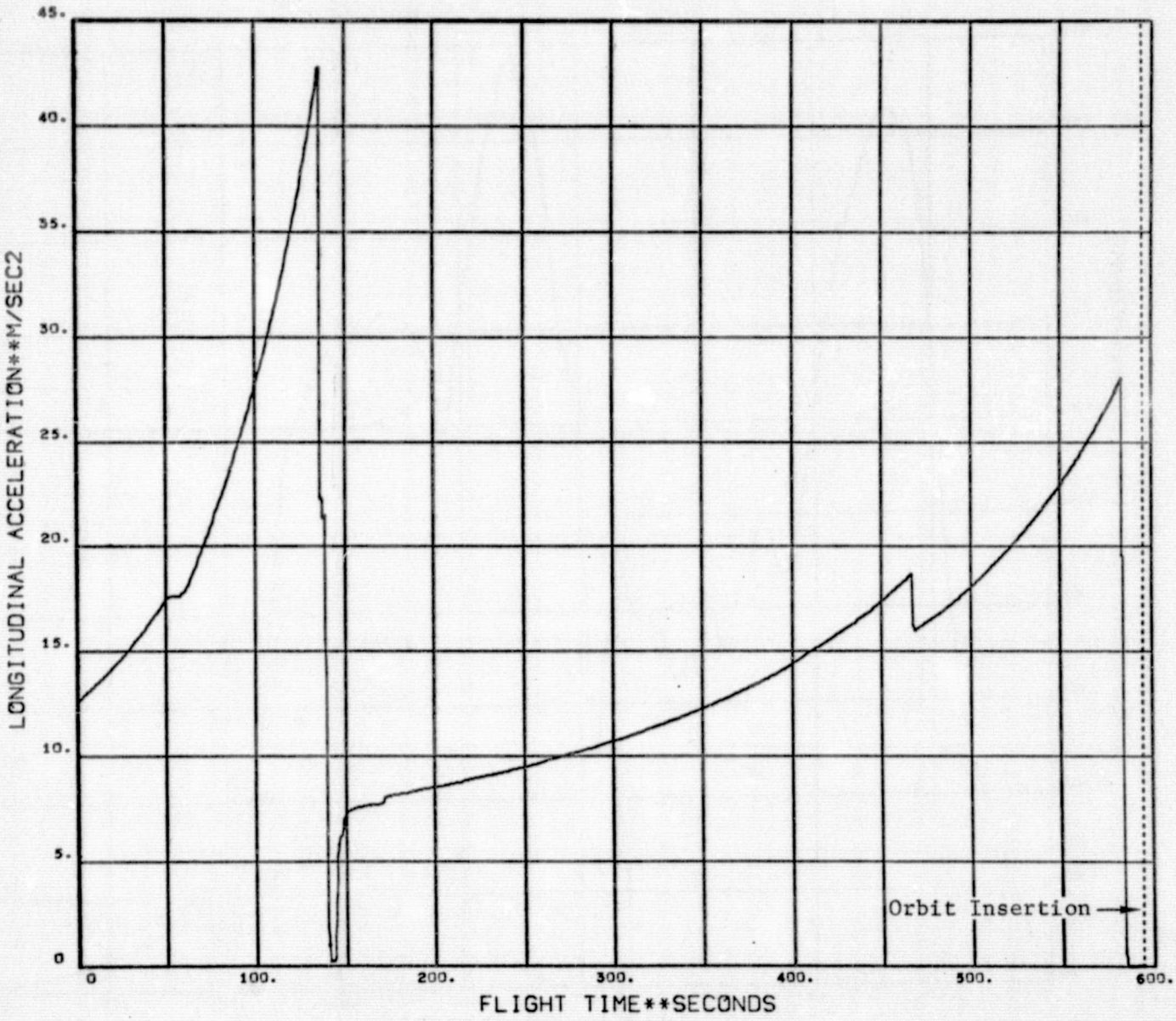


FIGURE 9E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
LONGITUDINAL ACCELERATION HISTORY



c. 4

FIGURE 10E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
INERTIAL PITCH ATTITUDE AND PITCH ATTITUDE COMMAND HISTORIES

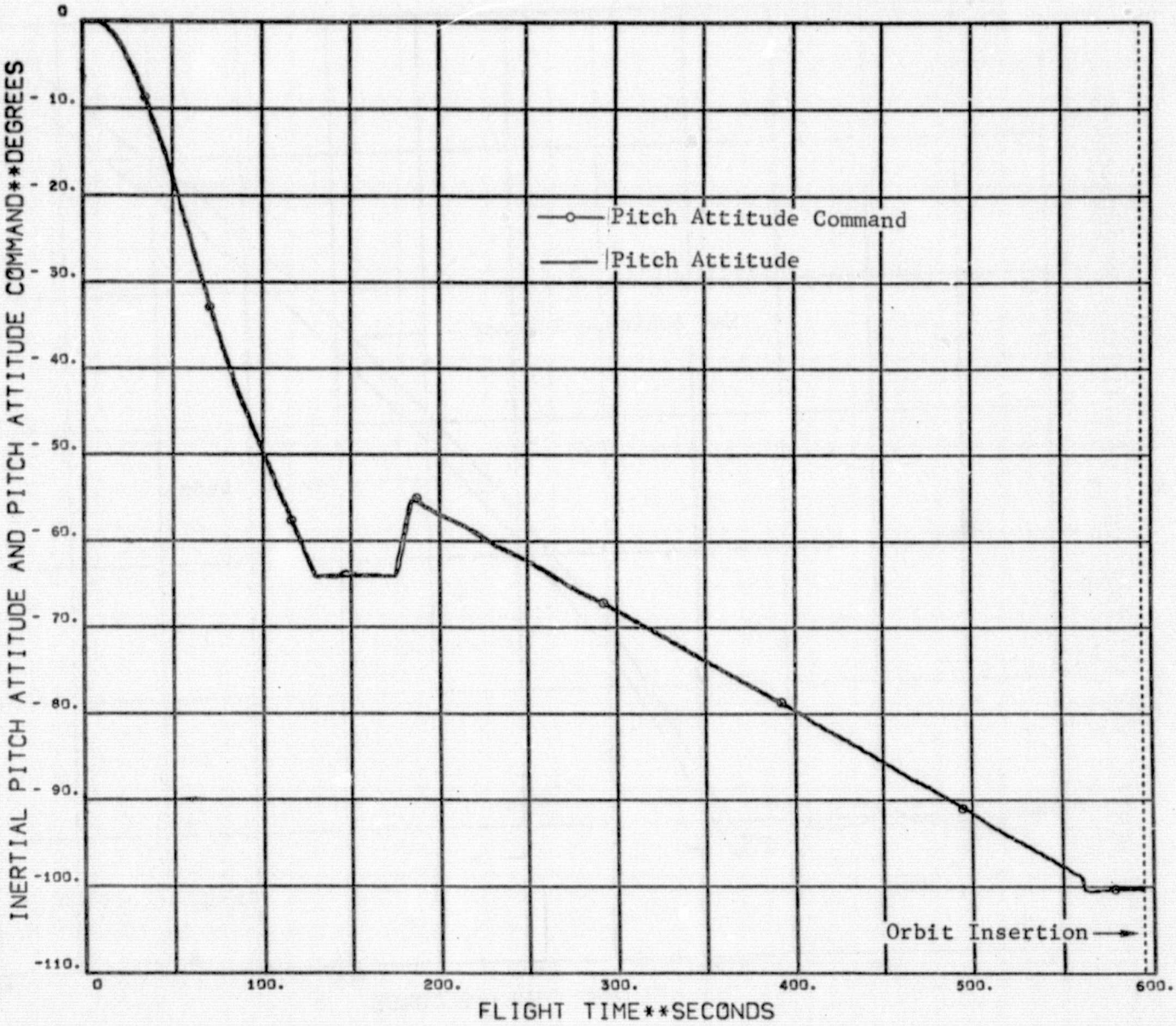


FIGURE 11E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
INERTIAL YAW ATTITUDE AND YAW ATTITUDE COMMAND HISTORIES

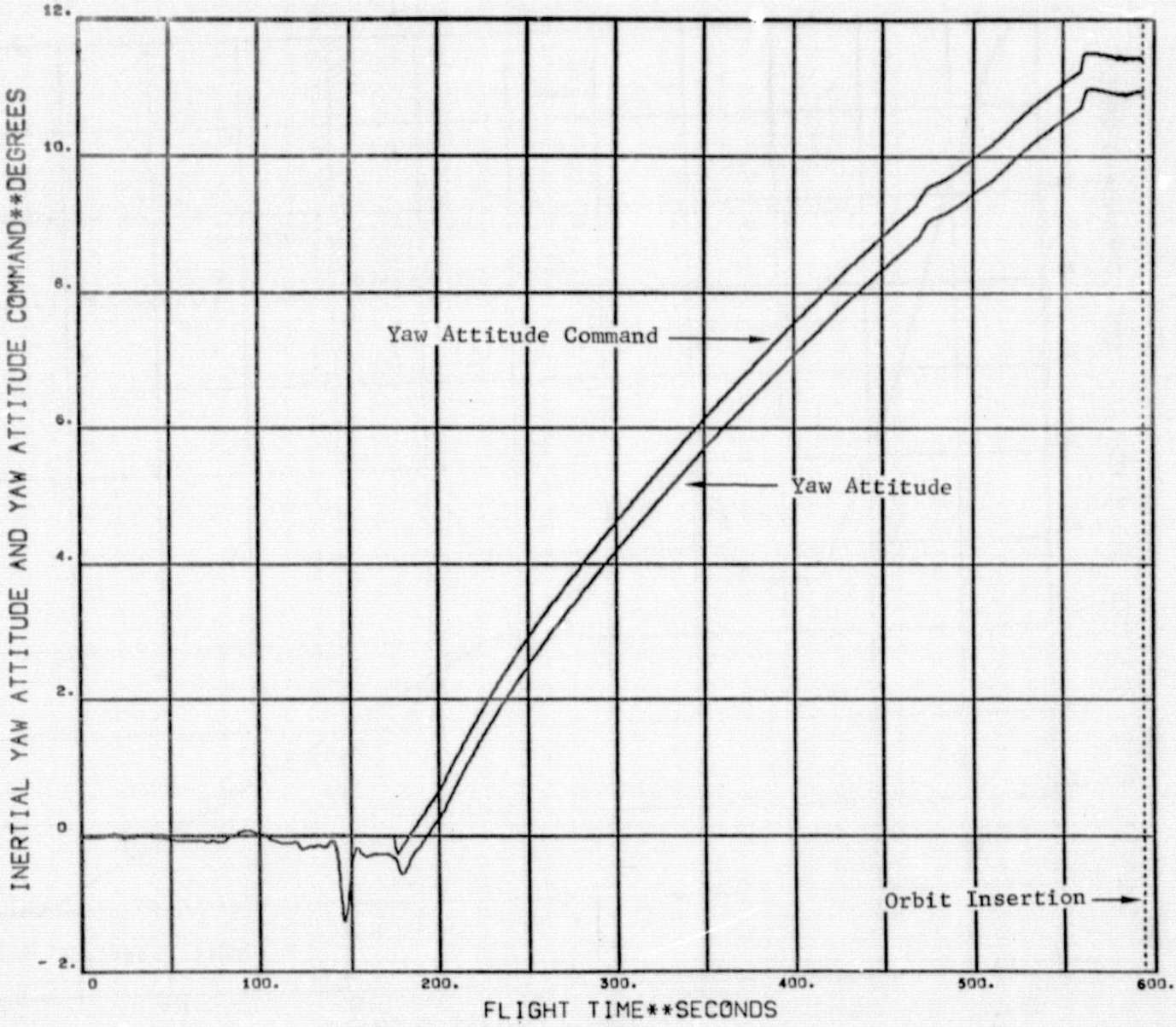


FIGURE 12E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
PITCH, YAW, AND ROLL BODY RATE HISTORIES

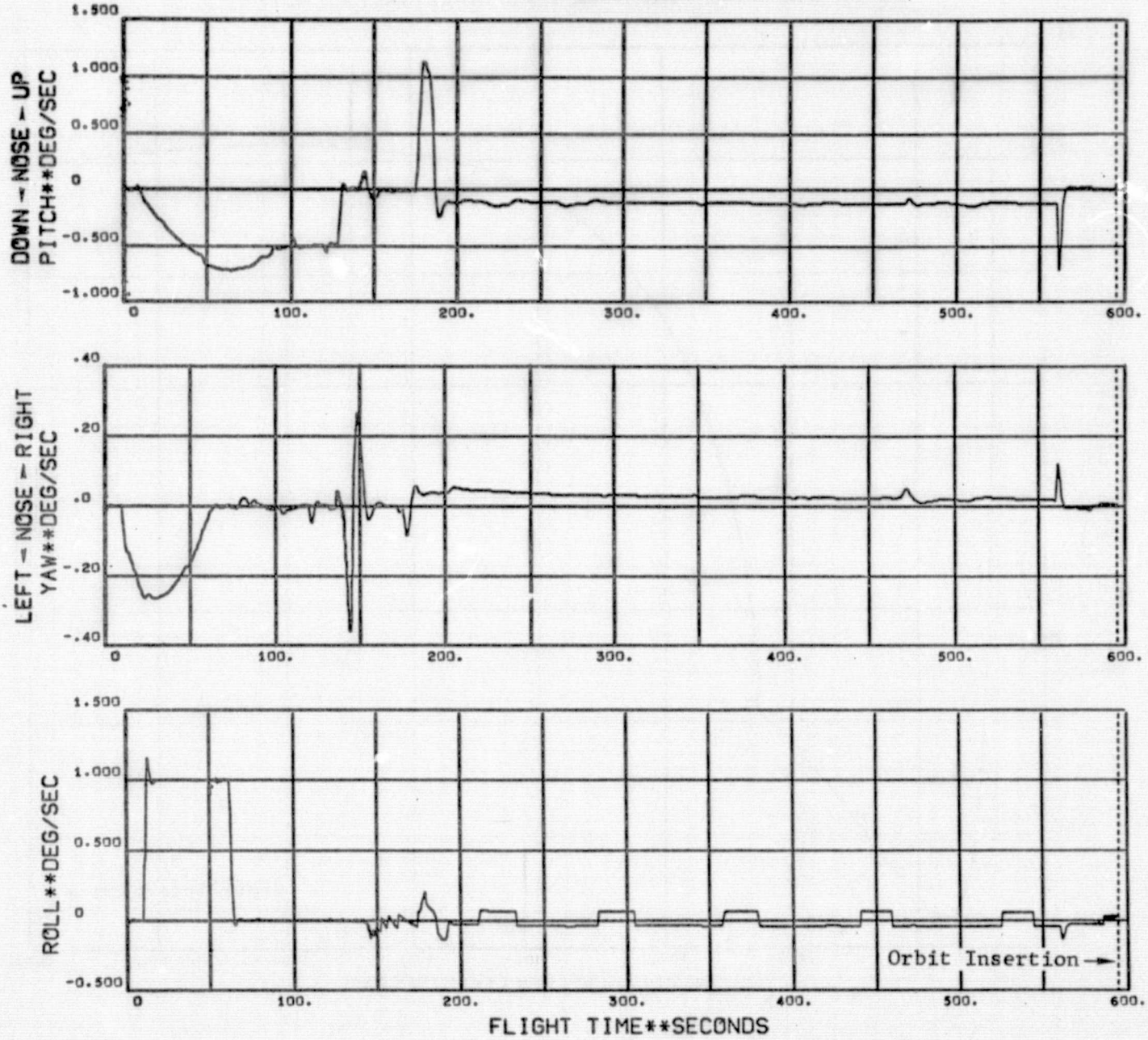


FIGURE 13E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
INERTIAL PATH ANGLE VS. INERTIAL VELOCITY

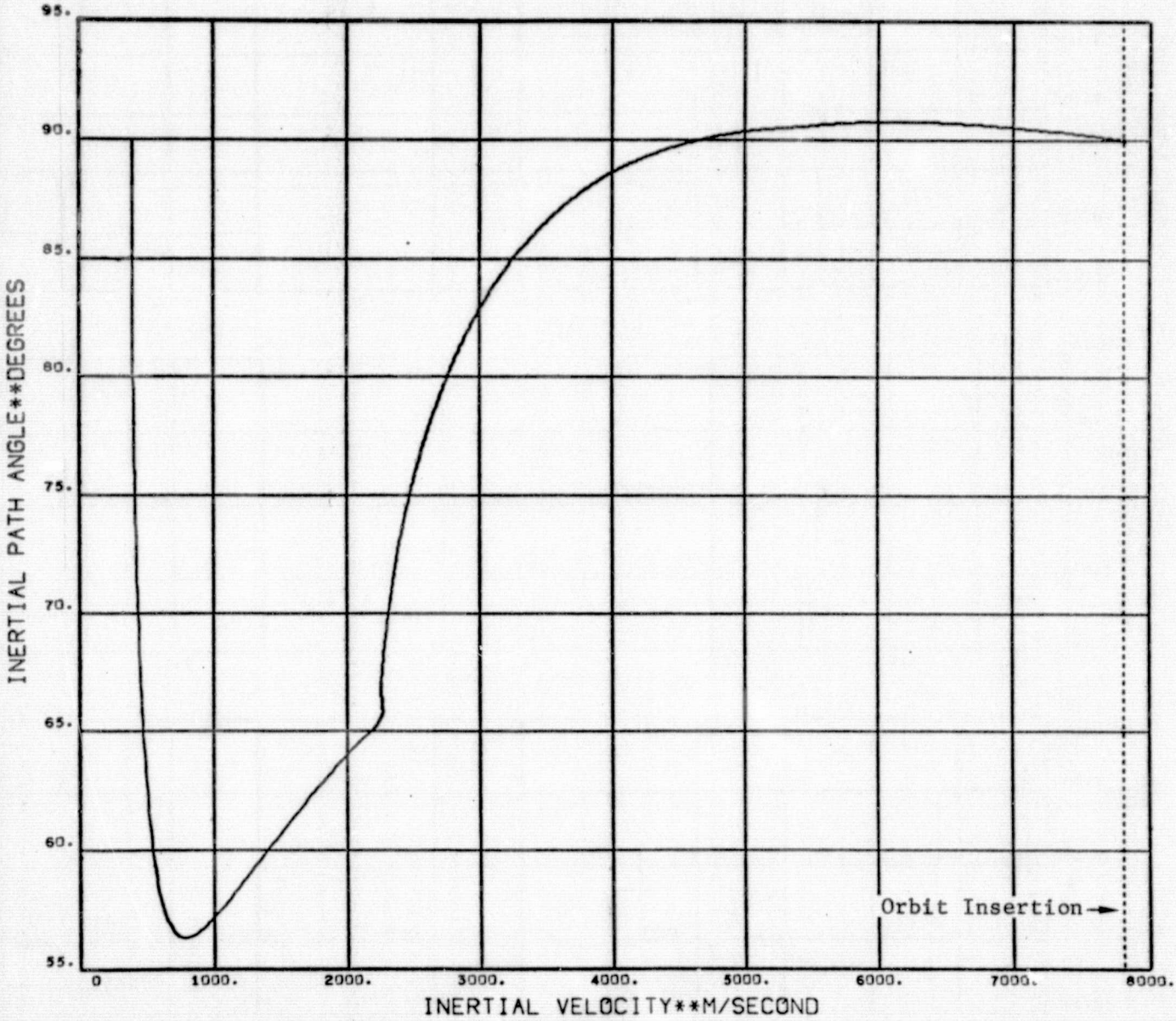
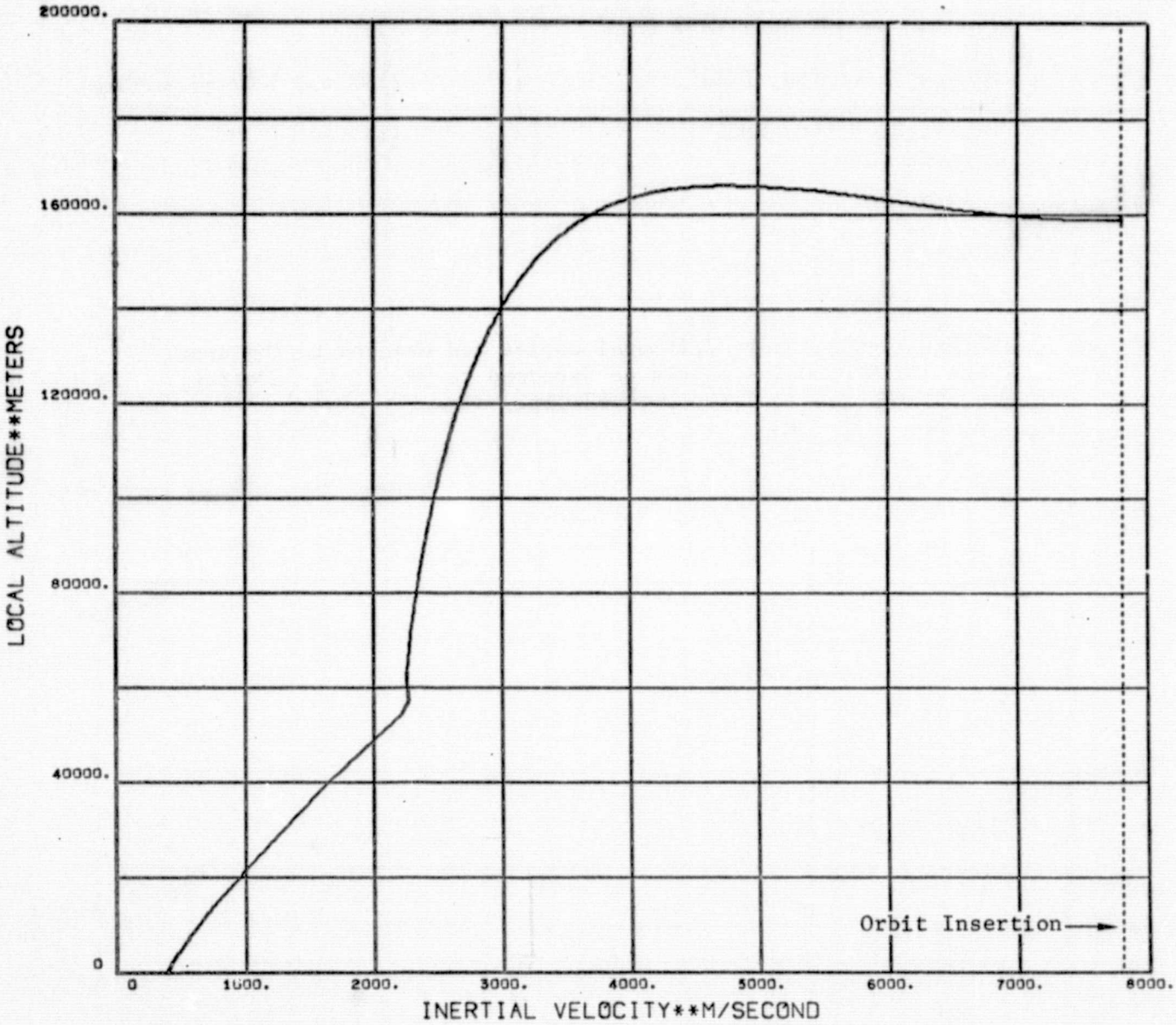



FIGURE 14E
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
LAUNCH WINDOW CLOSING
ALTITUDE VS. INERTIAL VELOCITY