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S-IVB-503N STAGE
FLIGHT TEST PLAN

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CORPORATION

S-IVB-503N STAGE
FLIGHT TEST PLAN

SM-47000A

DECEMBER 1968

PREPARED BY
SATURN S-IVB TEST PLANNING AND
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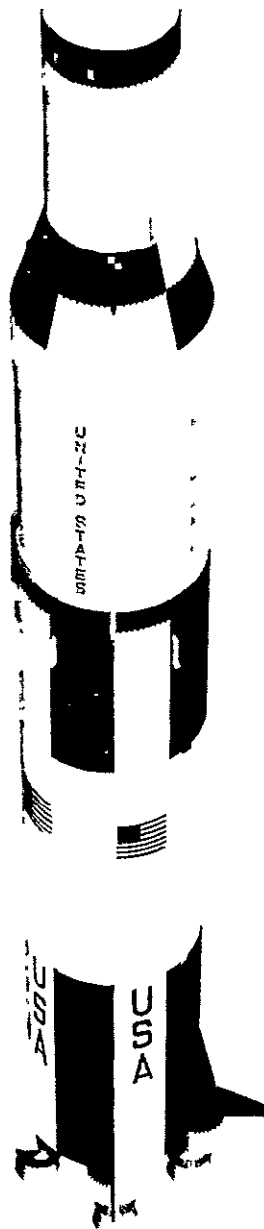SPACE ADMINISTRATION
UNDER NASA CONTRACT NAS7-101

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WESTERN DIVISION

Saturn V Space Vehicle

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S-IVB-503N STAGE FLIGHT TEST PLAN, SM-47000A

This revision supersedes the original issue of this document
dated 1 March 1968.

ABSTRACT

This report presents the flight test plan for the Saturn
S-IVB-503N stage which is the third stage of the AS-503
space vehicle. S-IVB stage performance and mission
objectives are defined and include criteria for their
evaluation. Included in this test plan are McDonnell
Douglas Astronautics Company-Western Division responsibilities
and support activities as required under NASA Contract
NAS7-101.

DESCRIPTORS

AS-503 Mission

SA-503 Launch Vehicle

S-IVB-503N Stage

Sequence of Events

S-IVB-503N Stage Configuration

S-IVB-503N Stage Predicted
Flight Performance

S-IVB-503N Stage Mass
Characteristics

J-2 Engine

PREFACE

The purpose of this report is to provide a flight test plan for the Saturn S-IVB-503N stage. In general, it provides information and direction to McDonnell Douglas Astronautics Company-Western Division personnel at Huntington Beach, California, Florida Test Center, and Marshall Space Flight Center.

Included in this report are detailed descriptions of the following: AS-503 vehicle mission and objectives, S-IVB-503N stage configuration and objectives, redlines and launch mission rules, sequence of events, and mass characteristics. The propulsion system performance predictions presented are in accordance with requirements noted in NASA/MSFC Contract Letter I-V-S-IVB-TD-66-45, dated 7 July 1966.

This report, prepared under National Aeronautics and Space Administration Contract NAS7-101, is issued in accordance with the contractual requirements of NAS7-101 Contract Data Requirements, Saturn S-IVB Stage and GSE, MSFC-DRL-021, Revision A, dated 1 February 1968. The report is reissued as SM-47000A for the AS-503 C Prime mission assignment as directed by MSFC Change Order 1979.

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INTRODUCTION

1. INTRODUCTION

This document delineates the requirements and responsibilities of the
McDonnell Douglas Astronautics Company-Western Division (MDAC-WD)
in support of the S-IVB-503N stage flight test. The flight test, as
defined in this test plan, will be limited to the S-IVB stage
contribution toward the accomplishment of the AS-503 flight mission and
S-IVB stage performance verification as the third stage of the SA-503
launch vehicle.

1.1 General

This document provides information and direction to personnel comprising
the Saturn S-IVB Test Planning and Evaluation Committees at MDAC-WD,
Huntington Beach, California, Florida Test Center (FTC), and the liaison
team at Marshall Space Flight Center, Huntsville, Alabama.

Detailed descriptions of the following are included:

    a. Launch vehicle objectives

    b. S-IVB stage objectives

    c. S-IVB stage configuration

    d. S-IVB stage redlines and launch mission rules

    e. S-IVB stage flight test management, communication and
       documentation.

1.2 Background

The S-IVB-503N stage was assembled at MDAC-WD, Huntington Beach where
production testing of components and systems was accomplished. The
stage was then transported to the Sacramento Test Center (STC), where
the acceptance firing was conducted. Preliminary tests consisted of
manual and automatic subsystem checkouts, integrated system tests and
a simulated acceptance firing. Following these preliminary tests, the
stage underwent an automatic acceptance firing; the engine was fired
until propellant depletion. Additional acceptance firings of the

O_2-H_2 burner were also conducted. Postfiring checkout included manual leak checks, functional tests, and an all systems test. The stage was then shipped to Kennedy Space Center (KSC), installed in the low bay of the vehicle assembly building and subjected to post transportation receiving inspections. After installation of the aft interstage, the stage was installed in the high bay. The S-IVB-503N stage was then mated to AS-503. Figure 1-1 presents a checkout and test history of the S-IVB-503N stage.

1966 1967 1968

	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	OCT	NOV	DEC

HUNTINGTON BEACH

INSTALLED IN CHECKOUT TOWER NO. 6 .. 22

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REMOVE FROM CHECKOUT TOWER NO. 6 20

SHIP TO STC   25

STC

ARRIVAL 25

INSTALLED IN BETA I 27

INSTALLATION, MODIFICATIONS

AND STORAGE . . 30 18 21 28

PREFIRE CHECKOUT .   . 23 ... 13

SIMULATED ACCEPTANCE FIRING . 19 ... 20

ACCEPTANCE FIRING .   . 3 4 SEC THEN 446 9 SEC

O2-H2 BURNER FIRING 8 225 SEC

POSTFIRE CHECKOUT IN BETA I . 9 ... 11

REMOVE FROM BETA I TO VCL . . 12

POSTFIRE CHECKOUT IN VCL 6 15

O2-H2 BURNER REVERIFICATION FIRING 12 ... 13 4 FIRINGS, TOTAL OF 3,005 SEC

ALL SYSTEMS TEST 15

POST-STORAGE CHECKOUT 25 28

POST-STORAGE ALL SYSTEMS TEST .. 22

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FTC

ARRIVAL 30

INSTALL IN VAB (LOW BAY) .   . 2

INSTALLATION AND MODIFICATIONS . 2

PRELAUNCH CHECKOUT (LOW BAY) . ..... 4 ... 2

INSTALLED IN HIGH BAY 3

TRANSFER TO LAUNCH COMPLEX 39A . . . OCT 9

FLIGHT READINESS TEST .. . . . NOV 19

COUNTDOWN DEMONSTRATION TEST.. . . .

LAUNCH .. . .

Figure 1-1. S-IVB-503N Stage Checkout and Test History

MISSION

2. MISSION

The AS-503 is the third Saturn V launch vehicle allocated for launch vehicle and spacecraft development and qualification. This section delineates the objectives of the vehicle as a whole. The AS-503 C prime (C') mission will be flown for the general purpose of maturing the launch vehicle and command service module (CSM) systems and operations to the maximum degree consistent with the state of space vehicle development and flight experience resulting from Apollo 7 (mission C). Mission C' will be characterized by a simulated lunar landing mission in which the CSM is injected into a translunar trajectory and will nominally brake into a lunar parking orbit. The S-IVB stage will perform the safing operations required for a "slingshot" trajectory; also, the mission will include the first flight test of the O_2-H_2 burner, which is the prime mode of S-IVB pressurization during the second burn.

Section 3 describes the objectives of the S-IVB-503N stage. Figure 2-1 presents the launch configuration of the SA-503 space vehicle.

2.1 Mission Objectives

McDonnell Douglas Astronautics Company-Western Division (MDAC-WD) considers MSFC Saturn V, Mission Implementation Plan, Mission C Prime, AS-503/Apollo 8 (reference 1, appendix 11) as the official document for providing necessary launch vehicle mission requirements.

The mission implementation plan gives the objectives as follows:

a. MSF Objectives

   Specific primary objectives have not yet been published by the Office of Manned Space Flight (OMSF). OMSF stated that: "The C Prime Mission is to have the general purpose of maturing the CSM and launch vehicle systems and operations to the maximum degree consistent with the state of space vehicle development and flight experience resulting from Apollo 7."

b. MSFC Detailed Test Objectives (DTO's) for the Mission C Prime

   All MSFC DTO's are in support of the general mission purpose stated in paragraph a. above.

Priority	Principle DTO's
1	Verify launch vehicle capability for free return, translunar injection (TLI).
2	Demonstrate S-IVB restart capability.
3	Verify J-2 engine modifications.
3	Confirm J-2 engine environment in S-II and S-IVB stages.
4	Confirm launch vehicle longitudinal oscillation environment during S-IC stage burn period.
4	Verify that modifications incorporated in the S-IC stage suppress low frequency longitudinal oscillations.
5	Demonstrate helium heater repressurization system operation.
6	Verify capability to inject S-IVB/IU/LTA-B into a lunar "slingshot" trajectory.
7	Demonstrate capability to safe S-IVB stage.
8	Verify the onboard command and communications system (CCS)/ground system interface and operation in the deep space environment.

Priorities are assigned to the mission objectives for use in realtime mission contingency planning. Priorities do not apply to a nominal flight.

2.2 Mission Constraints

The following paragraphs describe the mission, trajectory, and launch vehicle systems constraints imposed on AS-503 mission C' as stated in MSFC memorandum R-AERO-FMT-199-68, AS-503 C' Operational Trajectory Analysis - Option 1, December Launch Opportunity (Reference 2, appendix 11) and MSFC report 1-MO-31-68, Apollo 8 Mission C' Launch Vehicle Ground Support Plan (Reference 3, appendix 11).

2.2.1 Mission and Trajectory Constraints

a. The vehicle will be launched from pad A, complex 39, of the Kennedy Space Center.

b. The flight azimuth employed will lie between 72 deg and 108 deg, inclusive.

c. Launch will occur on a day within the December lunar landing mission launch window.

d. Launch will occur no earlier than 30 min before sunrise and no later than 30 min after sunset on any available launch day.

e. Continuous tracking and communication coverage is required for all phases of launch vehicle powered flight to parking orbit.

f. Tracking and telemetry coverage and continuous updata capability are required from liftoff until 3 min after S-IVB cutoff.

g. Tracking and telemetry coverage and updata capability are required during each revolution in parking orbit coast from at least two stations separated by approximately 180 deg.

h. Continuous telemetry record from the start of pre-ignition sequencing to 1 min after S-IVB cutoff is required.

i. Continuous tracking and telemetry coverage and updata capability are required for at least 7 min prior to the initiation of the separation maneuver (TB7 +15 min).

j. Continuous telemetry record and realtime flight control data and continuous updata capability are required from TB7 +20 min until TB7 +3 hr. Continuous tracking coverage is required from TB7 +20 min until the end of launch vehicle systems lifetime.

2.2.2 Launch Vehicle System Constraints

a. In earth orbit and post-TLI coast modes the crew has a manual attitude control capability. During the spacecraft control mode, the Saturn guidance system will function in a "follow-up" mode; when control is returned to the IU, the attitude orientation will either be maintained relative to the local horizontal, or maintained inertially, depending upon the mode called for by the nominal timeline at the time control is returned to the IU.

b. Guidance command angle rate shall not exceed 1 deg/sec in pitch and yaw (first stage tilt program and upper stage guidance program).

c. Maximum command in the yaw plane shall not exceed 45 deg.

d. Vehicle attitude rate limits during orbital coast are 0.3 deg/sec in pitch and yaw and 0.5 deg/sec in roll, except during the time interval from TB7 +900 sec until TB7 +1,200 sec, when the rates are increased to 1 deg/sec in pitch, yaw and roll.

e. The S-IC center engine cutoff time shall occur prior to attaining a 4 g acceleration.

2.2.3 Launch Window and Dual Restart Opportunities

The launch window for the AS-503 mission is defined for launch days from December 20 through December 27, 1968. The earth's rotation and the movement of the moon in its orbit make it necessary to vary flight azimuth with time each day in order to align the earth parking orbit in the desired orientation with respect to the moon. Due to considerations involving range safety, launch vehicle performance, and telemetry coverage the flight azimuth employed for boost to parking orbit is

constrained to values between 72 deg and 108 deg, inclusive. On each
day for which a window is available, the window will open at such a
time as the earth-moon geometry is suitable for employing a 72 deg
flight azimuth. The window will close on each day at such a time as
earth-moon geometry requires employing a flight azimuth greater than
108 deg.

Launch during the December 20, 1968, window has been recently prohibited.
This decision followed the considerations listed below:

a. For a powered return trajectory there is insufficient lighting
   in the spacecraft recovery area if launch occurs on December 20.

b. The locus of free-return impact locations lies primarily over
   the African continent for a December 20 launch. This would
   require usage of an undesirably large quantity of Reaction
   Control System (RCS) propellant to shift the impact location
   and ensure a water landing.

This section will present data applicable to the December 20 launch
window, although this date has been removed from consideration.

Figure 2-2 shows the span for which a launch window is available on each
day from December 20 through December 27, 1968. Due to the desirability
of a daylight launch, an additional constraint has been imposed to pre-
clude launching prior to 30 min before sunrise or after 30 min after
sunset. This constraint shortens the available window on December 20,
25, 26, and 27.

Figure 2-3 shows the variation of flight azimuth with time from the
opening of the launch window for each day. The daylight launch constraint
limits the range of available azimuths, as shown.

The S-IVB stage will restart for boost into translunar orbit at a point
in the earth parking orbit which satisfies the necessary vehicle-moon
geometry. There is one satisfactory point in each revolution in parking
orbit; however, due to the length of time required for orbital check-out

of vehicle subsystems and due to engine limitations, restart during the
first parking orbit revolution is prohibited. The launch vehicle digital
computer (LVDC) calculates the time of restart during the second revolu-
tion (first opportunity) unless an inhibit has been initiated by the
flight crew, in which case restart will be initiated on the third revolu-
tion (second opportunity).

2.2.4 S-IC Stage Flight Phase

This phase of the launch vehicle trajectory is initiated at guidance
reference release (GRR), which occurs at 17.25 sec before first motion.
The time of umbilical disconnect and the corresponding establishment
of time base one (TB1) is assumed to be 0.4 sec after first motion.

The AS-503 vehicle will be launched from Kennedy Space Center (KSC)
Complex 39A from a launch azimuth of 90 deg. During the first 10 sec
of ascent, a small yaw maneuver is commanded to ensure tower clearance
under low-probability wind conditions. After tower clearance, à tilt
and roll maneuver is initiated to achieve the flight attitude and
proper orientation for the desired flight azimuth. From the end of
tilt maneuver until 147 sec from first motion, the vehicle flies a
gravity-turn pitch profile to provide a near zero-lift trajectory.
At 76.0 sec after first motion, the vehicle encounters the maximum
dynamic pressure of about 740 lbf/ft^2. Trajectory conditions at maximum
dynamic pressure are shown in table 2-1. At TB1 +125.2 sec center
engine cutoff occurs, establishing time base 2 (TB2). Approximately
21 sec later S-IC tilt arrest is initiated, and attitude commands are
frozen for about 45 sec, until S-II stage guidance is activated. S-IC
outboard engine cutoff (OECO) occurs at TB1 +150.6 sec, establishing
time base 3 (TB3).

S-IC/S-II separation is commanded 0.7 sec after TB3 is established.
Trajectory conditions at S-IC/S-II separation are shown in table 2-2
for a 72 deg flight azimuth. Retrorockets force the S-IC stage away
from the flight vehicle, and ullage rockets are fired to settle the
S-II stage propellant. The expended S-IC stage will impact 373 nmi
downrange from KSC.

2.2.5 S-II Stage Flight Phase

The S-IC/S-II forward interstage is jettisoned at TB3 +30.5 sec; the launch escape tower is jettisoned by crew command approximately 5.7 sec later.

At 41 sec after TB3 the iterative guidance mode (IGM) is initiated to steer the flight vehicle on a near-optimum trajectory toward the desired orbit. Guidance initiation occurs nominally at 192.0 sec from first motion. At about 282 sec after TB3 a propellant utilization (PU) valve cutback is commanded, decreasing the engine mixture ratio from 5.5 to 4.5. At approximately 11 sec before S-II cutoff the IGM steering is arrested until 6.5 sec after S-II Engine Cutoff Command (ECC). The S-II stage engine cutoff, establishing time base 4 (TB4), is actuated by propellant depletion in either tank, nominally occurring at 520.1 sec after first motion. The expended S-II stage will impact 2,333 nmi downrange of KSC.

2.2.6 S-IVB Stage Flight Phase (First Burn)

During the period from S-II cutoff until attainment of the S-IVB 90 percent thrust level, S-II/S-IVB separation occurs, retrorockets force the S-II stage away from the space vehicle, and ullage rockets are fired to settle the S-IVB stage propellants. The S-IVB stage J-2 engine thrust buildup is characterized by a 3 sec fuel lead initiated at Engine Start Command (ESC), nominally 521.1 sec after first motion.

The vehicle is guided by the IGM into a 185.2 km (100 nmi) altitude (referenced to the Fischer earth model equatorial radius) circular parking orbit. Chi tilde is initiated approximately 35 sec prior to S-IVB cutoff, and the attitude commands are frozen at approximately 8 sec prior to S-IVB cutoff. Time base 5 (TB5) is established by S-IVB cutoff at a nominal time of 678.3 to 681.7 sec from first motion, dependent on the flight azimuth employed.

Figure 2-4 presents pictorially the AS-503 mission profile. Figure 2-5 shows plots of the ground trace for boost to parking orbit at flight

azimuths of 72 deg and 108 deg. Profiles of altitude, ground range, earth-fixed and inertial velocity, earth-fixed and inertial elevation and azimuth flight path angles, earth-fixed cross range position, axial acceleration, pitch and yaw angles of attack, and S-IVB stage attitude commands are presented in figure 2-6 for a "typical" boost to parking orbit trajectory (December 21, 72 deg azimuth).

2.2.7 Earth Parking Orbit Phase

The S-IVB stage first burn will insert the flight vehicle into a nearly circular parking orbit with a mean altitude of 100 nmi, referenced to the Fischer earth model equatorial radius. The descending node and inclination of the parking orbit plane are functions of the launch azimuth employed, in order that proper orientation with respect to the moon may be achieved. Values of inclination and longitude of the descending node across the launch window are presented in figure 2-7.

Following S-IVB stage cutoff, inertial attitude commands are frozen for 20 sec, after which the vehicle longitudinal axis is maneuvered to a position within the orbit plane and parallel to the local horizontal (position I down). This attitude is maintained for the duration of parking orbit coast, unless overriden by manual attitude commands. Manual attitude control capability is available during earth parking orbit. The attitude which is present at the time of the return of control from the flight crew to the LVDC will be maintained with respect to the local horizontal, or maintained inertially, depending upon the mode called for by the nominal timeline at the time control is returned to the LVDC.

Vehicle subsystems checkout is performed from ground stations during parking orbit coast. The vehicle will remain in earth parking orbit for approximately 1-1/2 revolutions, if the first restart opportunity is employed. If the second restart opportunity is desired, the flight crew will initiate a restart inhibit prior to first opportunity, and another revolution in parking orbit will occur prior to restart. The parking orbit is continually perturbed by a low level LH2 venting thrust

and further perturbed by burns of the ullage engine which occur during the initial and final seconds of the parking orbit and by a burn of the O_2-H_2 burner near the end of the final revolution. As a result of these perturbations, perigee altitude and apogee altitude at restart are increased by, respectively, 5.9 and 13.7 nmi over the respective values at parking orbit insertion for first opportunity restart and, respectively, 7.8 and 15.6 nmi for second opportunity.

The ground trace for parking orbit coast is presented in figure 2-5 for flight azimuths of 72 deg and 108 deg. Figure 2-8 presents profiles of altitude, inertial velocity, and propulsive forces acting during parking orbit coast for a "typical" trajectory (December 21, 72 deg).

2.2.8 S-IVB Stage Flight (Second Burn)

The S-IVB second burn sequence is initiated by the guidance computer upon satisfaction of trajectory geometry when the vehicle is over the Pacific Ocean in the second or third parking orbit revolution. Time base 6 (TB6) is established upon initiation of the restart sequence. The flight time corresponding to TB6 varies with time and day of launch and with the restart opportunity selected. Figure 2-9 summarizes the predicted TB6 times across the launch window for each day and opportunity.

S-IVB stage second Engine Start Command (ESC2) is issued at TB6 plus 570 sec, initiating an 8 sec lead. Following fuel lead, S-IVB restart occurs at an engine propellant mixture ratio (EMR) of 4.5:1.0. The propellant utilization valve is commanded to the null position at ESC2 +13 sec, providing an EMR of 5.0:1.0 for the duration of second S-IVB burn.

The flight vehicle attitude is maintained in the orbit plane and parallel to the local horizontal throughout parking orbit coast until second burn IGM initiation, which occurs at ESC2 +13 sec. From this time the IGM steers the vehicle along a near-optimum flight profile into a translunar conic. Since the position of the moon relative to the parking orbit plane changes between first and second opportunity, a plane change

must be achieved during S-IVB second burn for at least one opportunity.
To minimize the maximum required plane change, lunar vehicle targeting
is incorporated such as to "split" the maximum plane change between first
and second opportunities. Therefore, a plane change requiring a signi-
ficant yaw maneuver will be made during second S-IVB burn for either
opportunity. The magnitude of this plane change is "split" between
opportunities in such a manner as to equalize the translunar insertion
weight for each opportunity. Chi tilde is initiated approximately 30 sec
before S-IVB cutoff, and the inertial attitude commands are frozen at
approximately 3 sec prior to cutoff. Nominal cutoff conditions vary
with time and day of launch and with the restart opportunity employed.

Figure 2-10 presents plots of the ground trace during restart preparations,
S-IVB stage second burn, and coast in translunar orbit until time of
initiation of the S-IVB LOX dump for flight azimuths of 72 deg and 108 deg
and varying launch days and opportunities. "Typical" trajectory
(December 21, 72 deg azimuth) profiles of altitude, inertial velocity,
inertial elevation and azimuth flight path angles, axial acceleration,
pitch and yaw angles of attack, and S-IVB attitude commands for S-IVB
stage second burn are presented in figure 2-11.

2.2.9 Coast in Translunar Orbit

Immediately following S-IVB second cutoff, establishing time base 7 (TB7),
venting of both LOX and LH2 tanks is programmed to guarantee no tank
relief venting during the time in which launch vehicle spacecraft (LV/SC)
separation is to occur. This vent sequence following second cutoff is
incorporated as follows:

(1) a 150 sec non-propulsive vent (NPV) of the LOX tank;

(2) a 900 sec LH2 tank NPV;

(3) a 900 sec continuous vent of the LH2 tank.

For 20 sec after TB7 the inertial attitude commands are frozen at their
cutoff values. At TB7 plus 20 sec a maneuver is initiated to align the
vehicle centerline along the local horizontal to assure good T/M

digital strength prior to spacecraft separation. This attitude is maintained until TB7 plus 900 sec, at which time the maneuver to the desired separation attitude is initiated. Once achieved, the separation attitude is frozen inertially for about 3,340 sec.

The LV/SC separation sequence is initiated by crew command after completion of the maneuver to separation attitude at TB7 plus 1,200 sec. At TB7 plus 3,600 sec a 900-sec LH2 tank NPV is commanded to ensure no relief venting prior to the start of the propellant dump sequence.

At TB7 plus 6,540 sec a maneuver is initiated to align the S-IVB/IU in a retrograde, near local horizontal attitude for the ensuing propellant dump. The propellant dump sequence is initiated at TB7 plus 7,200 sec with the opening of the LH2 tank continuous vent valves. A 300 sec LOX dump through the J-2 engine is initiated at TB7 +7,920 sec. At TB7 +8,223 sec an NPV of both LOX and LH2 tanks is initiated. Both the continuous vent valves and the NPV valves remain open for the remainder of S-IVB flight. At TB7 +9,000 sec the auxiliary propulsion system (APS) ullage engines are ignited and will continue to burn until depletion of APS propellants.

The change in S-IVB stage velocity (ΔV) due to the impulse imparted by the LOX dump and the APS ullage burn will significantly perturb the S-IVB stage translunar trajectory. Since the impulse is imparted in a retrograde direction along the local horizontal, the resulting trajectory will be characterized by a lower orbital energy. The small decrease in orbital energy corresponding to the available range of retrograde ΔV velocity impulses will cause an appreciable increase in the earth-moon transit time, thus causing the S-IVB to pass into the vicinity of the moon's orbit somewhat later than it would have had it been allowed to continue unperturbed. Without a velocity decrease the stage would pass slightly in front of the moon on a trajectory similar to that traveled by the CSM. Slowed down by the LOX dump and APS ullaging, however, the stage arrives at a moon that is ahead of where it would have been had the dump not taken place. Depending quite

closely upon the magnitude of the incremental ΔV, one of three things
will then occur. First, if the ΔV is relatively small the stage will
impact the lunar surface. Alternatively, if the ΔV is slightly greater
than that for lunar impact, the transit time of the stage will increase
sufficiently that it will pass behind the moon's trailing edge, although
still within several thousand kilometers of the surface. The nearness
of passage will allow the moon, acting through its gravitational field,
to accelerate or "slingshot" the stage--in effect, "dragging" the S-IVB
along. By imparting a portion of its kinetic energy, the moon induces
a resultant acceleration which causes, in turn, an increase in velocity
sufficient for the stage to escape into solar orbit.

Finally, if the retrograde ΔV is relatively large (greater than that
needed for slingshot) the stage will be slowed to the extent that it
will arrive in the vicinity of the lunar orbit long after the moon has
already passed. The effect, then, of the lunar gravity will be negligible
in that any energy gained will still be insufficient to enable the stage
to reach escape velocity. The net result will be a highly eccentric,
geocentric orbit resulting in earth return.

At the time of this writing there is not available accurate data
differentiating between the ΔV increments required for lunar impact,
earth return, and nonearth return. As a result, it is difficult to
arrive at firm conclusions regarding the post-dump behavior of the S-IVB
stage. The information presented in figures 2-12a and 2-12b is valid
in any case since LOX dump and APS ullage ΔV's vary principally as
functions of launch date and launch azimuth. When the ΔV boundaries
between the various regions of post-dump trajectories have been more
precisely defined, they may be used with figures 12a and 12b to obtain
valid conclusions as to the final behavior of the stage.

Table 2-3 presents the orbital attitude timeline for the AS-503 mission.
A schematic of the vehicle attitude timeline is shown in figure 2-13.
Figure 2-12a presents the predicted S-IVB velocity change during LOX

dump as a function of flight azimuth for first and second opportunities. Figure 2-12b shows for each date of launch the range of total S-IVB velocity change for flight azimuths of 72 deg and 90 deg.

Appendix 3 presents the predicted launch vehicle trajectory for a December 21, 1968, launch at a flight azimuth of 72 deg.

2.2.10 Trajectory Variations with Time of Launch

Due to the changing earth-moon geometry over the launch window, the trajectory profile will vary for each time of launch on each day, as well as between first and second restart opportunity. These variations are accounted for in determining predicted trajectory parameters in figures 2-7, 2-9 and 2-14 through 2-18. These figures present the variation in selected trajectory parameters and vehicle weight across the launch window at the following significant events during the AS-503 mission.

Figure	Event
2-7	Parking Orbit Insertion
2-9	Time Base 6 Initiation
2-14	S-II/S-IVB Physical Separation
2-15	S-IVB Restart
2-16	Translunar Orbit Insertion
2-17	LV/SC Separation
2-18	Initiation of LOX Dump Sequence

2.2.11 Vehicle Performance Summary

The performance requirement of the S-IVB-503N stage will vary considerably across the range of launch dates, times, and restart opportunities. This effect may be quantitized by investigating the expected variation in residual propellant weight at second S-IVB cutoff, since the total propellant load is the same for each day in the launch window. Factors causing these variations in cutoff residuals may be grouped into two general categories:

a. Nominal change in earth-moon geometry conditions across the
    launch window, and

b. Launch-vehicle system performance deviations.

The change in earth-moon geometry conditions across the launch window
requires a different trajectory profile with a different propellant
consumption for each day, time, and restart opportunity. The total
change in earth-moon geometry causes the following individual effects:

a. Launch azimuth variation

b. Split injection opportunity (for two TLI opportunities, the
    launch time is chosen such that when making the required plane
    change, the TLI weight is approximately equal for either
    opportunity)

c. Variations in the moon's distance and velocity with respect
    to the earth which result in changes in energy at TLI and
    corresponding changes in cutoff residuals

d. Oblate earth effects (varying parking orbit inclination varies
    the gravity potential to which the vehicle is subjected)

The variation in usable residual propellants at second S-IVB cutoff
caused by the flight geometry variations is presented below. Nominal
available residual propellant for a December 21, 72 deg trajectory,
is also shown as a baseline:

	Available Residual Propellant (lb)	Uncertainty Band (lb)
First Opportunity	8,792	+1,100, -210
Second Opportunity	8,802	+1,170, -190

Table 2-5 presents a breakdown of S-IVB stage weights at significant
events during the AS-503 mission for a "typical" trajectory (December 21,

72 deg azimuth). Figure 2-16 shows the nominal deviations in total S-IVB burntime and in usable LOX and LH2 residuals at TLI which occur across the launch window.

The second category of factors causing variations in residual propellant weight at second S-IVB cutoff is deviations from launch vehicle system performance predictions. To ensure an acceptable probability of mission success, extra propellants are carried to provide the S-IVB with a sufficient performance capability to compensate for these system deviations. This required propellant reserve is designated as Flight Performance Reserve (FPR). For the AS-503 mission, the S-IVB-503N FPR has been determined as follows:

	First Opportunity	Second Opportunity
LOX	1,910 lb	1,957 lb
LH2	913 lb	944 lb

In summary, the total variation in usable residual propellants at second S-IVB cutoff, considering both flight geometry variations and vehicle performance deviations, is shown below:

	LOX	LH2
First Opportunity		
Maximum Residuals	9,125 lb	3,488 lb
Minimum Residuals	4,585 lb	1,175 lb
Second Opportunity		
Maximum Residuals	9,910 lb	3,350 lb
Minimum Residuals	5,300 lb	427 lb

TABLE 2-1
TRAJECTORY CONDITIONS AT MAXIMUM DYNAMIC PRESSURE

ITEM	UNITS	VALUE
Time, t	Sec.	76.0
Altitude, h	Ft	42,249.7
Range, S	Ft	18,912.0
Earth-Fixed Velocity, V_e	Ft/Sec	1,675.90
Earth-Fixed Velocity Elevation Angle, γ_1	Deg	53.1997
Axial Acceleration, a_{x_m}	Ft/Sec^2	21.78
Pitch Angle of Attack, α	Deg	0.3548
Yaw Angle of Attack, β	Deg	0.0573
Dynamic Pressure, q	Lb/Ft^2	738.8
Mach No., M	None	1.666

NOTE: Data is presented for 72 deg launch azimuth. Variation with launch azimuth in these parameters is negligible.

TABLE 2-2
TRAJECTORY CONDITIONS AT S-I/S-II STAGE SEPARATION

ITEM	UNITS	VALUE
Time, t	Sec	151.81
Altitude, h	Ft	221,697.0
Range, S	Ft	288,124.0
Inertial Velocity, V_I	Ft/Sec	8,897.51
Inertial Velocity Elevation Angle, $\gamma_{1I}{}^1$	Deg	21.7047
Inertial Velocity Azimuth Angle, $\gamma_{2I}{}^1$	Deg	75.3032
Pitch Angle of Attack, α	Deg	0.1729
Yaw Angle of Attack, β	Deg	0.0182
Dynamic Pressure, q	Lb/Ft^2	7.16
Mach No., M	None	7.826

NOTE: Data is presented for 72 deg flight azimuth. Variation with flight azimuth is negligible except for azimuth angle, $\gamma_{2I}{}'$.

TABLE 2-3
ATTITUDE TIMELINE FOR C' MISSION

	MANEUVER	SEC
1.	Maintain commanded cutoff inertial attitude.	TB5 +0
2.	Initiate maneuver to align the S-IVB/SC +x axis along the local horizontal (CSM forward, position 1 down) and maintain orbital rate.	TB5 +20
3.	Maintain commanded cutoff inertial attitude.	TB7 +0
4.	Initiate maneuver to align the S-IVB/SC +x axis along the local horizontal (SC forward, position 1 down). Maintain with respect to local reference.	TB7 +20
5*.	Initiate maneuver to CSM separation and S-IVB communications attitude. The attitude is defined in the local reference system which is frozen inertially at TB7 +900 seconds. When the desired SC separation attitude is attained, the vehicle attitude will be frozen inertially. The maneuver must be computer by TB7 +1200 seconds. See table 2-4 for spacecraft separation attitude requirements.	TB7 +900
6*.	Initiate maneuver to S-IVB communications and sling shot attitude. Attitude is defined by the following gimbal angles: X_P = 180 deg, X_Y = 0 deg, X_R = 0 deg (position 1 down). Maintain with respect to local reference.	TB7 +6540
7.	Begin LOX dump sequence. The LH2 CVS will be opened at TB7 +7200 sec. The LOX dump will start at TB7 +7920 sec and will be terminated at TB7 +8220 sec. (See table II).	TB7 +7200

*The maneuver must have inhibit capability.

TABLE 2-4
SPACECRAFT SEPARATION ATTITUDES

LAUNCH DATE	PITCH DEG	YAW DEG	ROLL DEG
DEC 20	+110	0	180
21	+120	0	180
22	+120	0	180
23	+120	0	180
24	+120	0	180
25	+120	−20	180
26	+120	−20	180
27	+120	−20	180

NOTES: (1) +Pitch is up: +Yaw is toward the +Y axis.
(2) Attitudes are defined in the local reference
system, which is frozen inertially at
TB7 +15 minutes.

TABLE 2-5 (Sheet 1 of 3)
AS-503 FLIGHT MASS SUMMARY, MISSION C PRIME TLI, SECOND OPPORTUNITY, SECOND BURN ONLY

EVENT	S-IC LIFT-OFF	S-II/ S-IVB SEPAR	FIRST S-IVB F S C	END FUEL LEAD	90 PERCENT THRUST	FIRST S-IVB E C C	END THRUST DECAY	BEGIN RESTRT PREPS
Time From Liftoff (Sec)	0 .000	521 .000	521 .200	524 .200	526 .700	681 .490	682 .890	9,660 .000
Launch excape	8,875	0	0	0	0	0	0	0
Separation pkg	53	0	0	0	0	0	0	0
Frost	300	0	0	0	0	0	0	0
Ullage rockets	252	249	243	151	130	0	0	0
Command module	12,392	12,392	12,392	12,392	12,392	12,392	12,392	12,392
Service module	10,675	10,675	10,675	10,675	10,675	10,675	10,675	10,675
SM propellant	40,583	40,583	40,583	40,583	40,583	40,583	40,583	40,583
Adapter ring	91	91	91	91	91	91	91	91
Adapter	4,059	4,059	4,059	4,059	4,059	4,059	4,059	4,059
LEM test artcl	19,900	19,900	19,900	19,900	19,900	19,900	19,900	19,900
Instrum unit	4,880	4,880	4,880	4,880	4,880	4,880	4,880	4,880
S4B503 dry stg	25,680	25,680	25,680	25,680	25,680	25,680	25,680	25,680
LOX in tank	192,557	192,557	192,557	192,557	192,261	131,034	130,896	130,708
LOX ullage gas	40	40	40	40	42	145	146	272
LOX below tank	367	367	367	367	397	397	367	367
LH2 in tank	43,532	43,532	43,532	43,522	43,421	31,008	30,980	28,431
LH2 ullage gas	58	58	58	58	58	154	155	319
LH2 below tank	48	48	48	53	58	58	48	48
Cold helium	369	369	369	369	368	322	322	322
APS prop + He	622	622	622	622	622	621	620	531
Helium-repress	72	72	72	72	72	72	72	72
GH2 in startnk	5	5	5	5	1	7	7	7
Service items	61	61	61	61	61	61	61	61
Total mass (1bm)	365,470	356,240	356,234	356,138	355,751	282,139	281,934	279,397

EVENT	SECOND S-IVB E S C	END FUEL LEAD	90 PERCENT THRUST	SECOND S-IVB E C C	END THRUST DECAY	SPACE-CRAFT SEPAR	START LOX DUMP	END PASSI-VATION
Time From Liftoff (Sec)	10,230 .000	10,238 .000	10,240 .500	10,554 .240	10,555 .740	11,754 .240	18,474 .400	22,283 .000
Launch escape	0	0	0	0	0	0	0	0
Separation pkg	0	0	0	0	0	0	0	0
Frost	0	0	0	0	0	0	0	0
Ullage rockets	0	0	0	0	0	0	0	0
Command module	12,392	12,392	12,392	12,392	12,392	0	0	0
Service mdoule	10,675	10,675	10,675	10,675	10,675	0	0	0
SM propellant	40,583	40,583	40,583	40,583	40,583	0	0	0
Adapter ring	91	91	91	91	91	0	0	0
Adapter	4,059	4,059	4,059	4,059	4,059	1,412	1,412	1,412
LEM test article	19,900	19,900	19,900	19,900	19,900	19,900	19,900	19,900
Instrum unit	4,880	4,880	4,880	4,880	4,880	4,880	4,880	4,880
S4B503 dry stage	25,680	25,680	25,680	25,680	25,680	25,680	25,680	25,680
LOX in tank	130,706	130,706	130,418	6,795	6,659	6,630	6,500	0
LOX ullage gas	280	284	285	442	442	420	550	0
LOX below tank	367	367	397	397	367	367	367	0
LH2 in tank	28,404	28,377	28,277	3,074	3,047	2,830	2,408	0
LH2 ullage gas	329	334	336	537	537	517	26	0
LH2 below tank	48	56	58	58	48	48	48	0
Cold helium	279	279	278	167	166	166	166	0
APS prop + He	395	393	393	388	387	310	240	203
Helium-repress	72	72	72	72	72	72	72	0
GH2 in start tank	7	7	1	7	7	7	7	0
Serviec items	61	61	61	61	61	61	61	61
Total mass (1bm)	279,208	279,195	278,836	130,257	130,052	63,300	62,317	52,136

TABLE 2-5 (Sheet 3 of 3)
AS-503 FLIGHT MASS SUMMARY, MISSION C PRIME TLI, SECOND OPPORTUNITY, SECOND BURN ONLY

EVENT	BEGIN RESTRT PREPS	SECOND S-IVB E S C	END FUEL LEAD	90 PERCENT THRUST	SECOND S-IVB E C C	END THRUST DECAY	SPACE-CRAFT SEPAR	END PASSI-VATION
Time From Liftoff (Sec)	14,952 .000	15,522 .000	15,530 .000	15,532 .500	15,844 .690	15,846 .190	17,044 .700	27,575 .000
Command module	12,392	12,392	12,392	12,392	12,392	12,392	0	0
Service module	10,675	10,675	10,675	10,675	10,675	10,675	0	0
SM propellant	40,583	40,583	49,583	40,583	40,583	40,583	0	0
Adapter ring	91	91	91	91	91	91	0	0
Adapter	4,059	4,059	4,059	4,059	4,059	4,059	1,412	1,412
LEM test artcl	19,900	19,900	19,900	19,900	19,900	19,900	19,900	19,900
Instrum unit	4,880	4,880	4,880	4,880	4,880	4,880	4,880	4,880
S4B503 dry stg	25,680	25,680	25,680	25,680	25,680	25,680	25,680	25,680
LOX in tank	130,706	180,706	130,706	130,418	7,386	7,250	7,220	0
LOX ullage gas	276	280	284	285	442	442	420	0
LOX below tank	367	367	367	397	397	367	367	0
LH2 in tank	27,521	27,521	27,494	27,394	2,311	2,284	2,067	0
LH2 ullage gas	306	347	352	353	537	537	517	0
LH2 below tank	48	48	56	58	58	48	48	0
Cold helium	322	279	279	278	166	166	166	0
APS. prop + He	531	395	393	393	389	385	310	200
Helium-repress	72	72	72	72	72	72	72	0
GH2 in start tank	7	7	7	1	7	7	7	0
Service items	61	61	61	61	61	61	61	61
Total mass (lbm)	278,477	278,343	278,330	277,970	130,086	129,881	63,127	52,133

15°

NASA   DAC

—4240 —————— 1695

—◄— 26 DIAMETER

LAUNCH
ESCAPE
TOWER

33°

COMMAND MODULE   — 3890   1344
                                  — 3840 ▲   1294 ▲
APOLLO   — 3775 ▲   1229 ▲
SPACECRAFT   SERVICE MODULE   — 3750   1204
             —◄— 154 DIAMETER —►— 3595 ▲   1149 ▲

             8°58'

LM
ADAPTER   — 3341 ▲   795 ▲
INSTRUMENT UNIT   — 3259   713
                                  — 3223   677

                —◄— 260 DIAMETER

S—IVB
STAGE

16°44'   — 2747 ▲   201 ▲
                                  — 2646 (GIMBAL) 100
                                  — 2519

                —◄— 396 DIAMETER

SATURN
LAUNCH
VEHICLE

S—II
STAGE

                                  — 1760 ▲

                                  — 1564 ▲
                                  — 1541

S—IC
STAGE

                                  — 365

▲ FLIGHT SEPARATION
  PLANES

                                  — 100 (GIMBAL)
NOTE: ALL DIMENSIONS   — 48.5
      ARE IN INCHES

                                  — -115

Figure 2-1. AS-503 Launch Vehicle

NOTE: UNLESS OTHERWISE NOTED THE LAUNCH AZIMUTH
        AT OPENING OF WINDOW IS 72° AND 108° AT
        CLOSING OF WINDOW
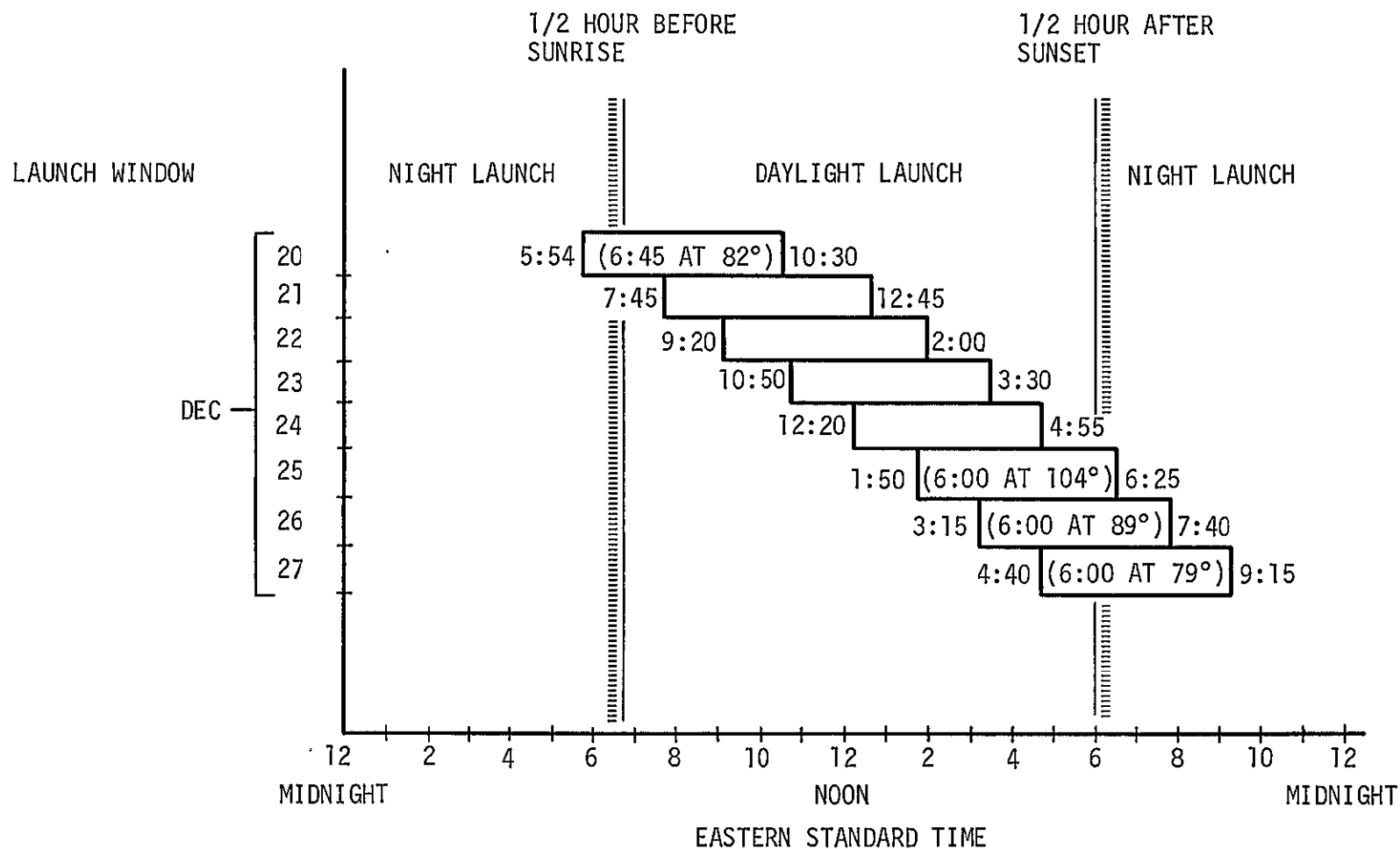
Figure 2-2.   Launch Window Summary Dec. 20 - 27, 1968

Figure 2-3. AS-503 C' Flight Azimuth History
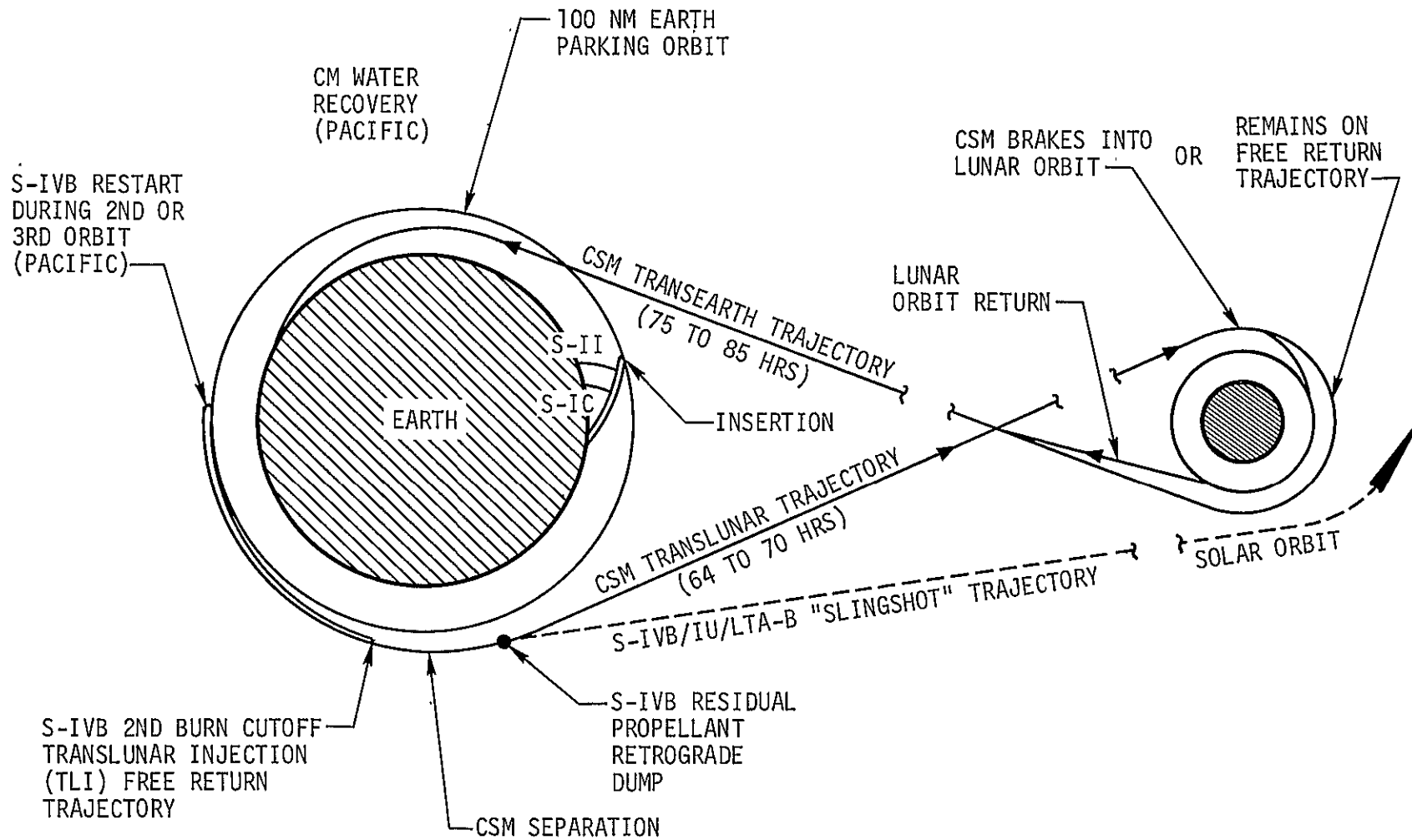
Figure 2-4.   AS-503 C' Mission Profile
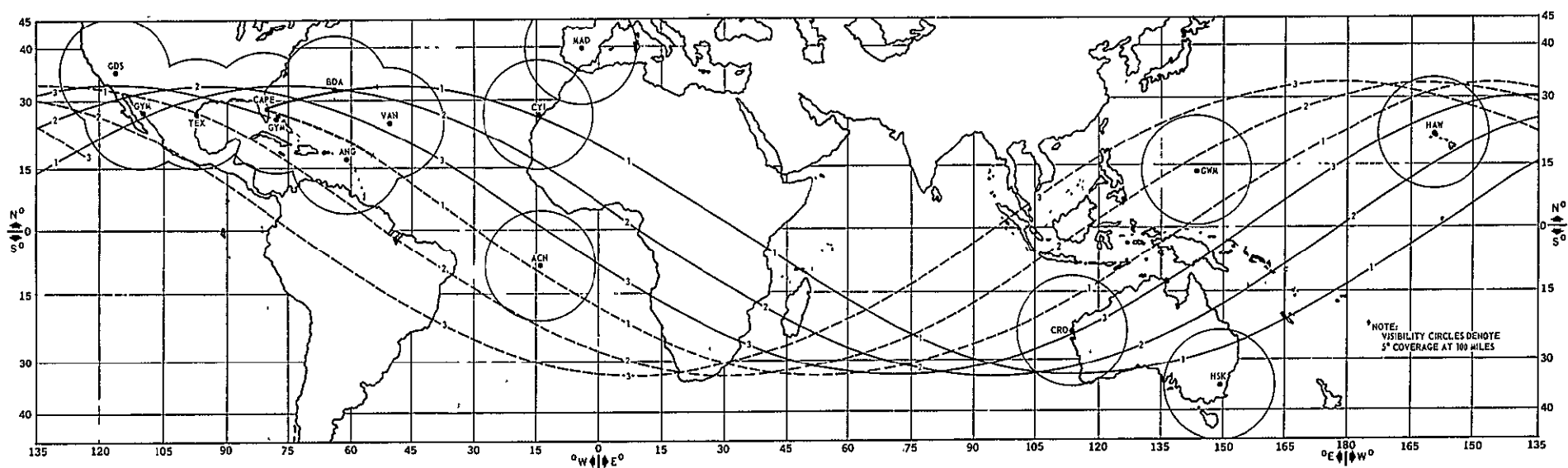
LEGEND:
——— 72° FLIGHT AZIMUTH
— — —108° FLIGHT AZIMUTH

Figure 2-5.   AS-503 C' Ground Trace Boost and Parking Orbit Flight Azimuths of 72 Deg and 108 Deg

ALTITUDE AND RANGE

NOTE: DATA SHOWN IS APPLICABLE TO ALL
        LAUNCH DAYS AND LAUNCH AZIMUTHS

TIME FROM LIFTOFF (SEC)
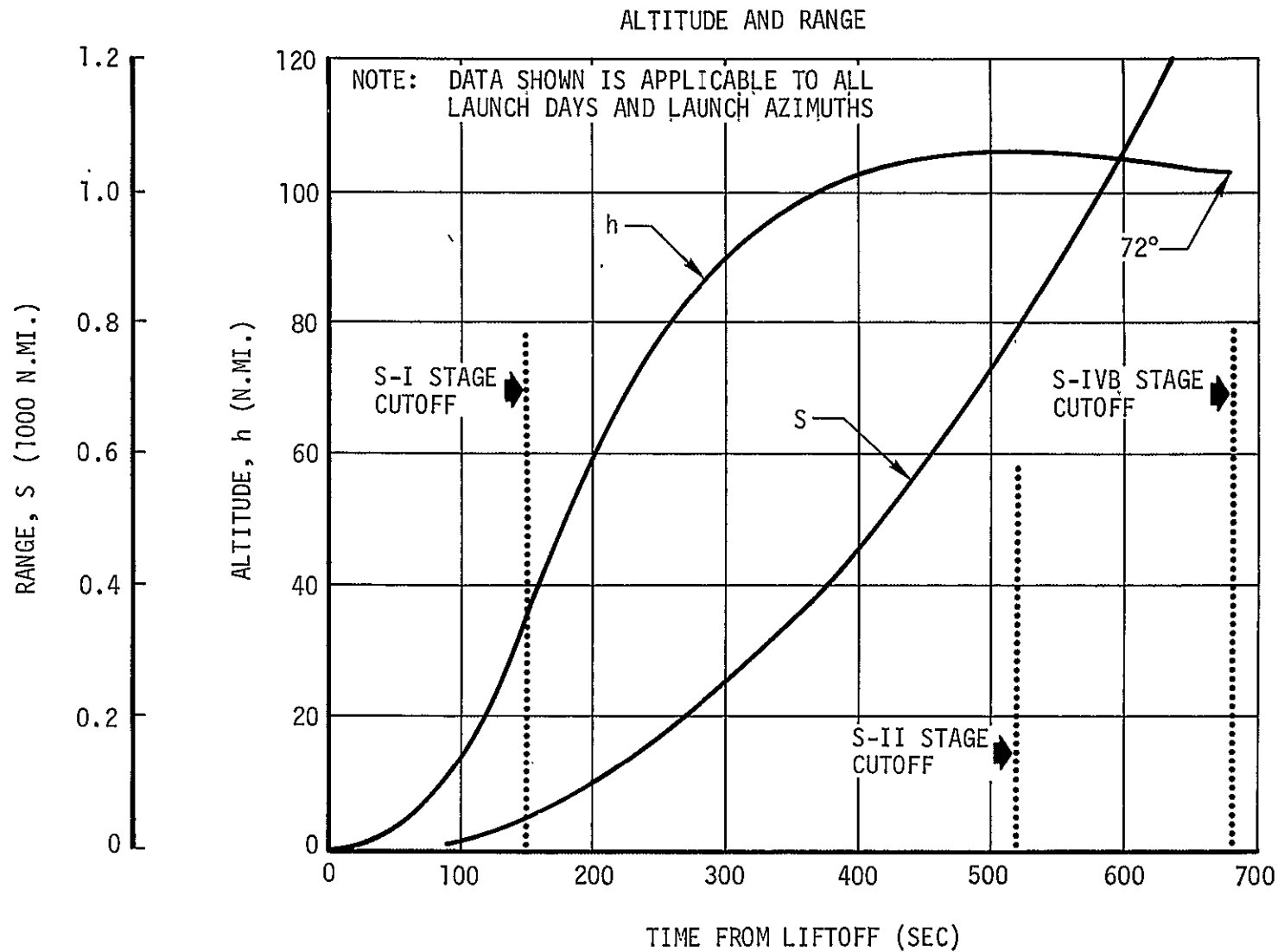
Figure 2-6. Typical Trajectory Profile Boost to Parking Orbit (Sheet 1 of 8)

503 C' DEC 21
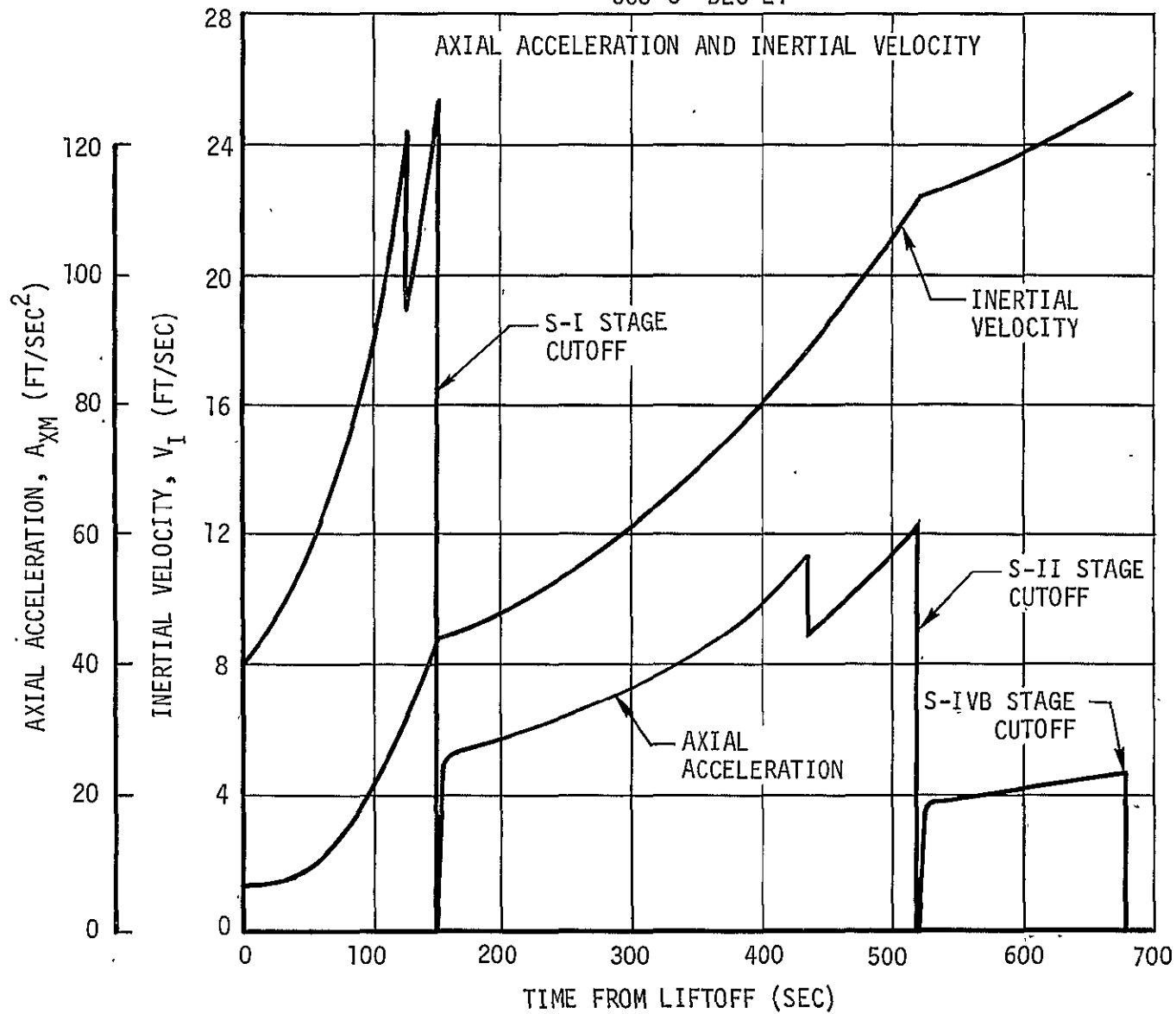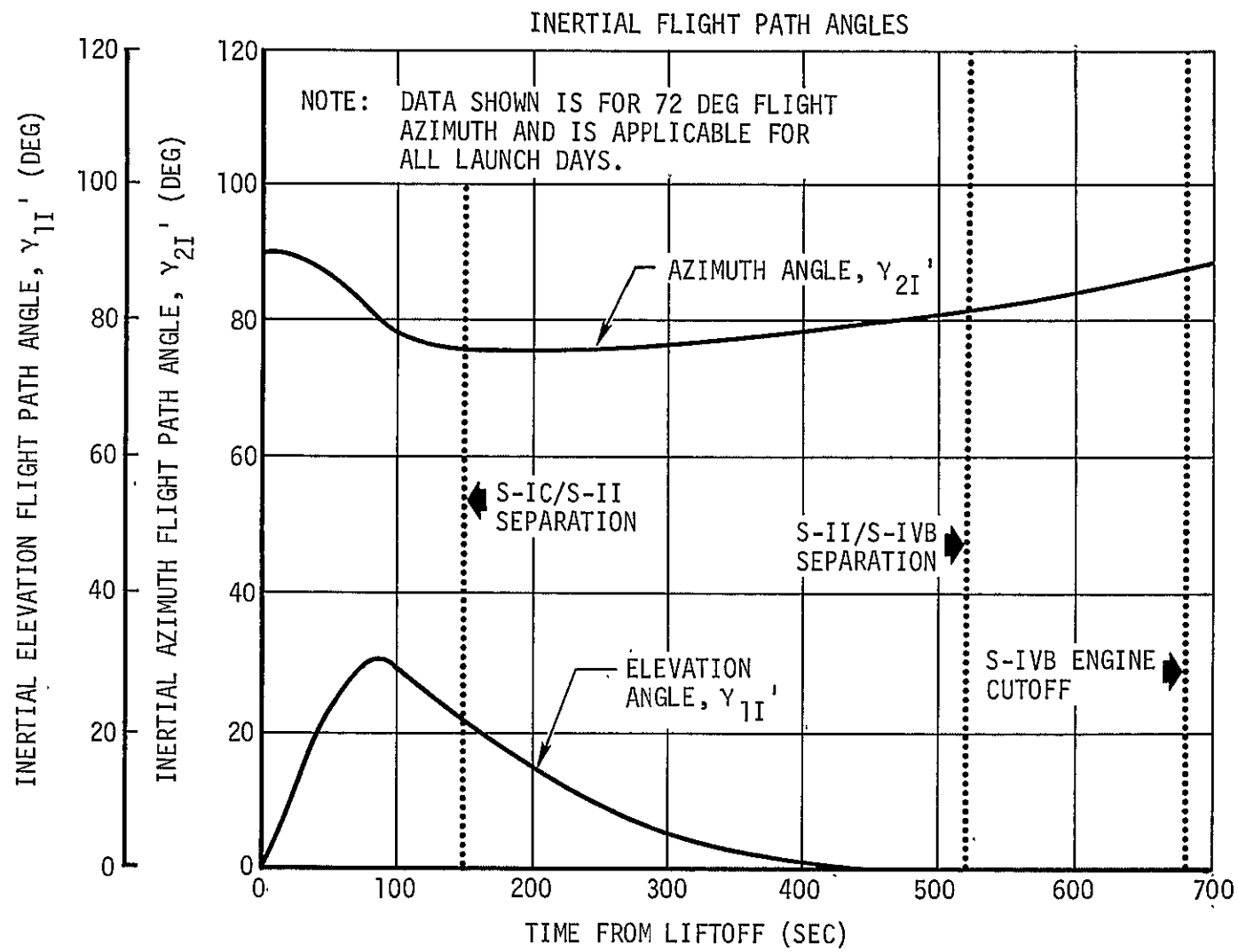
AXIAL ACCELERATION AND INERTIAL VELOCITY

Figure 2-6. Typical Trajectory Profile Boost to Parking Orbit (Sheet 2 of 8)

INERTIAL FLIGHT PATH ANGLES

Figure 2-6. Typical Trajectory Profile Boost to Parking Orbit (Sheet 3 of 8)

EARTH-FIXED VELOCITY AND CROSS-RANGE POSITION
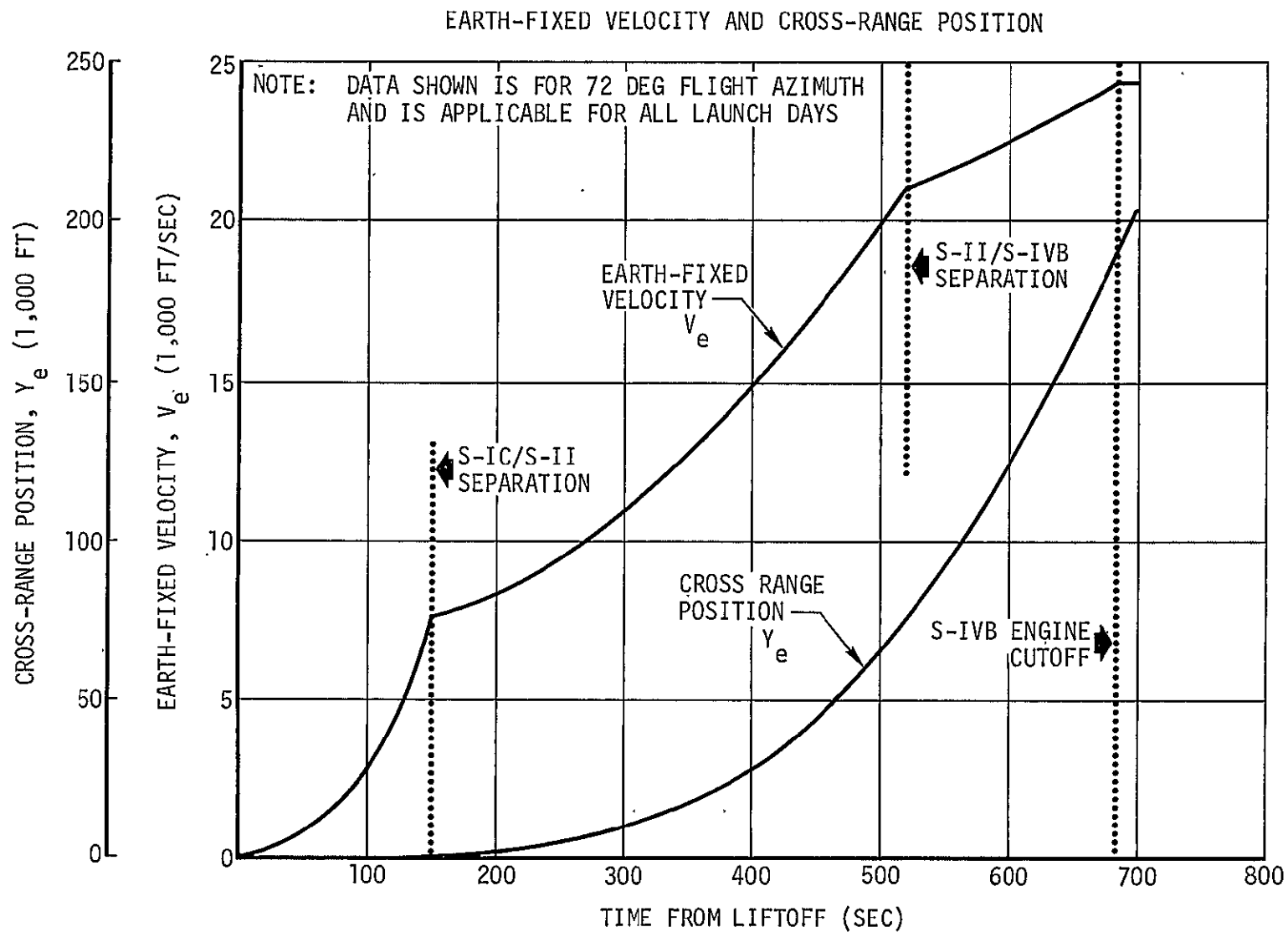
Figure 2-6. Typical Trajectory Profile Boost to Parking Orbit (Sheet 4 of 8)
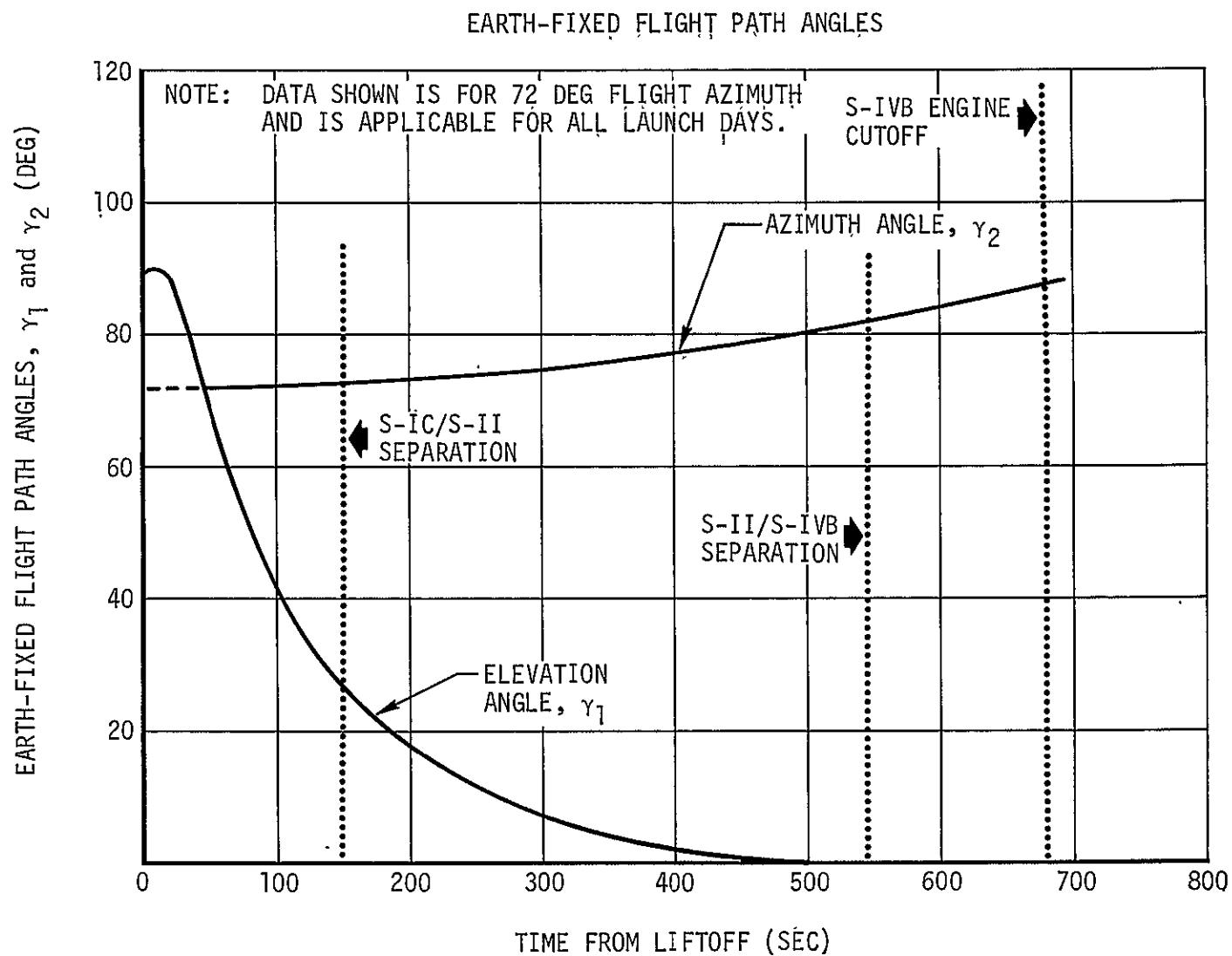
Figure 2-6. Typical Trajectory Profile Boost to Parking Orbit (Sheet 5 of 8)
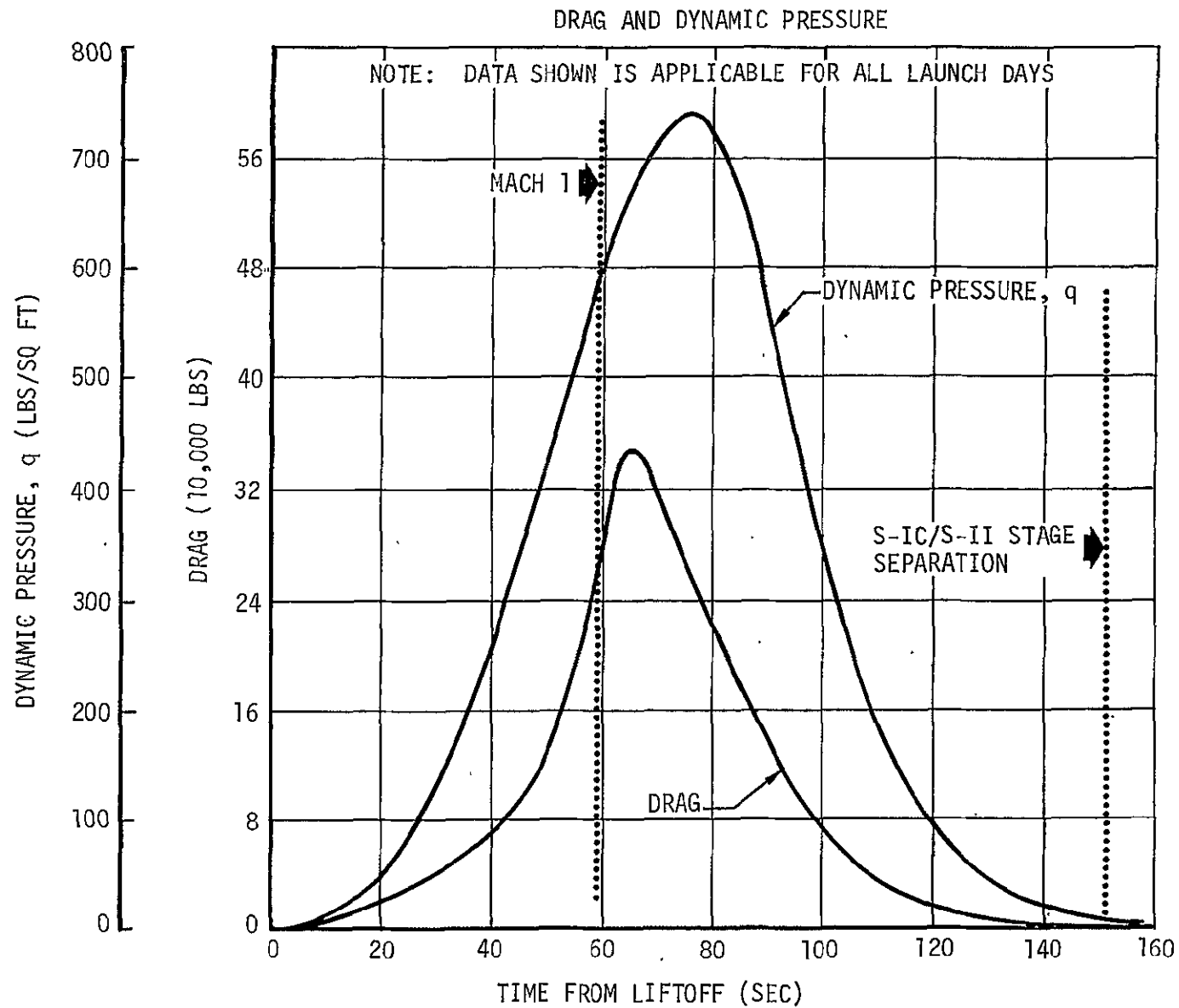
Figure 2-6. Typical Trajectory Profile Boost to Parking Orbit (Sheet 6 of 8)
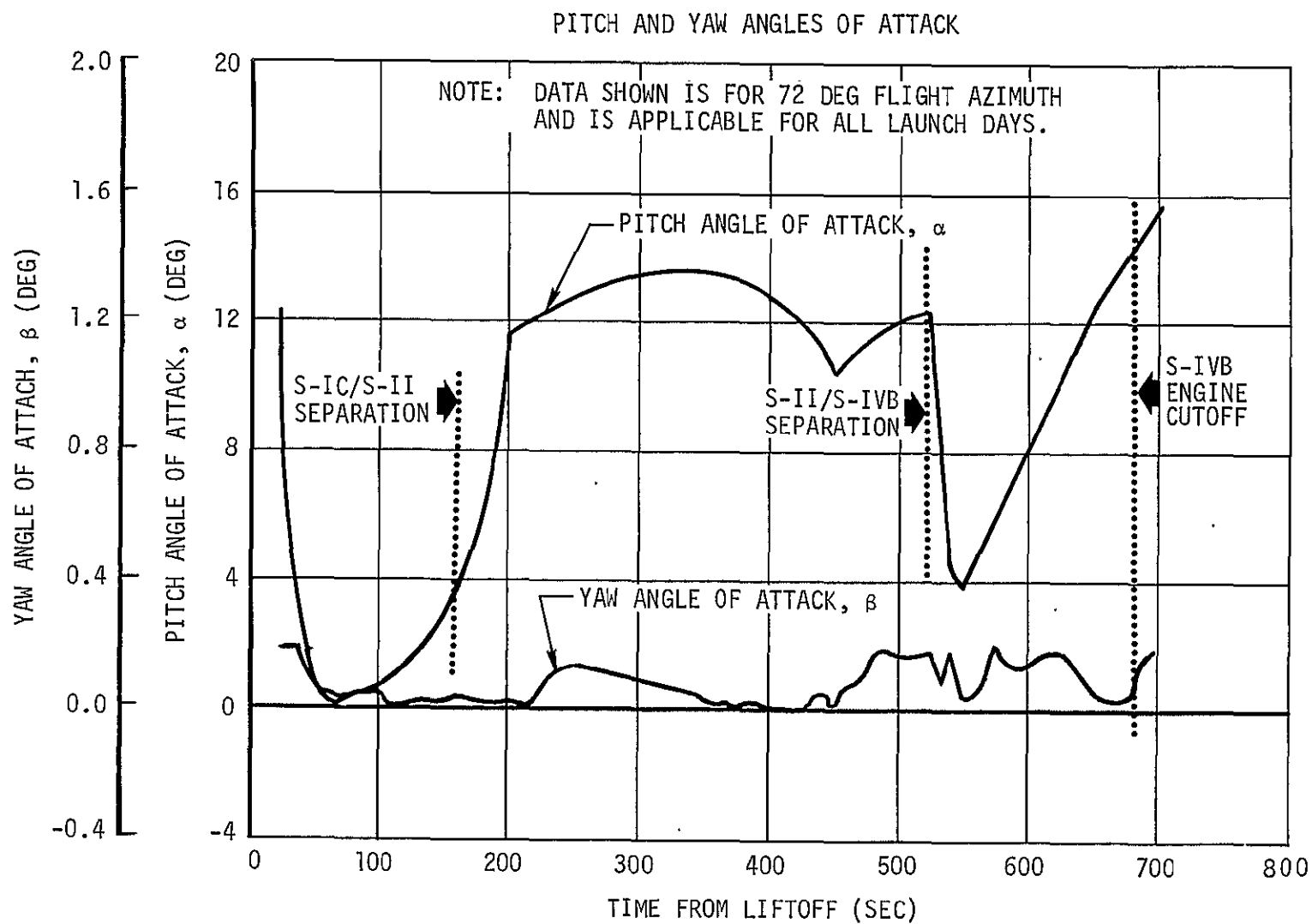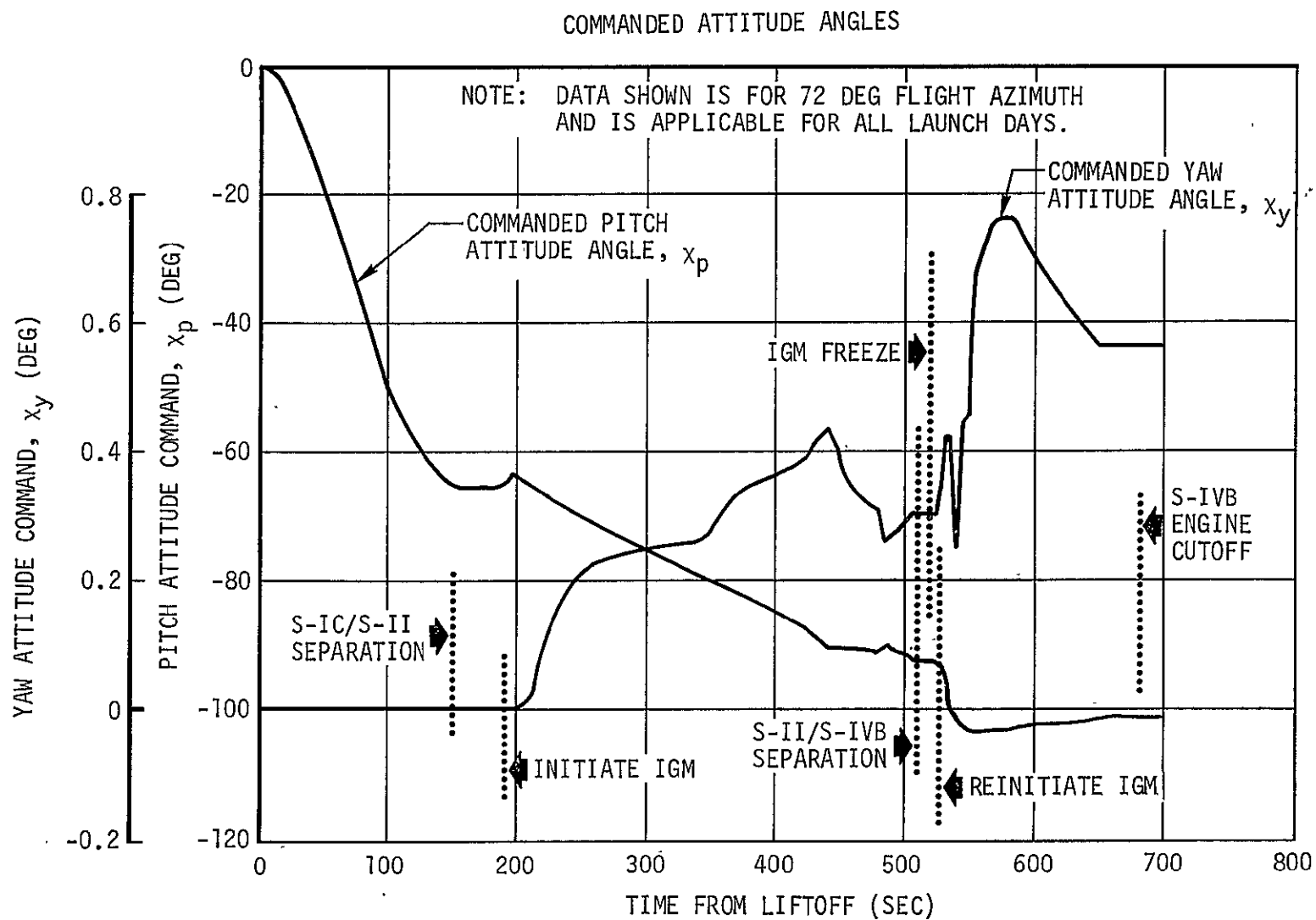
PITCH AND YAW ANGLES OF ATTACK

Figure 2-6. Typical Trajectory Profile Boost to Parking Orbit (Sheet 7 of 8)

COMMANDED ATTITUDE ANGLES

Figure 2-6. Typical Trajectory Profile Boost to Parking Orbit (Sheet 8 of 8)

ALTITUDE AND RANGE

Figure 2-7.   Trajectory Conditions at Parking Orbit Insertion (Sheet 1 of 5)

INERTIAL VELOCITY AND WEIGHT

Figure 2-7. Trajectory Conditions at Parking Orbit Insertion (Sheet 2 of 5)

INERTIAL ELEVATION AND AZIMUTH FLIGHT PATH ANGLES

Figure 2-7. Trajectory Conditions at Parking Orbit Insertion (Sheet 3 of 5)

PITCH AND YAW ANGLES OF ATTACK

Figure 2-7. Trajectory Conditions at Parking Orbit Insertion (Sheet 4 of 5)

INCLINATION AND LONGITUDE OF DESCENDING NODE
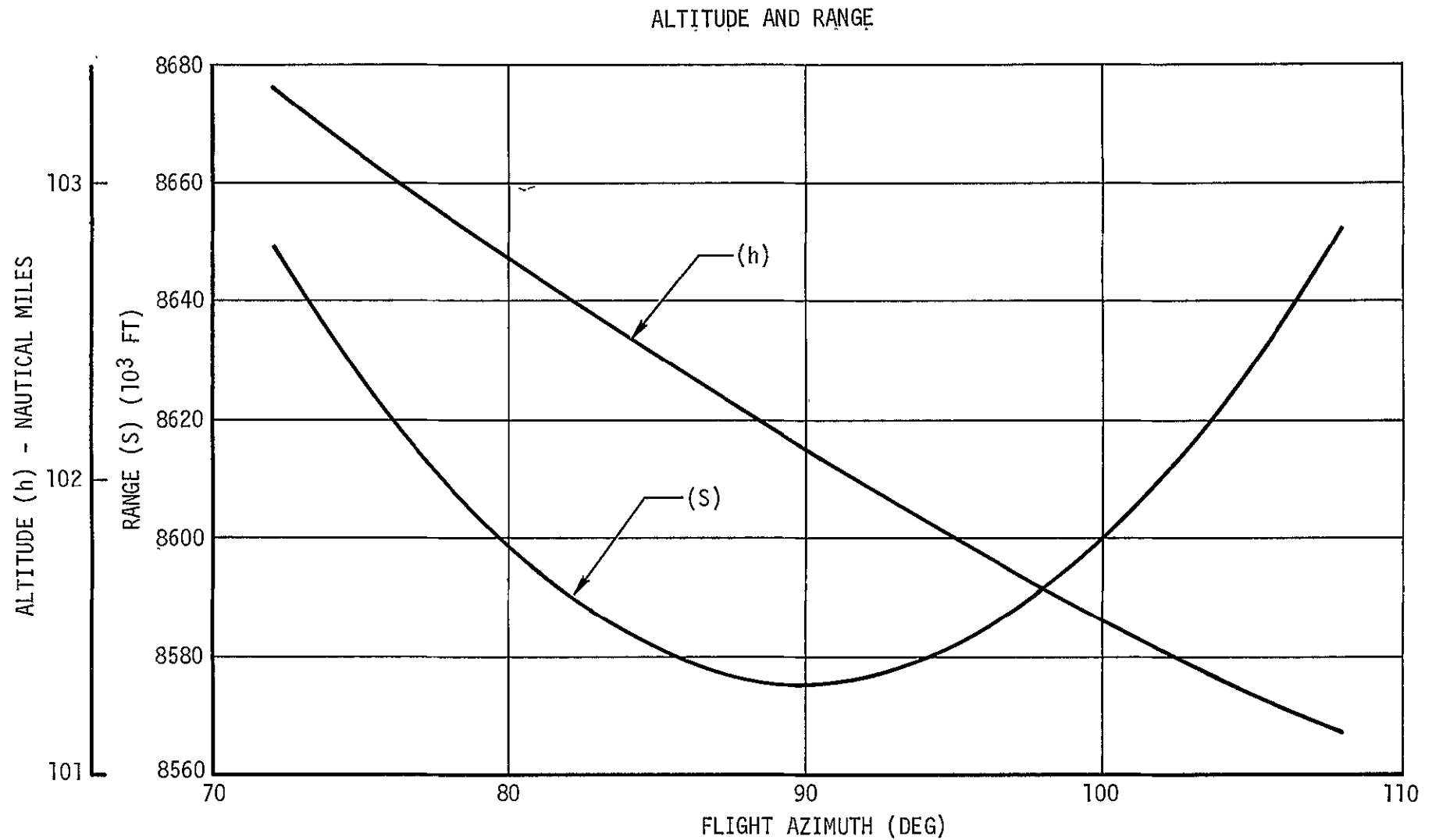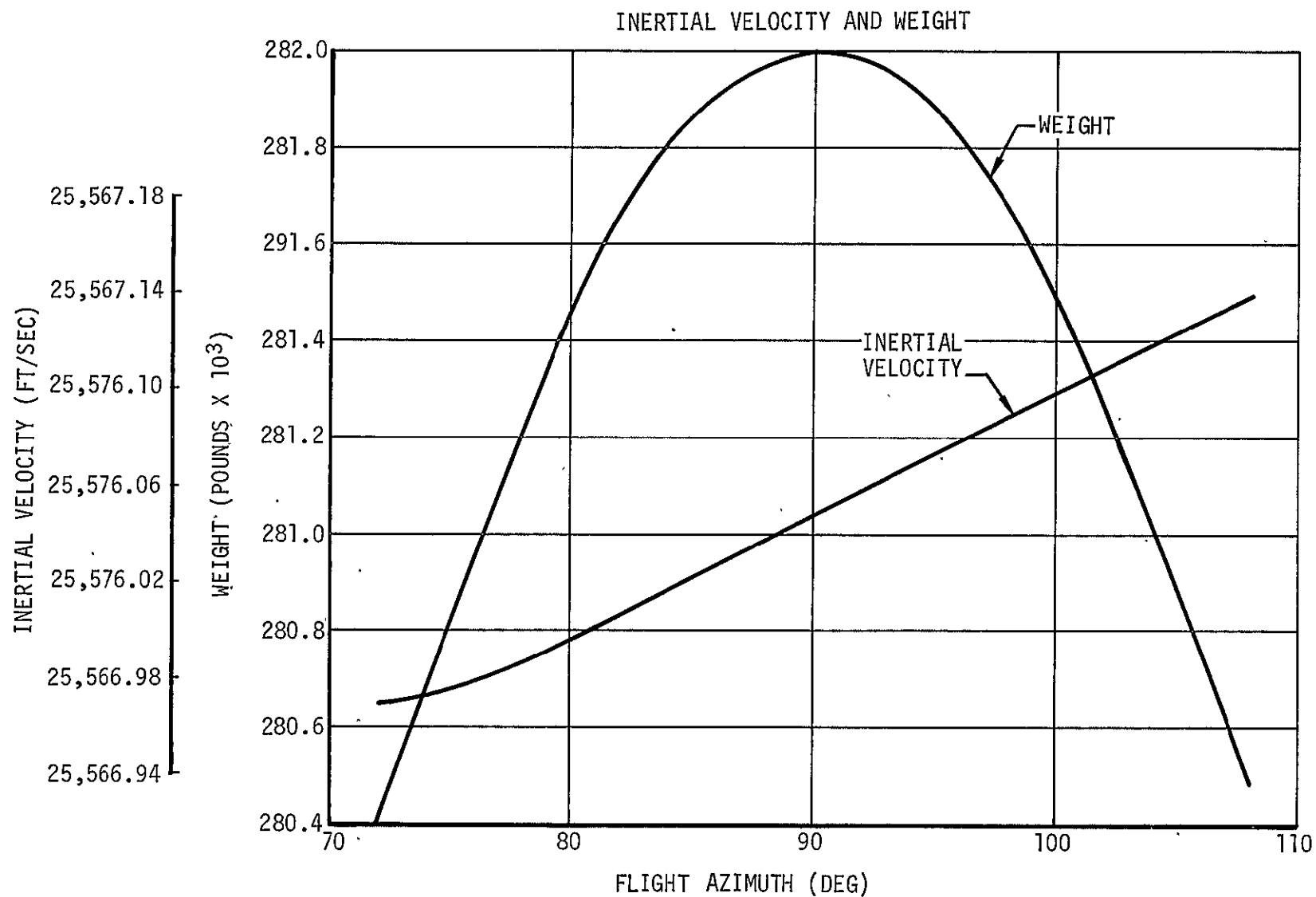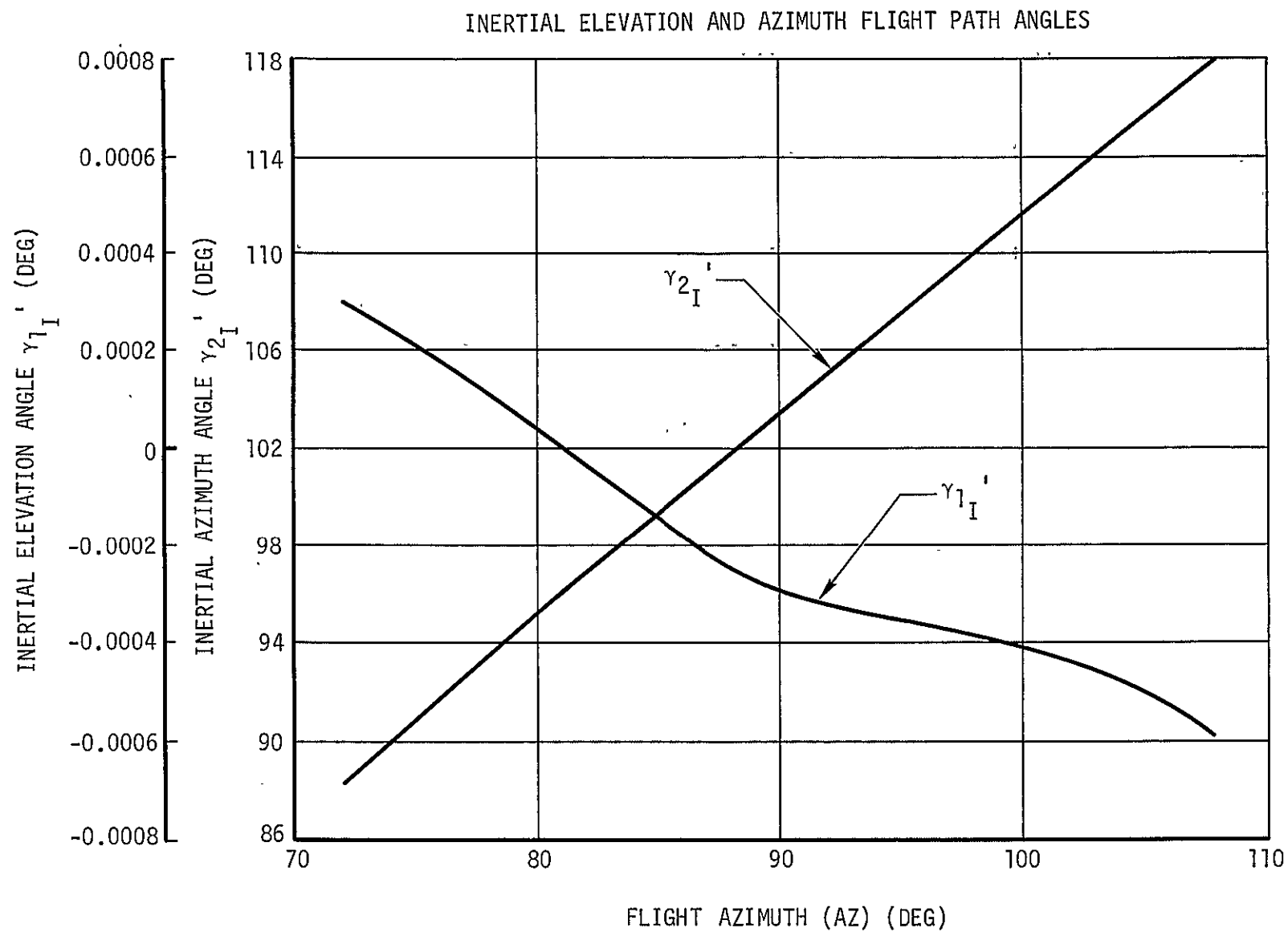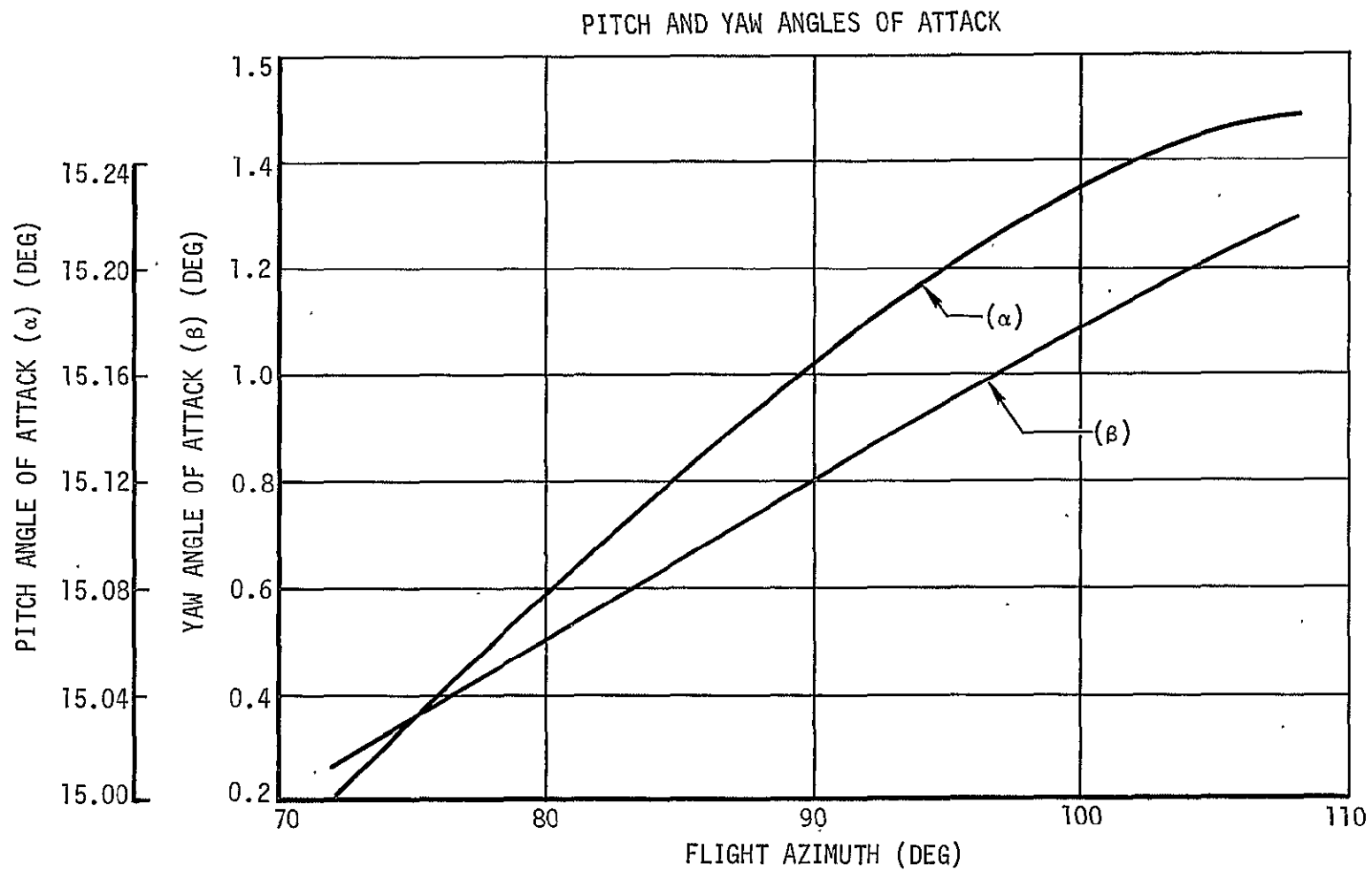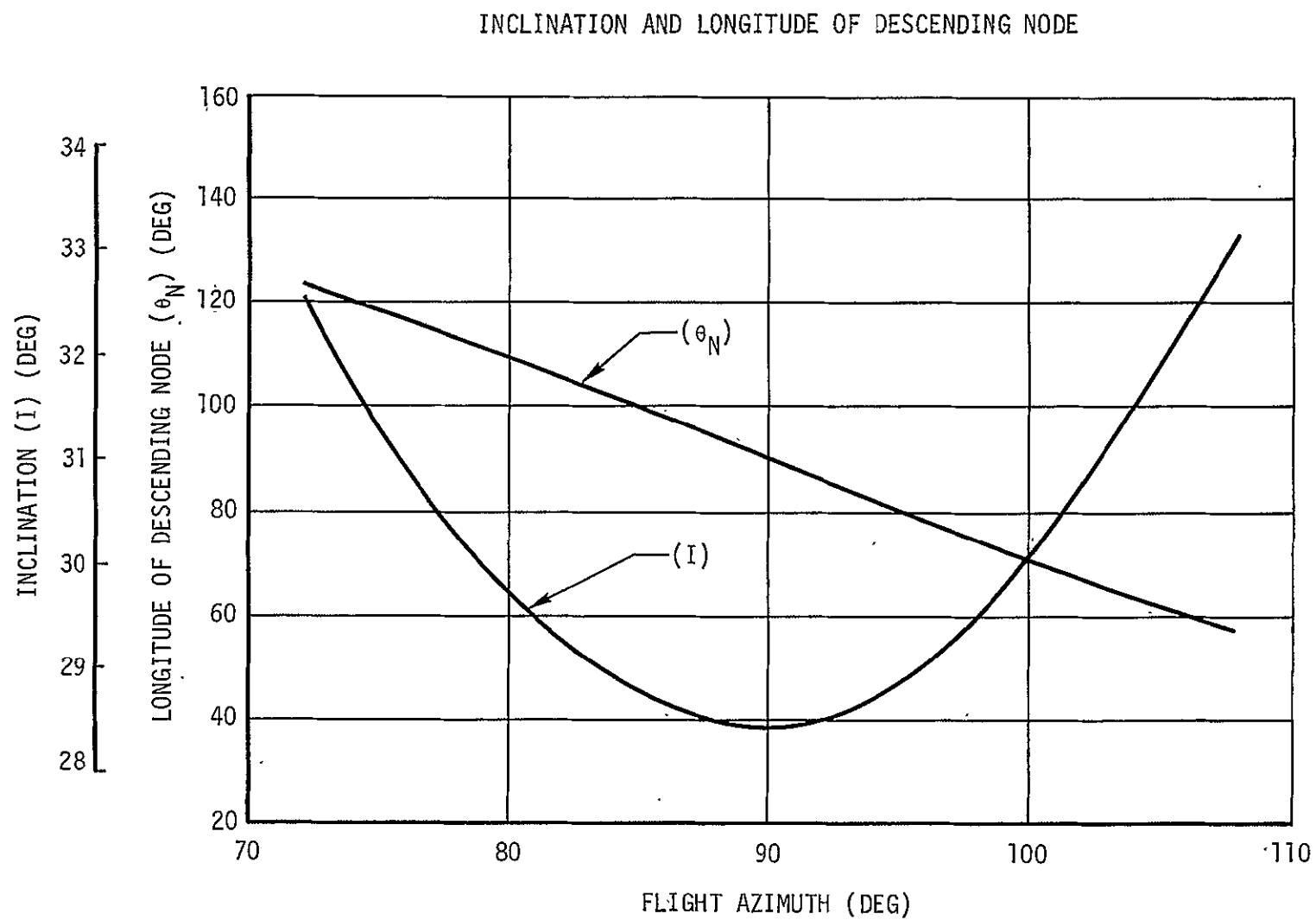
Figure 2-7. Trajectory Conditions at Parking Orbit Insertion (Sheet 5 of 5)

Figure 2-8. Typical Trajectory Profile Parking Orbit Coast (Sheet 1 of 3)

ALTITUDE

NOTE: DATA SHOWN IS FOR 72 AND 108 DEG FLIGHT AZIMUTHS,
SECOND LAUNCH OPPORTUNITY, FOR LAUNCH ON DEC 21
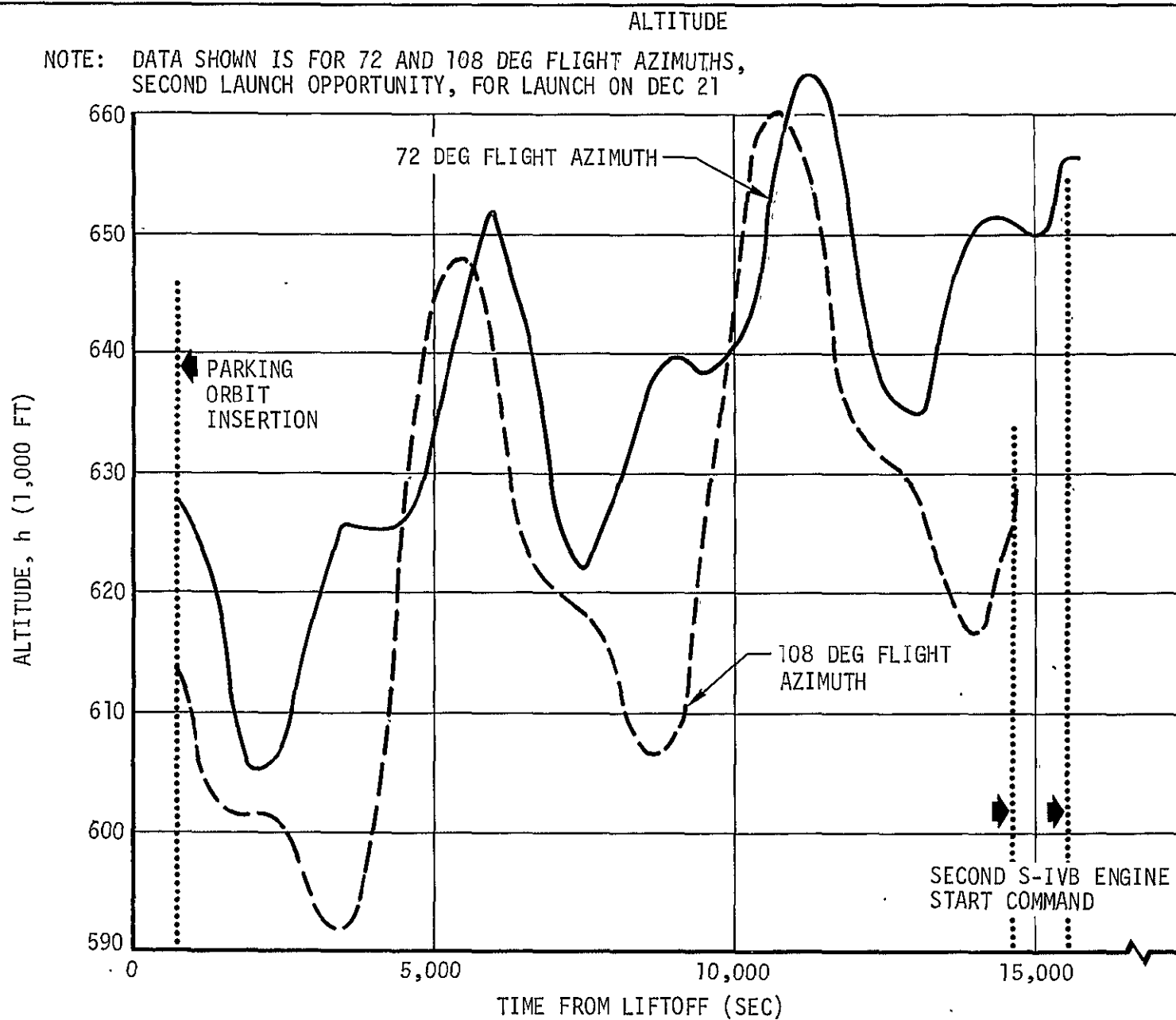
Figure 2-8. Typical Trajectory Profile Parking Orbit Coast (Sheet 2 of 3)

THRUST
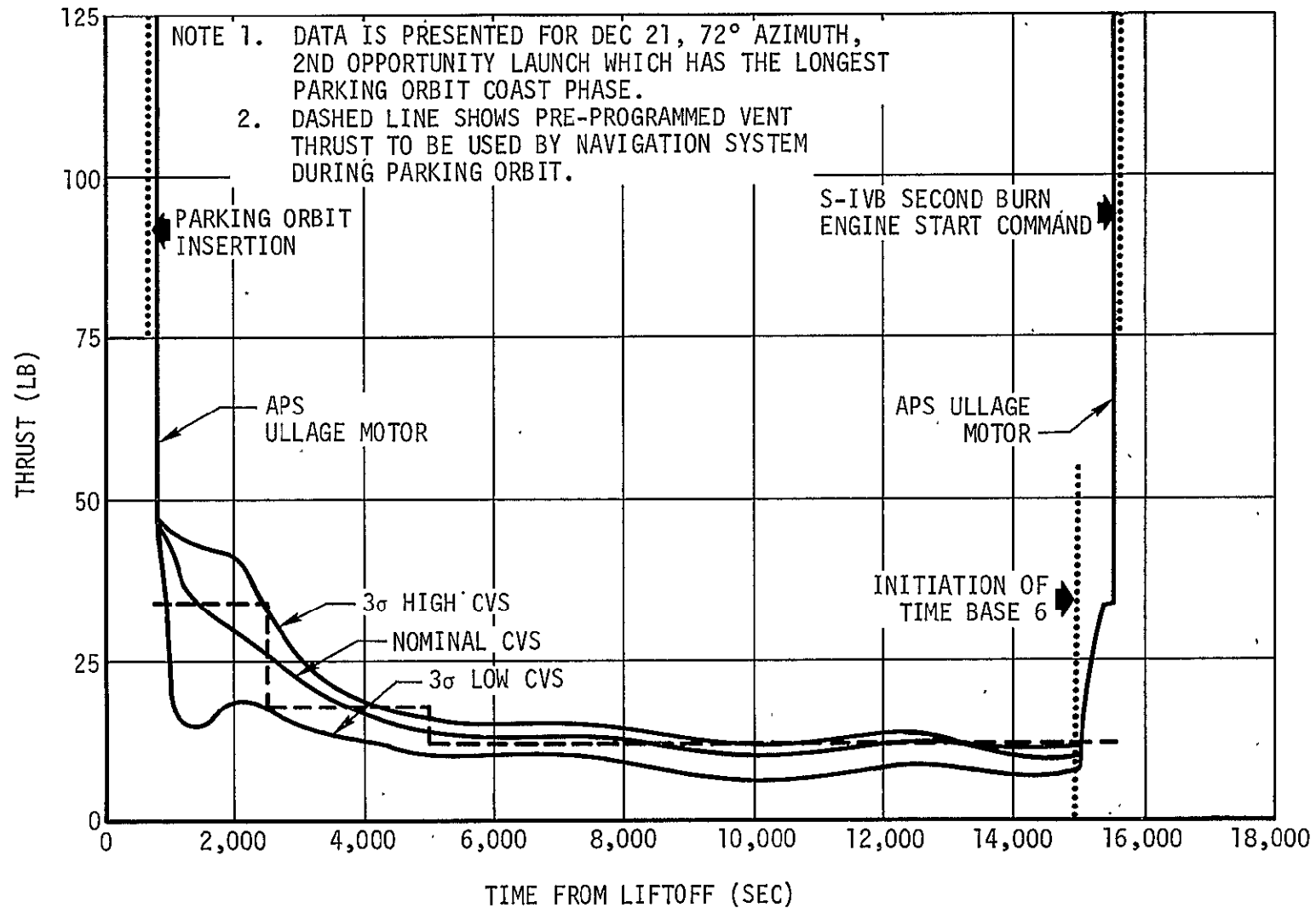
Figure 2-8. Typical Trajectory Profile Parking Orbit Coast (Sheet 3 of 3)
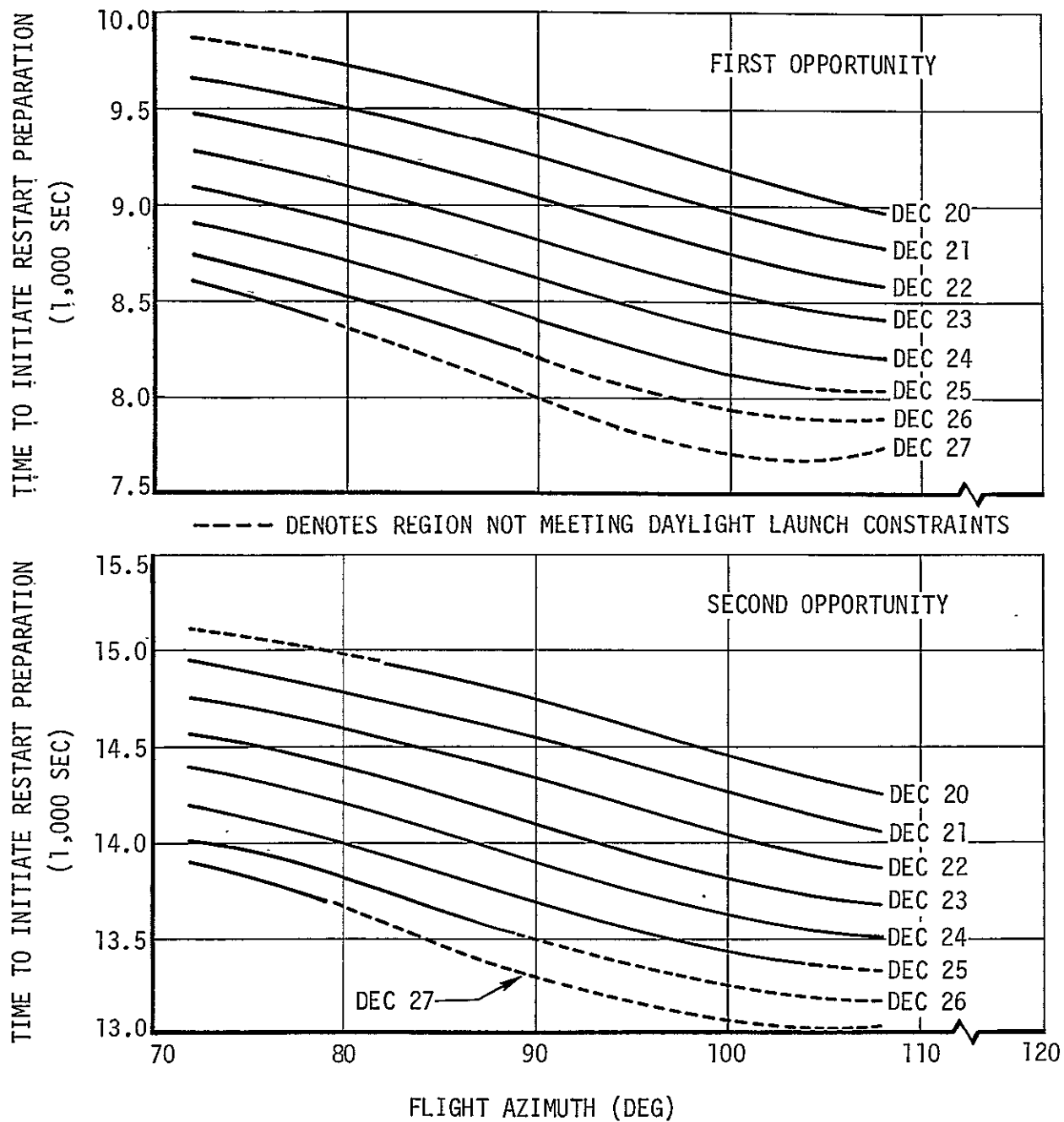
Figure 2-9. Trajectory Conditions at Initiation of Restart Preparations
Time from First Motion
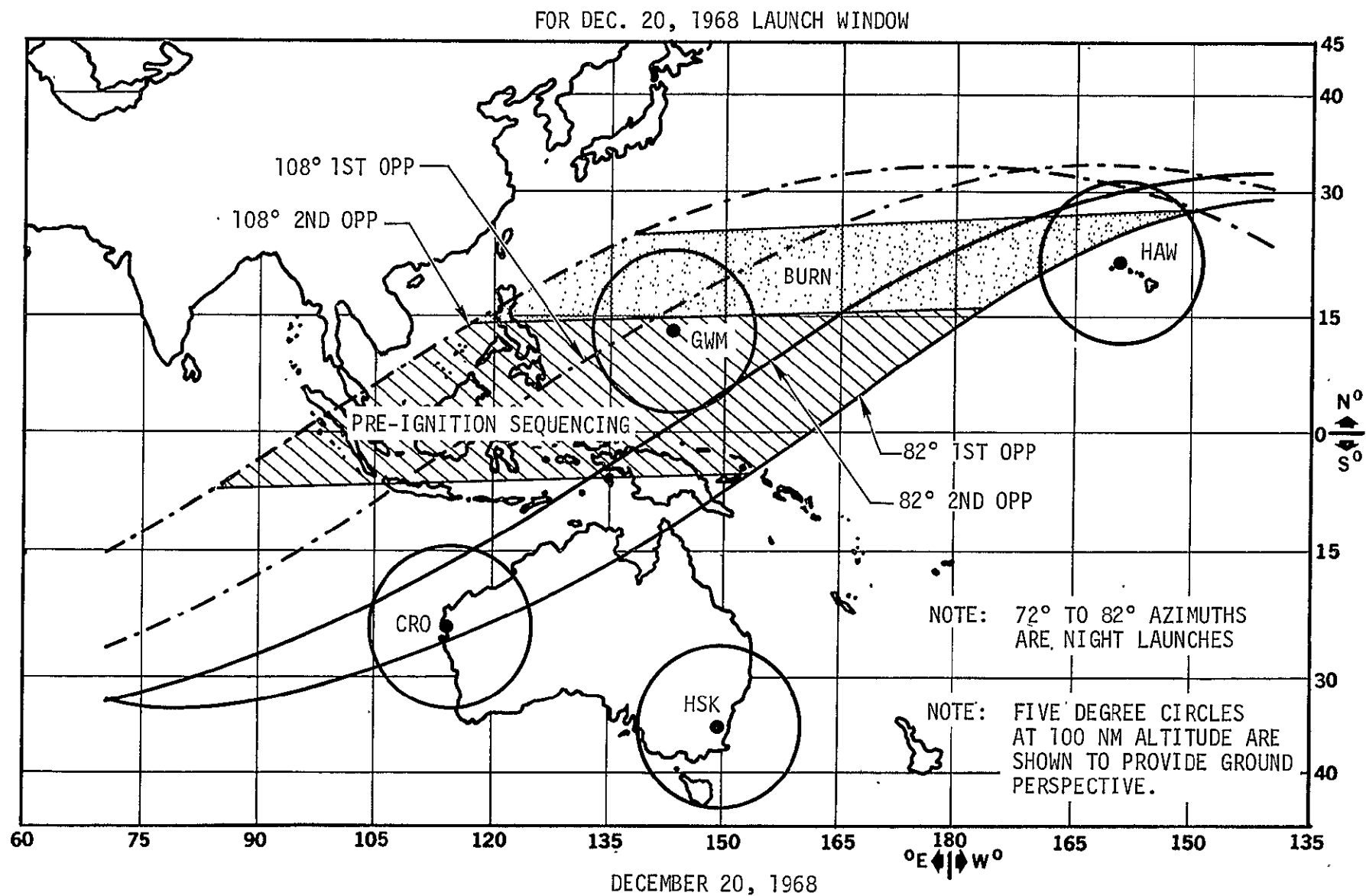
Figure 2-10a. Ground Projection of Pre-Ignition Sequencing and S-IVB 2nd Burn (Sheet 1 of 8)

FOR DEC. 21, 1968 LAUNCH WINDOW

DECEMBER 21, 1968
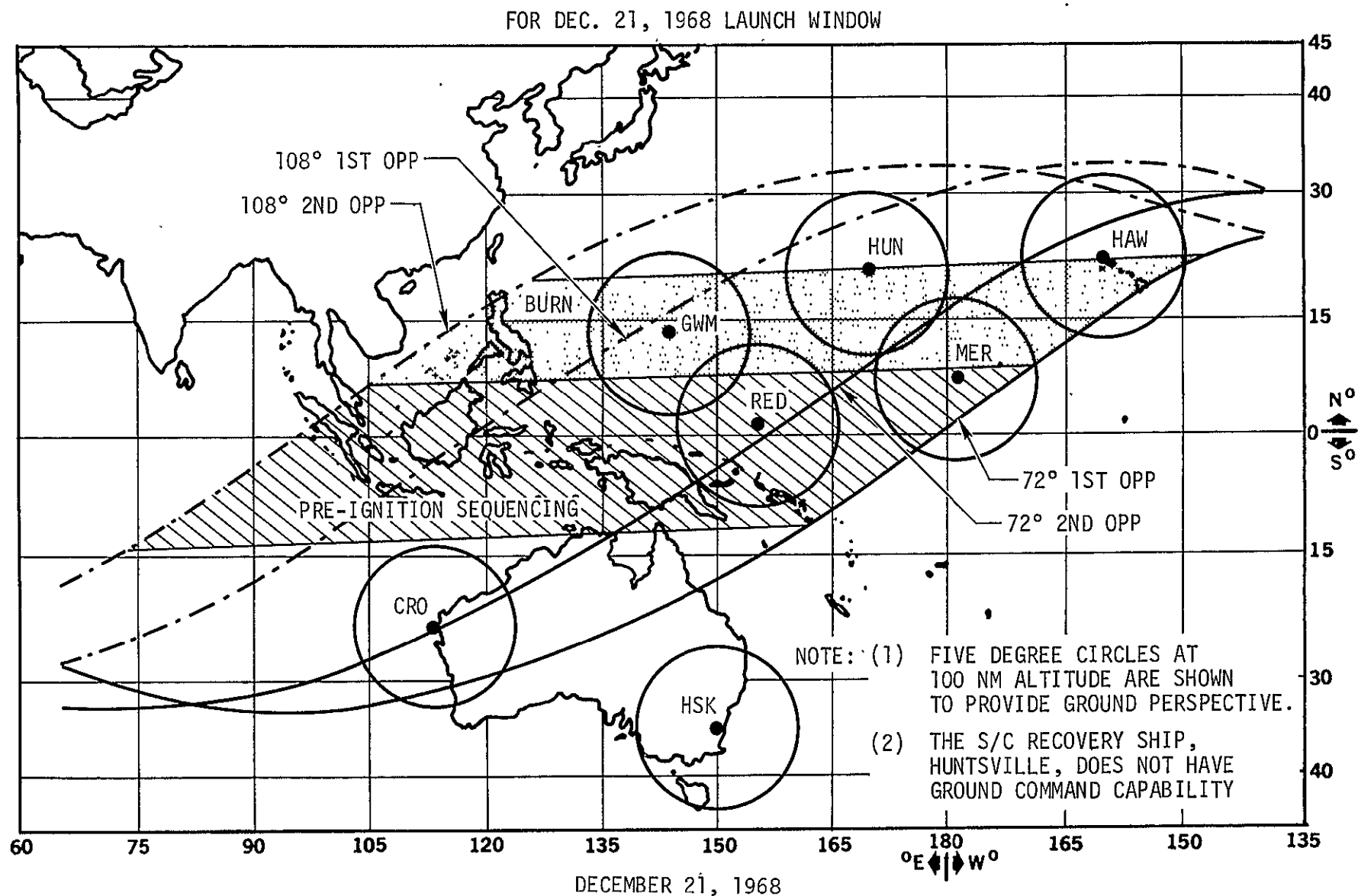
Figure 2-10a. Ground Projection of Pre-Ignition Sequencing and S-IVB 2nd Burn (Sheet 2 of 8)
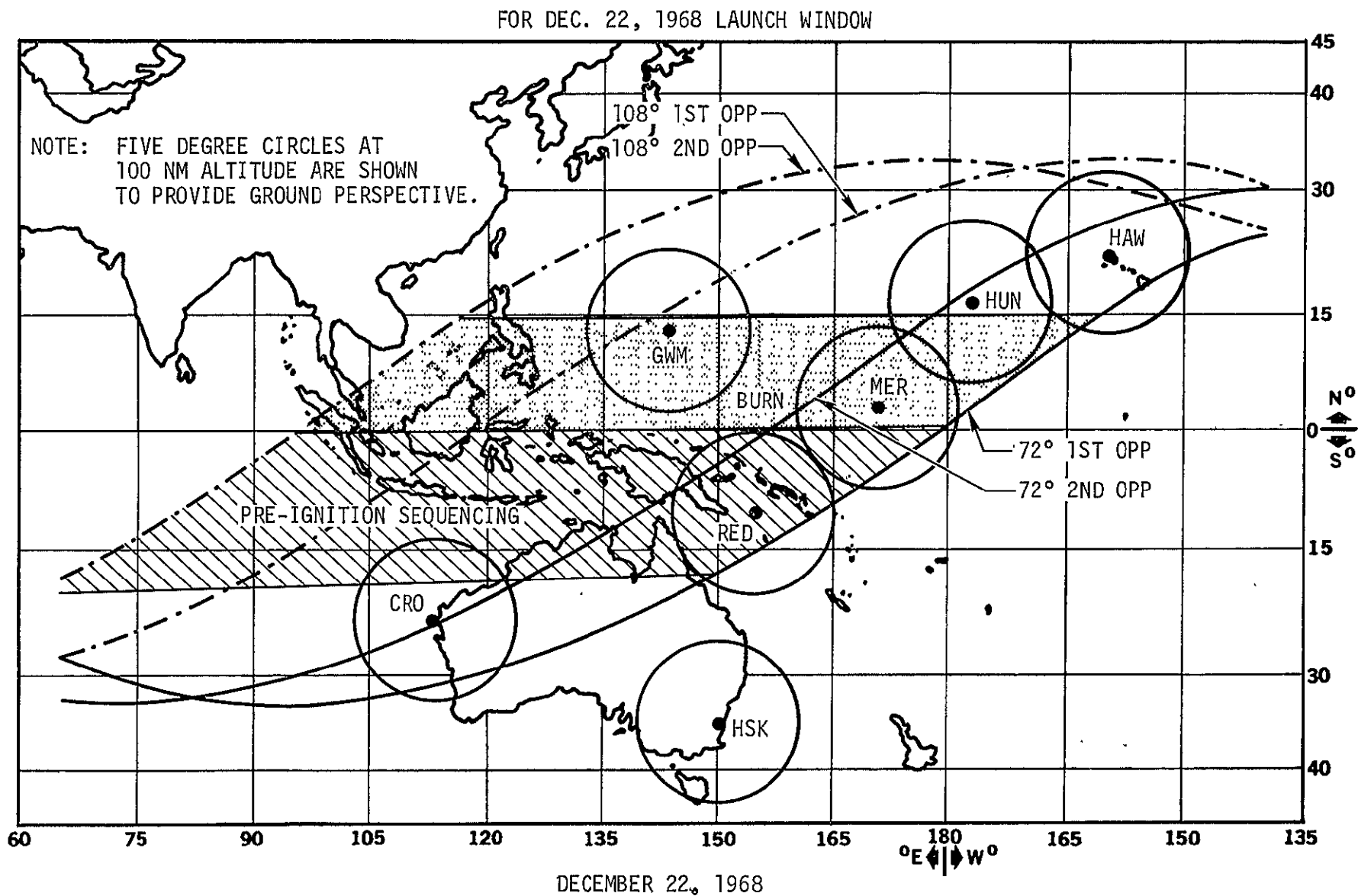
Figure 2-10a. Ground Projection of Pre-Ignition Sequencing and S-IVB 2nd Burn (Sheet 3 of 8)
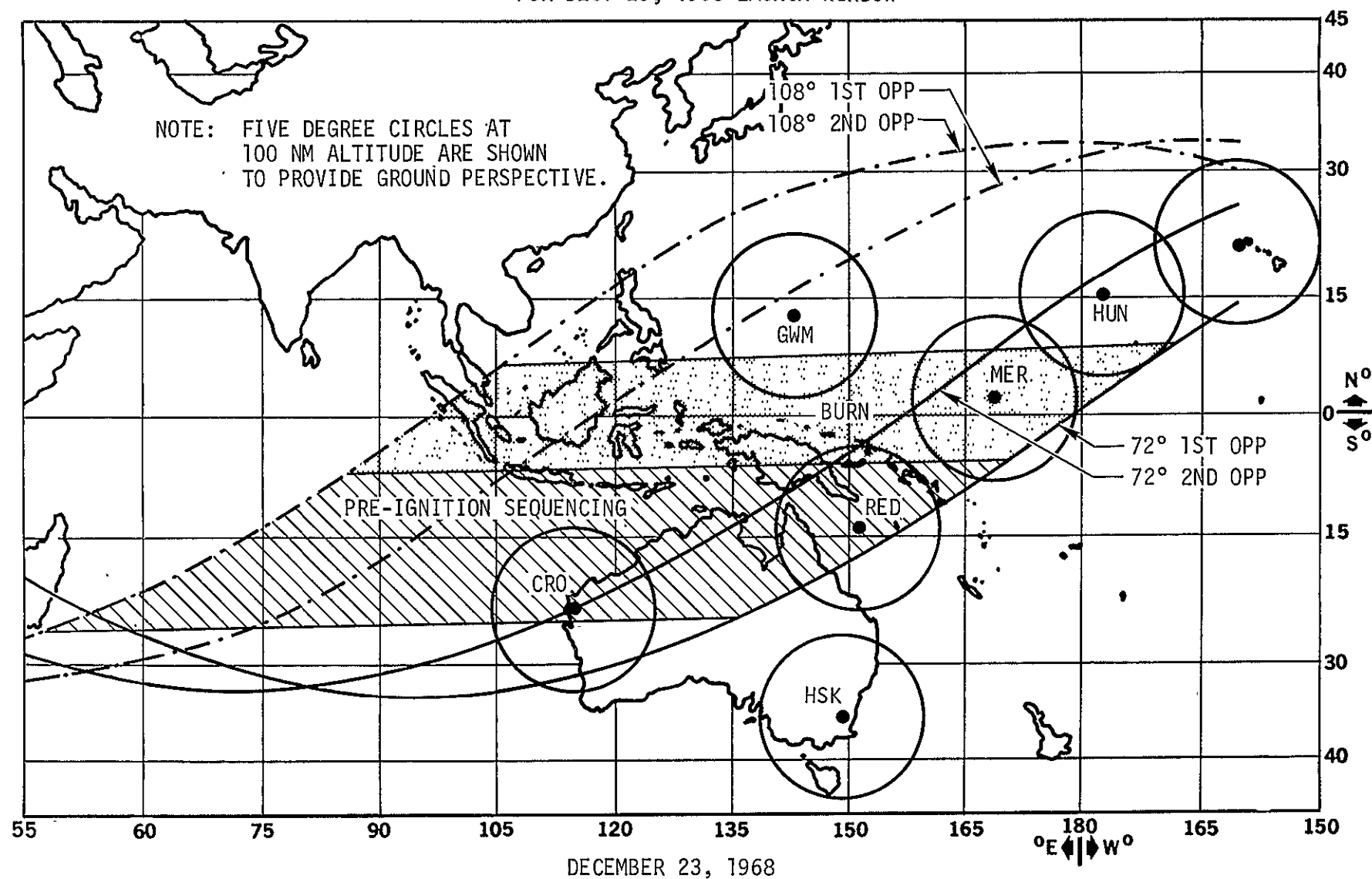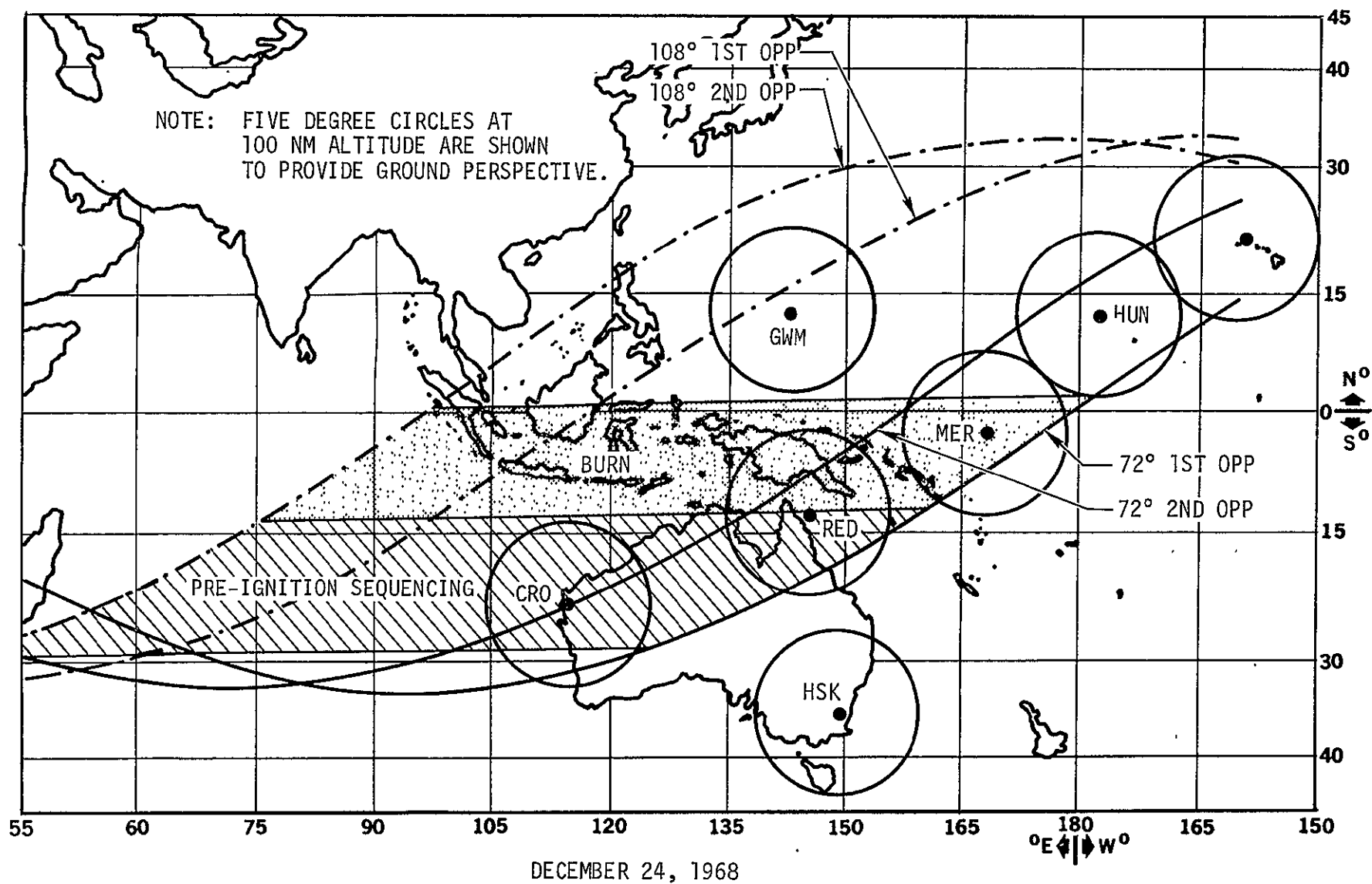
FOR DEC. 23, 1968 LAUNCH WINDOW

Figure 2-10a. Ground Projection of Pre-Ignition Sequencing and S-IVB 2nd Burn (Sheet 4 of 8)

Figure 2-10a. Ground Projection of Pre-Ignition Sequencing and S-IVB 2nd Burn (Sheet 5 of 8)

FOR DEC. 25, 1968 LAUNCH WINDOW

NOTE: FIVE DEGREE CIRCLES AT
        100 NM ALTITUDE ARE SHOWN
        TO PROVIDE GROUND PERSPECTIVE.

104° 1ST OPP
104° 2ND OPP
BURN

GWM

MER

72° 1ST OPP
72° 2ND OPP

HUN

N°
S°

RED

PRE-IGNITION SEQUENCING

CRO

HSK

NOTE: 104° to 108° AZIMUTHS
        ARE NIGHT LAUNCHES

30   45   60   75   90   105   120   135   150   165   180   165
                                                          °E ◀|▶ W°

45
40
30
15
0
15
30
40

DECEMBER 25, 1968

Figure 2-10a.   Ground Projection of Pre-Ignition Sequencing and S-IVB 2nd Burn (Sheet 6 of 8)

Figure 2-10a. Ground Projection of Pre-Ignition Sequencing and S-IVB 2nd Burn (Sheet 7 of 8)

FOR DEC. 27, 1968 LAUNCH WINDOW

NOTE: FIVE DEGREE CIRCLES AT
100 NM ALTITUDE ARE SHOWN
TO PROVIDE GROUND PERSPECTIVE.

GWM

HUN

MER

79° 1ST OPP
79° 2ND OPP

72° 1ST OPP

72° 2ND OPP

CRO BURN RED

PRE-IGNITION SEQUENCING

HSK

NOTE: 79° TO 108° AZIMUTHS
ARE NIGHT LAUNCHES

30 55 60 75 90 105 120 135 150 165 180 165

°E W°
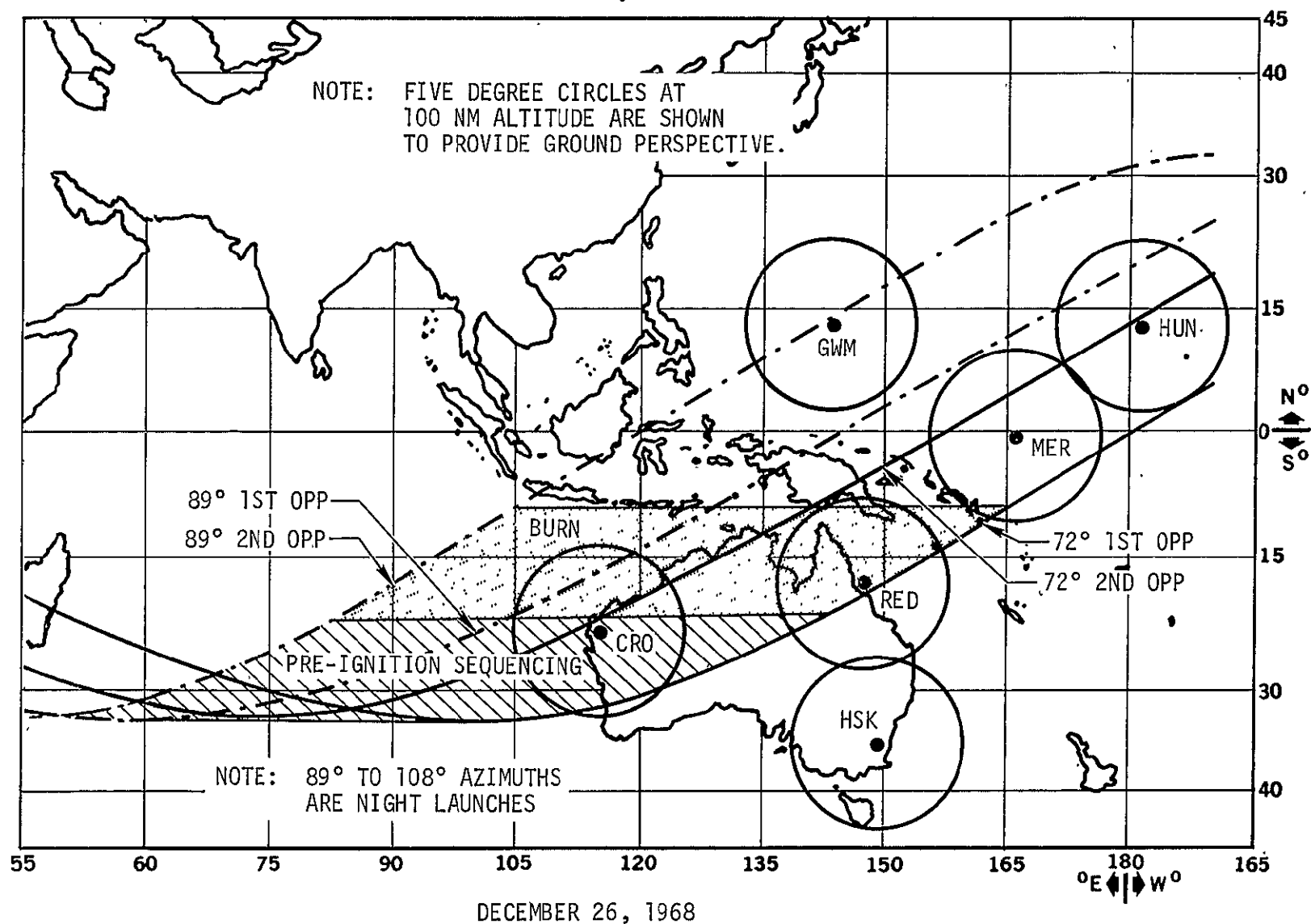
DECEMBER 27, 1968

Figure 2-10a. Ground Projection of Pre-Ignition Sequencing and S-IVB 2nd Burn (Sheet 8 of 8)

Figure 2-10b. Translunar Coast Ground Trace from TLI to Propellant Dump (Sheet 1 of 2)

SECOND OPPORTUNITY DECEMBER 21, 1968
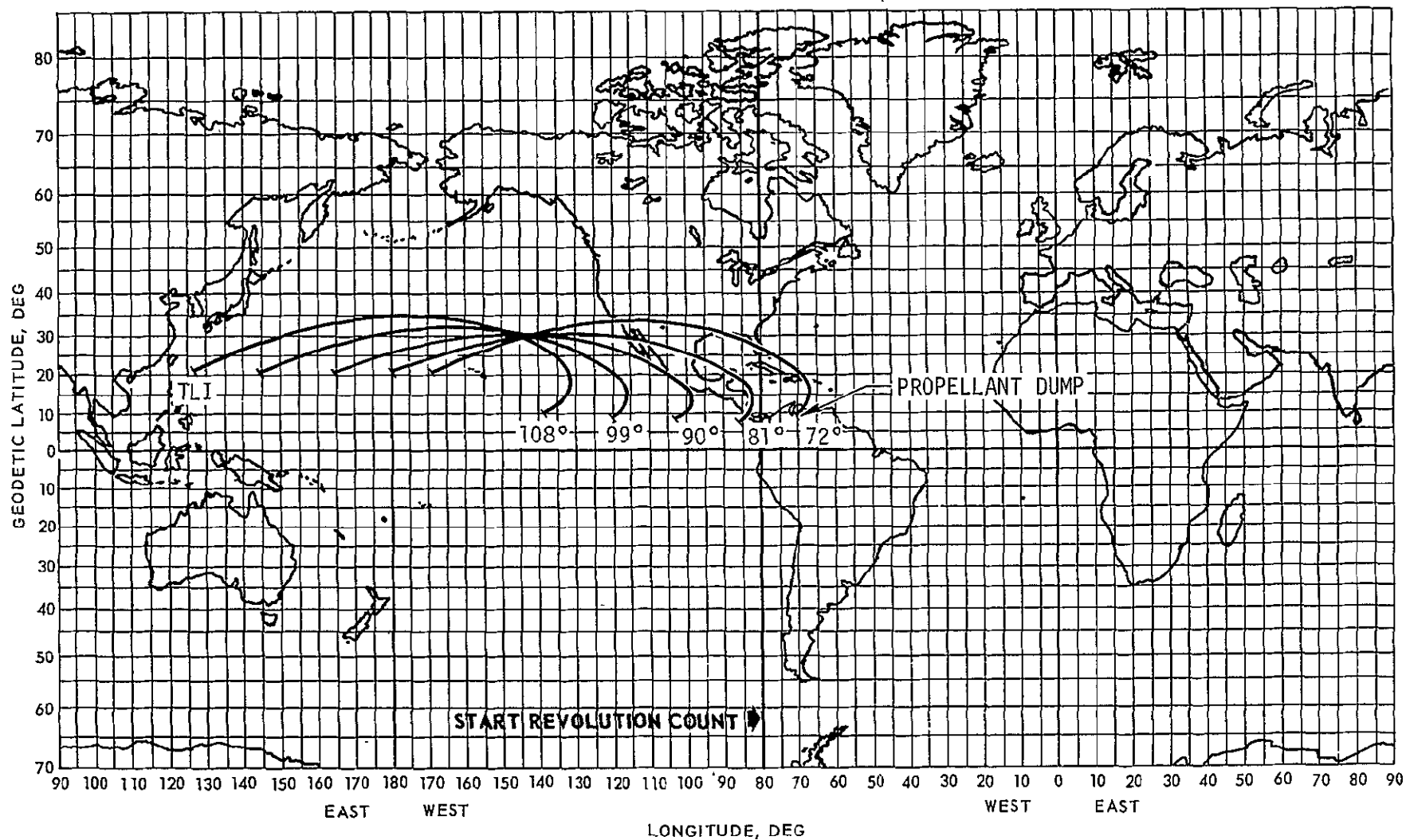
Figure 2-10b. Translunar Coast Ground Trace from TLI to Propellant Dump (Sheet 2 of 2)
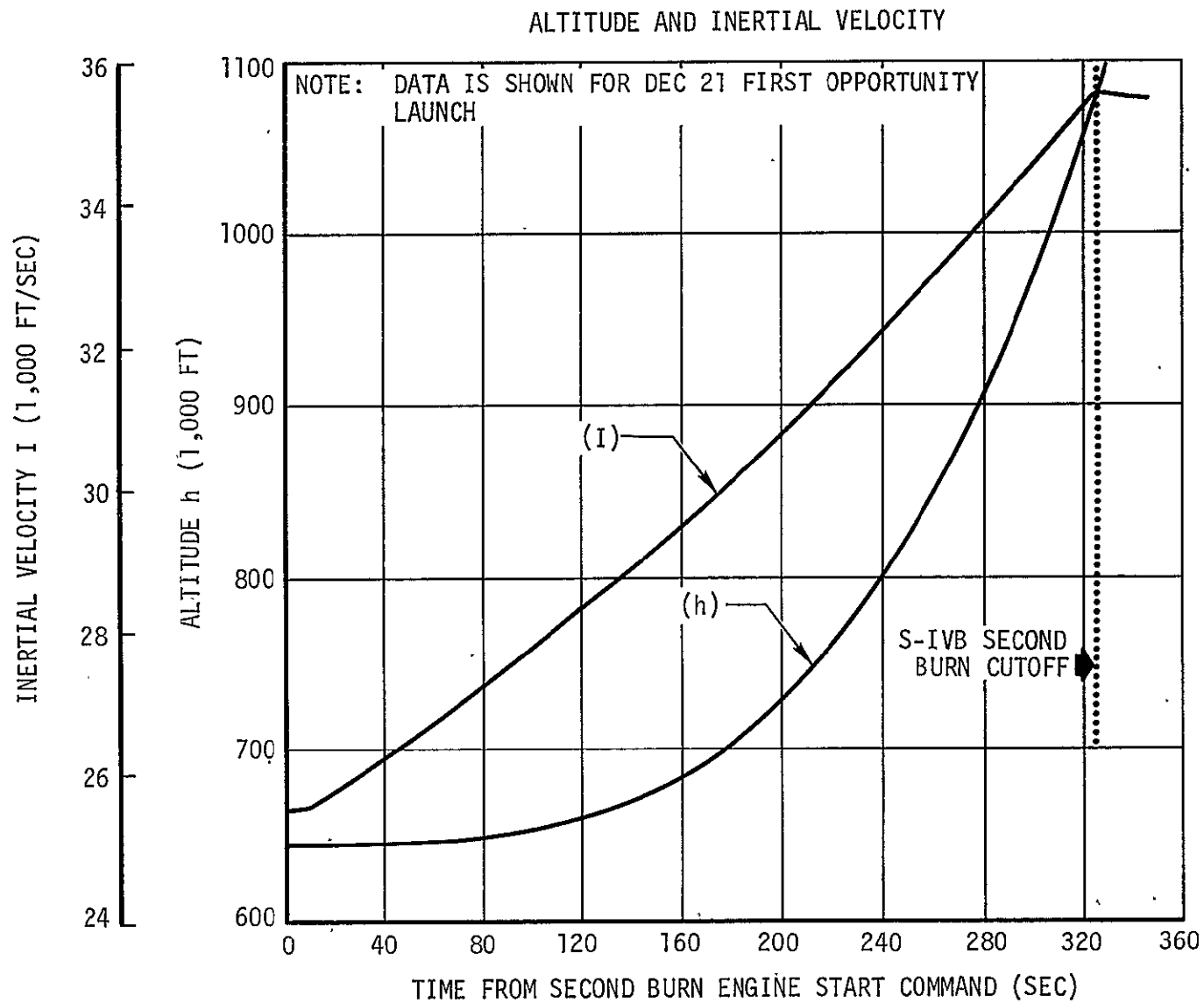
ALTITUDE AND INERTIAL VELOCITY

Figure 2-11. Typical Trajectory Profile - S-IVB Second Burn (Sheet 1 of 7)

AXIAL ACCELERATION

NOTE: DATA SHOWN IS TYPICAL FOR ANY LAUNCH DAY, AZIMUTH, OR OPPORTUNITY.
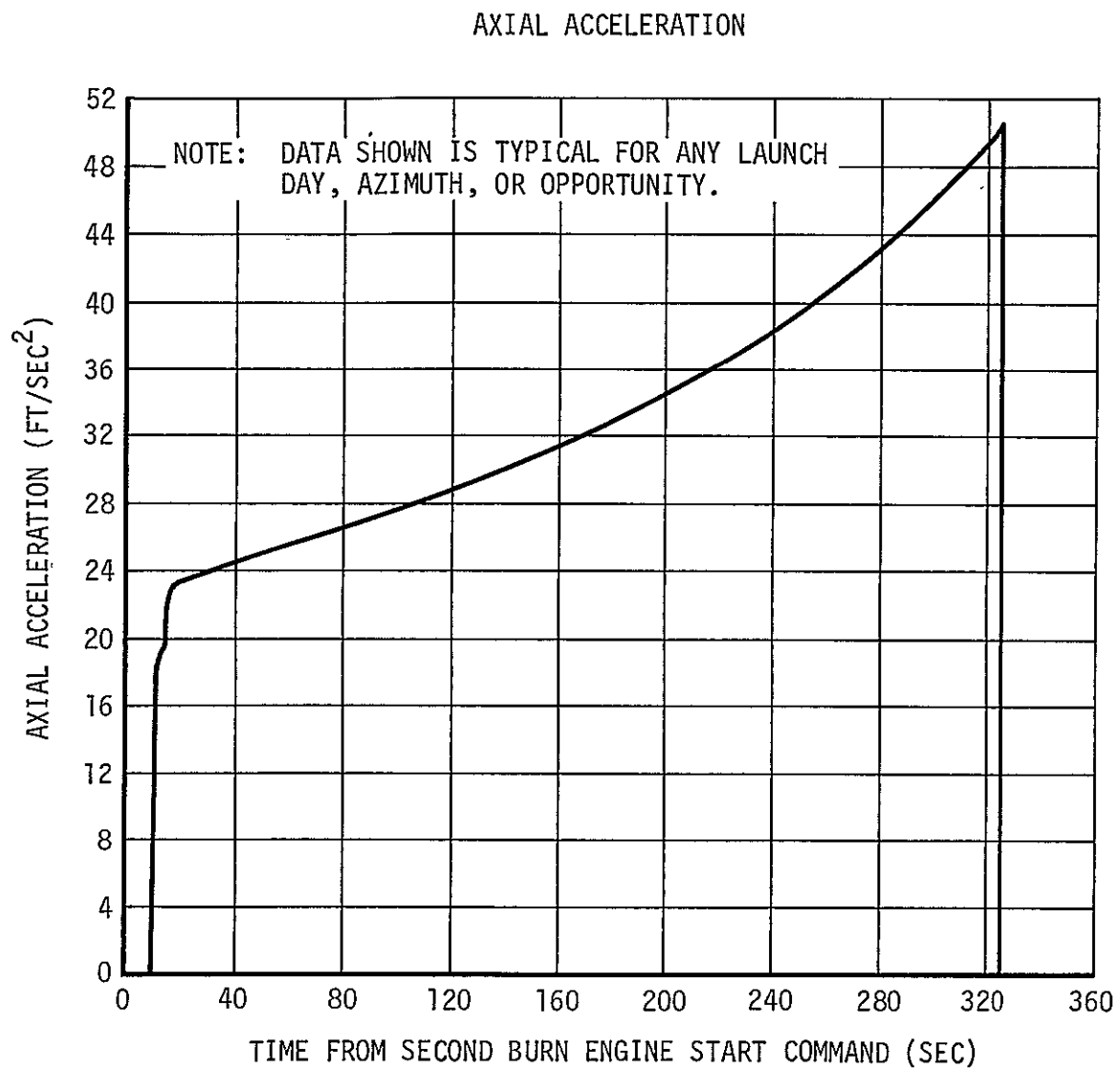
Figure 2-11. Typical Trajectory Profile - S-IVB Second Burn (Sheet 2 of 7)

INERTIAL ELEVATION AND AZIMUTH FLIGHT PATH ANGLES

NOTE: DATA SHOWN IS TYPICAL FOR ANY LAUNCH DAY, AZIMUTH, OR OPPORTUNITY.

γ_{1_I}'

NOTE: DATA SHOWN IS FOR DEC 21 LAUNCH

γ_{2_I}' (1ST OPP)

γ_{2_I}' (2ND OPP)

TIME FROM SECOND BURN ENGINE START COMMAND (SEC)
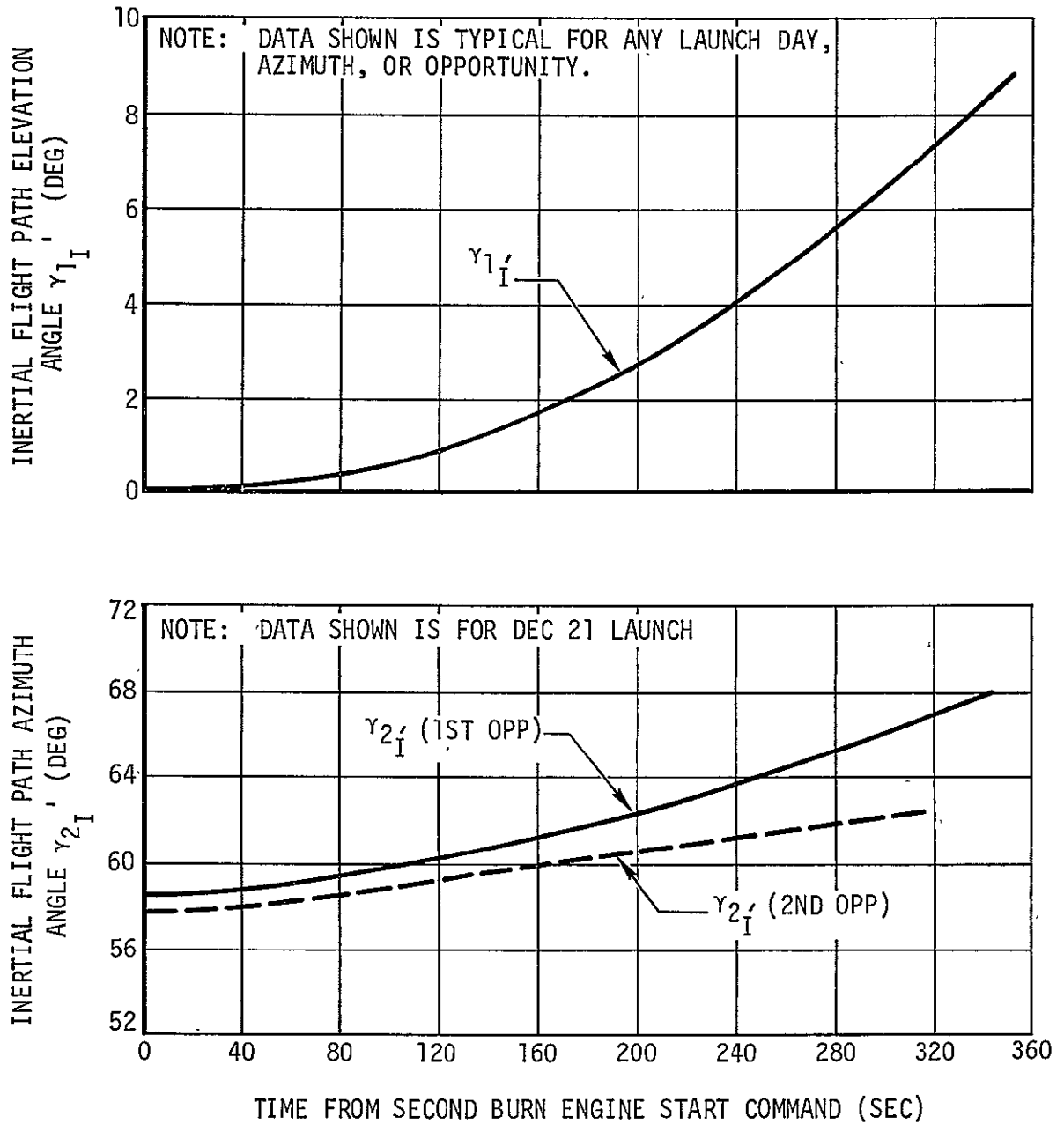
Figure 2-11. Typical Trajectory Profile - S-IVB Second Burn (Sheet 3 of 7)
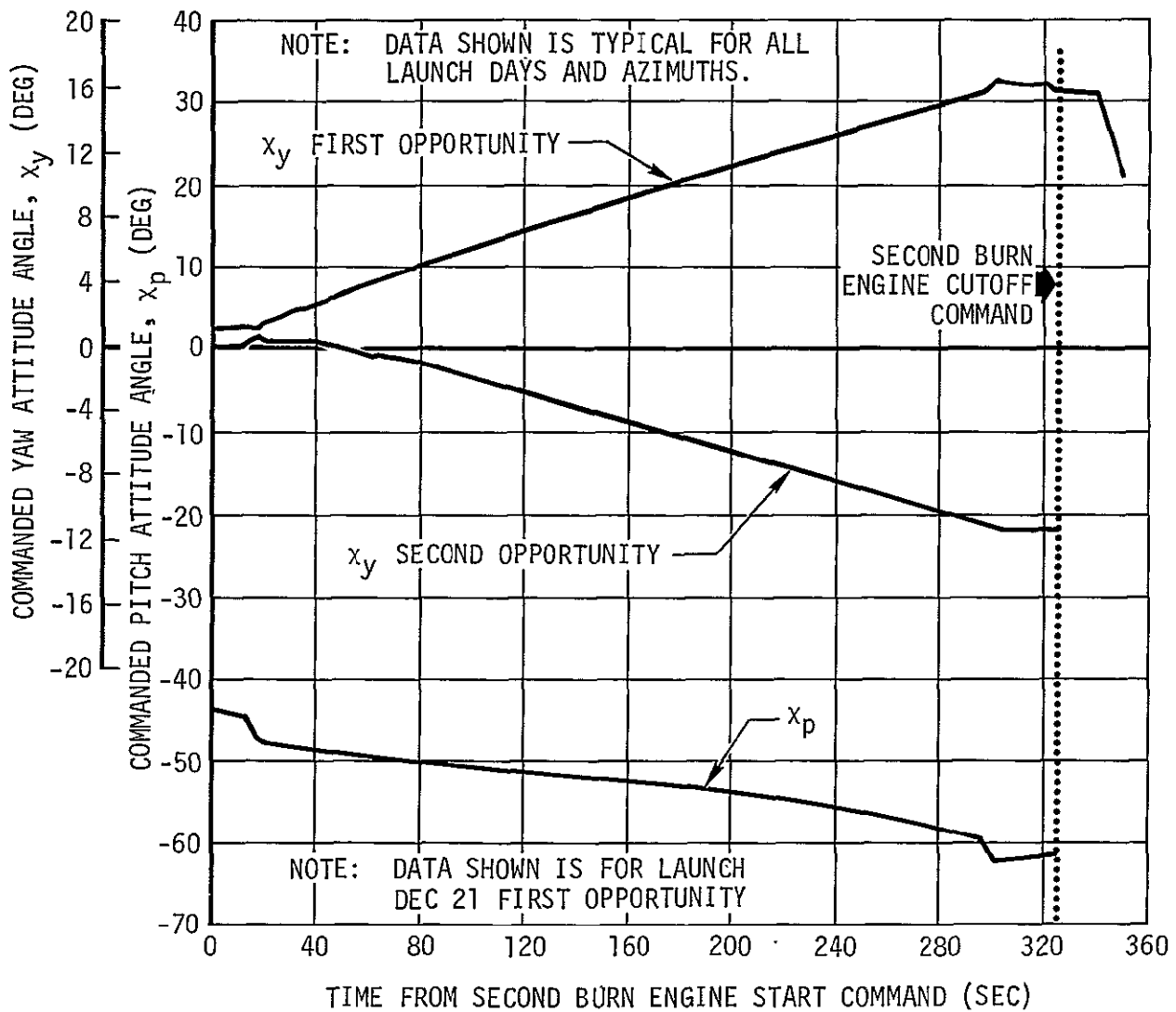
Figure 2-11. Typical Trajectory Profile - S-IVB Second Burn (Sheet 4 of 7)
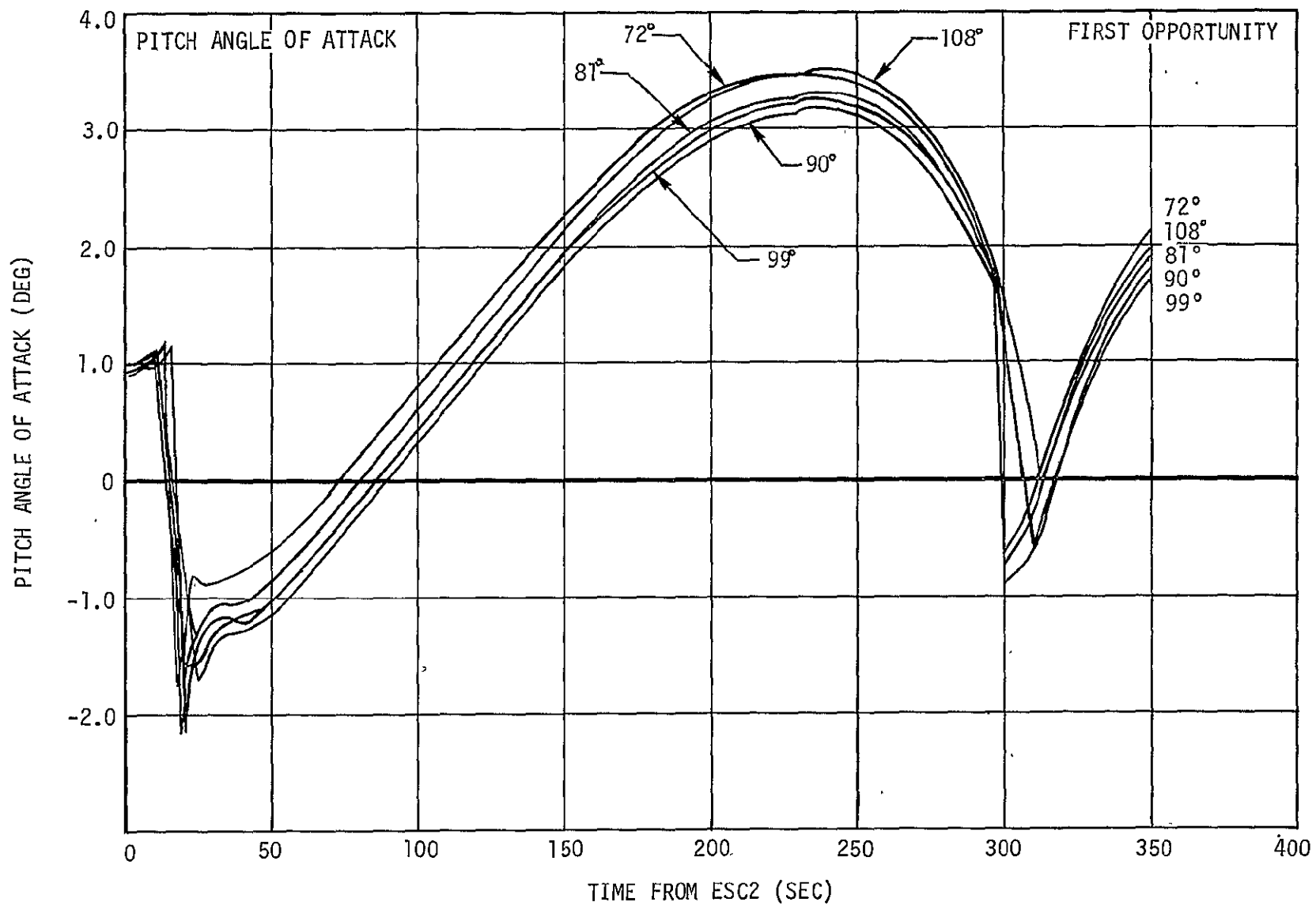
Figure 2-11. Typical Trajectory Profile – S-IVB Second Burn (Sheet 5 of 7)
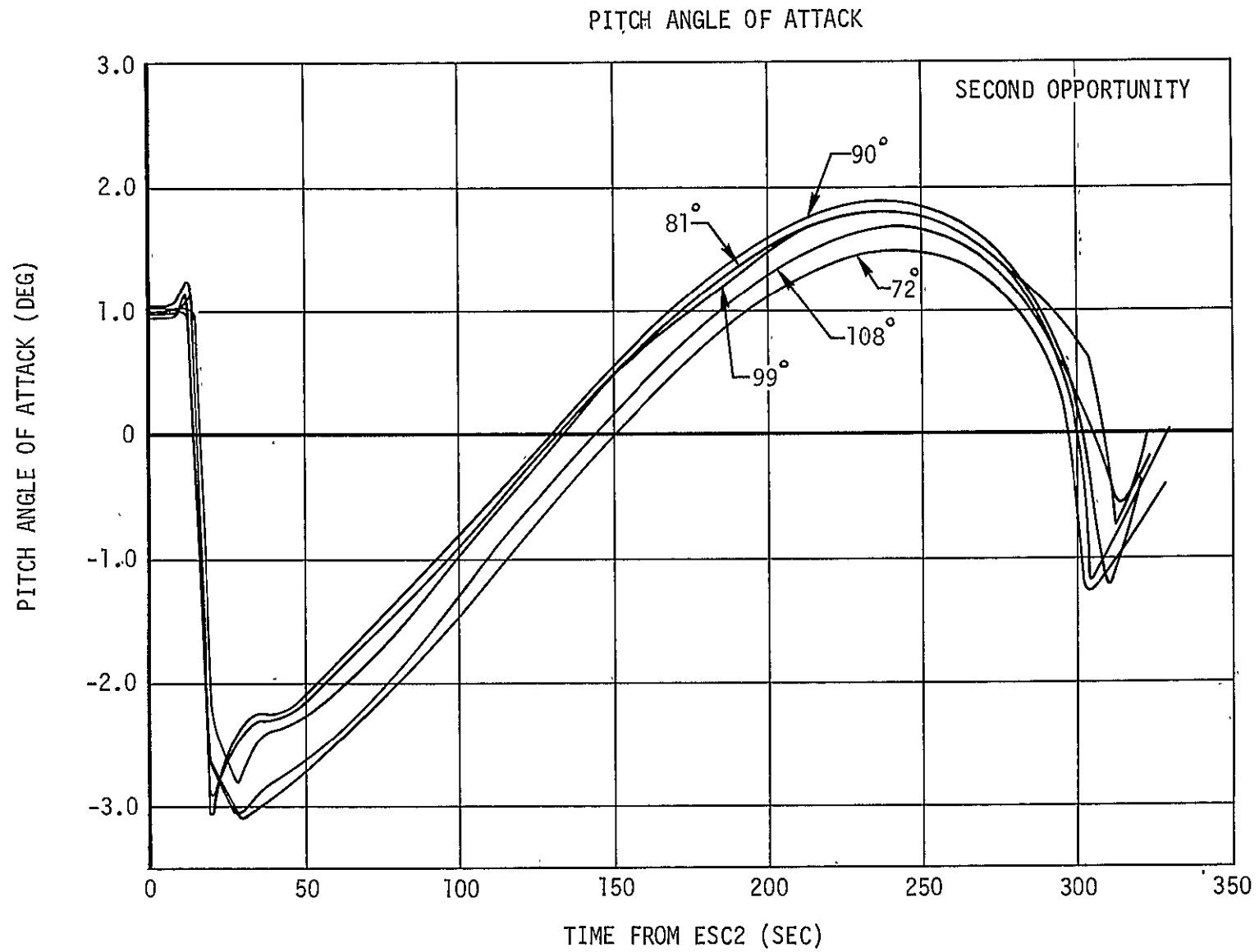
PITCH ANGLE OF ATTACK

Figure 2-11. Typical Trajectory Profile - S-IVB Second Burn (Sheet 6 of 7)

YAW ANGLE OF ATTACK ENVELOPE
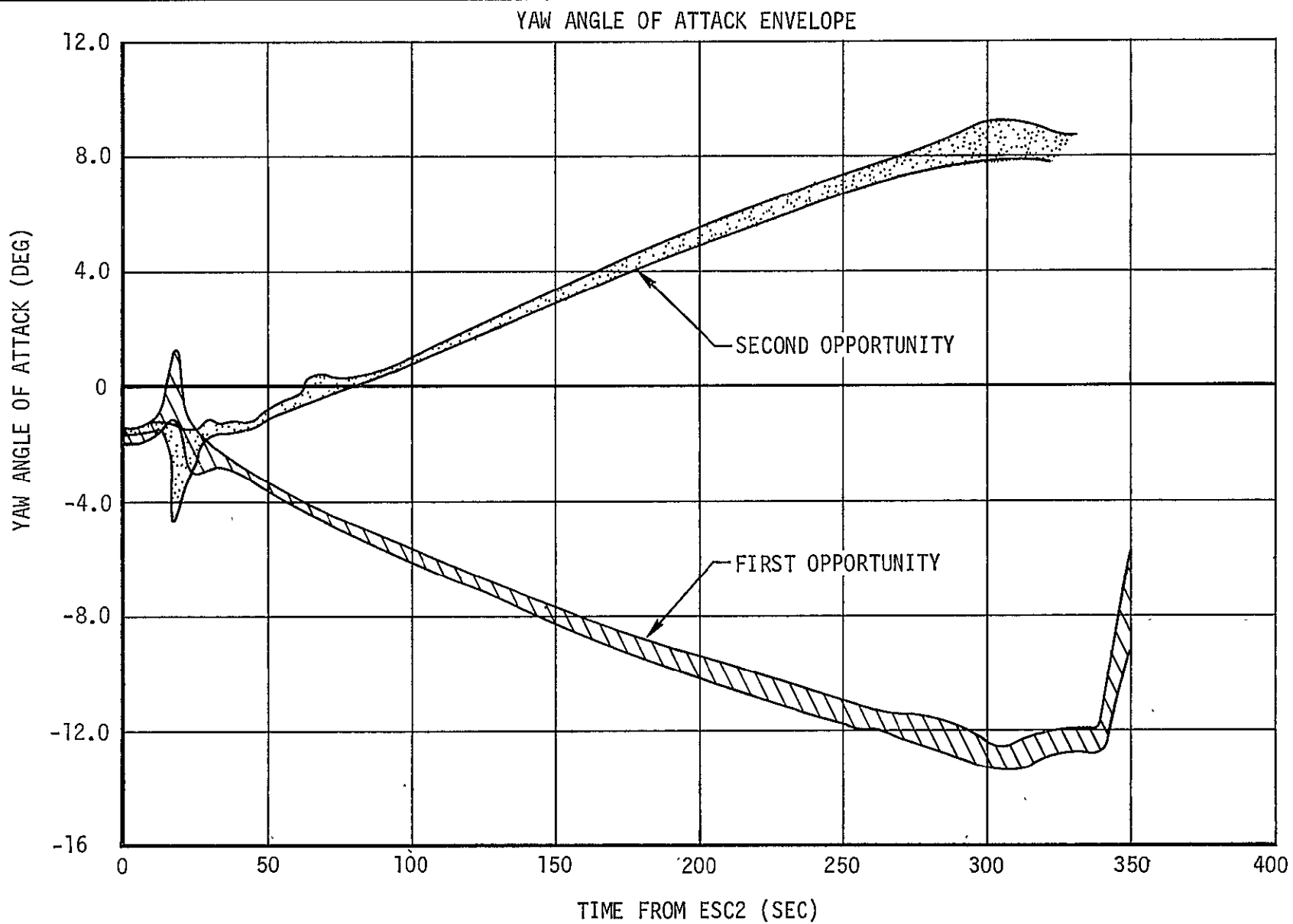
Figure 2-11. Typical Trajectory Profile - S-IVB Second Burn (Sheet 7 of 7)
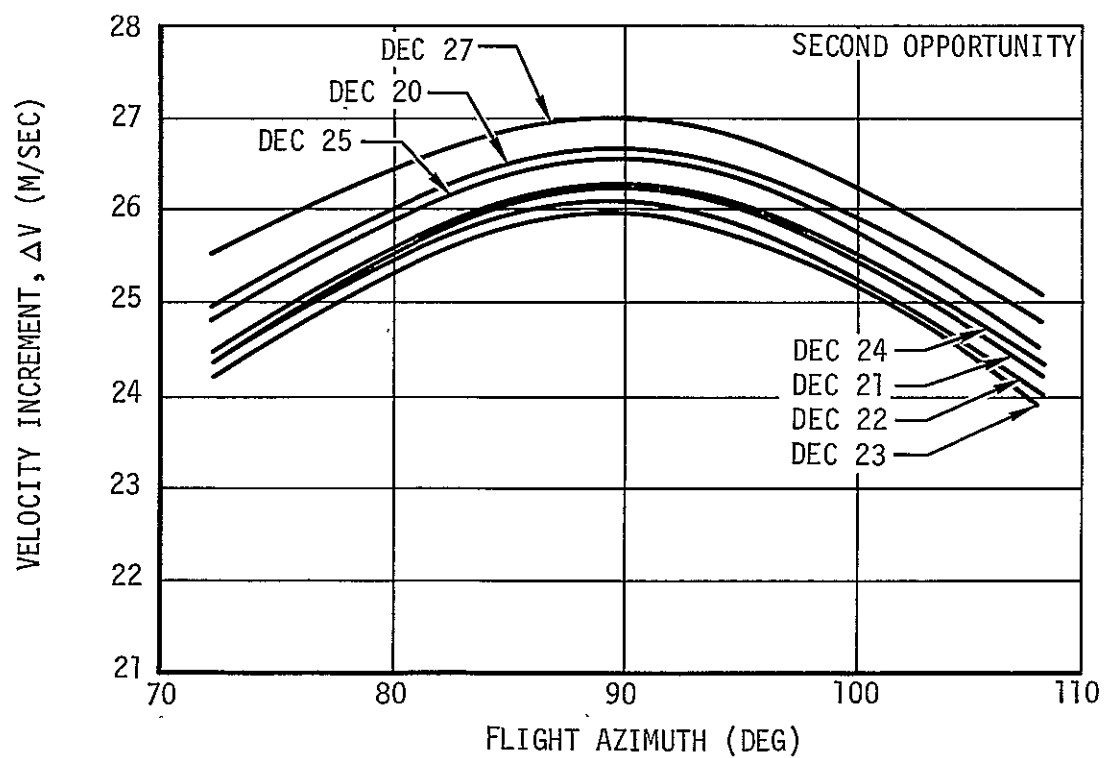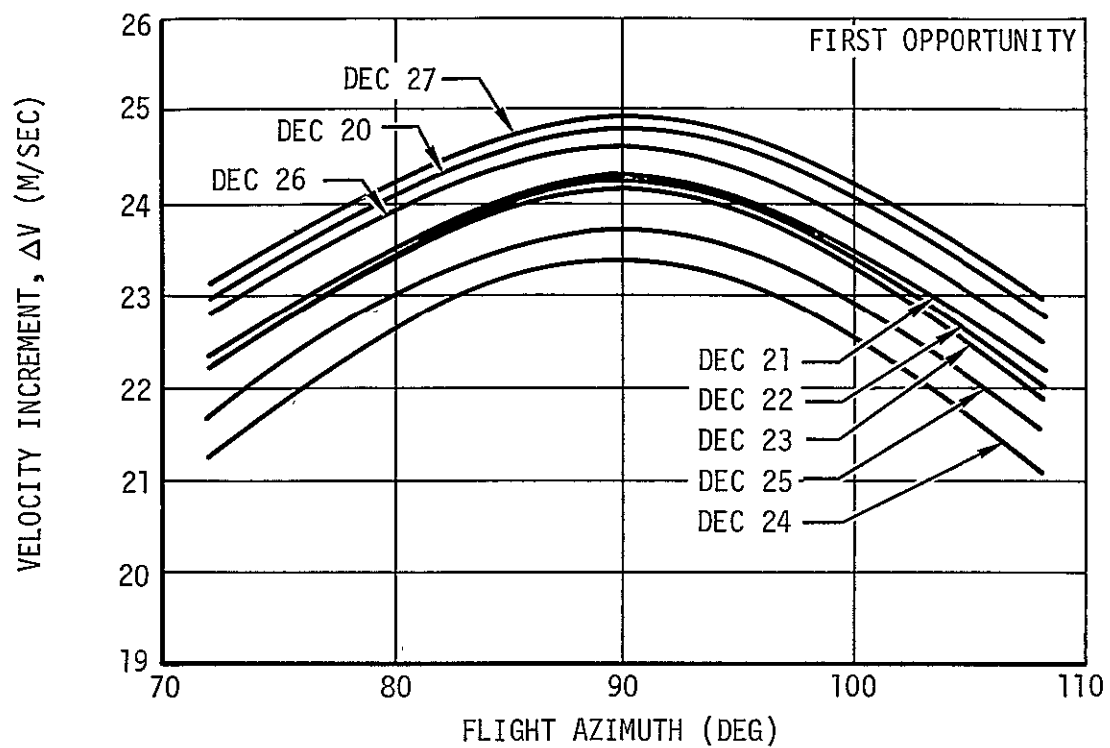
Figure 2-12a. Velocity Increment Due to LOX Dump
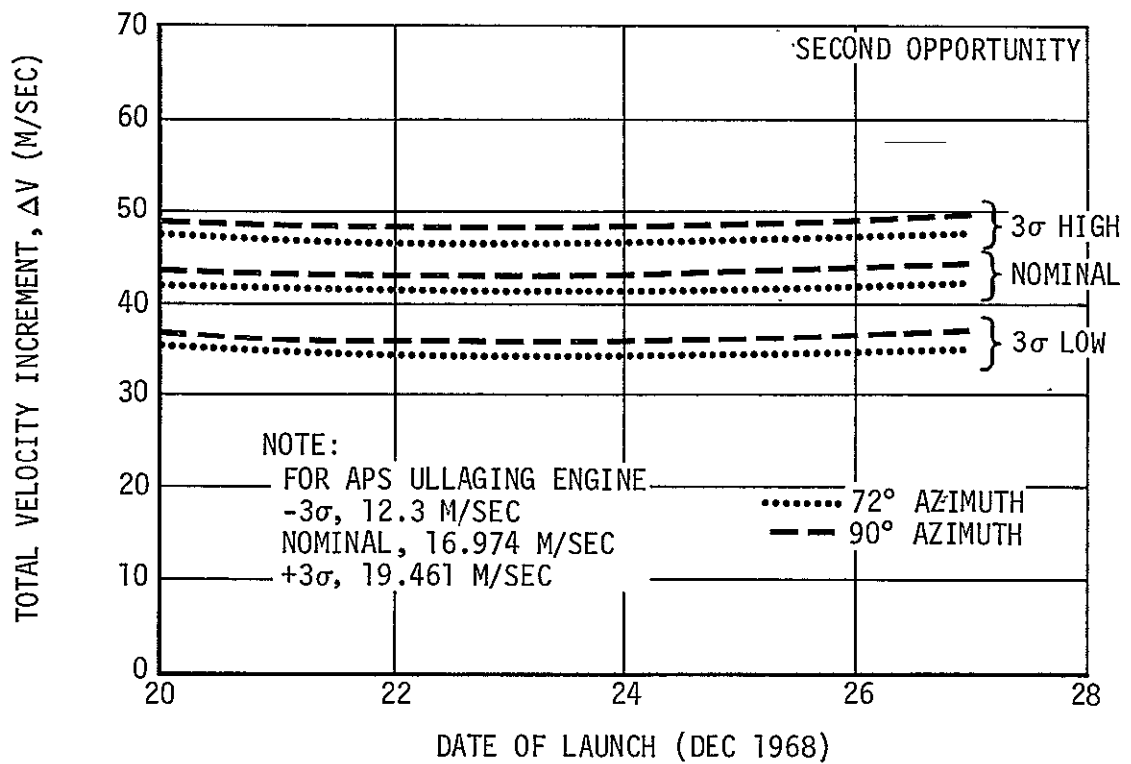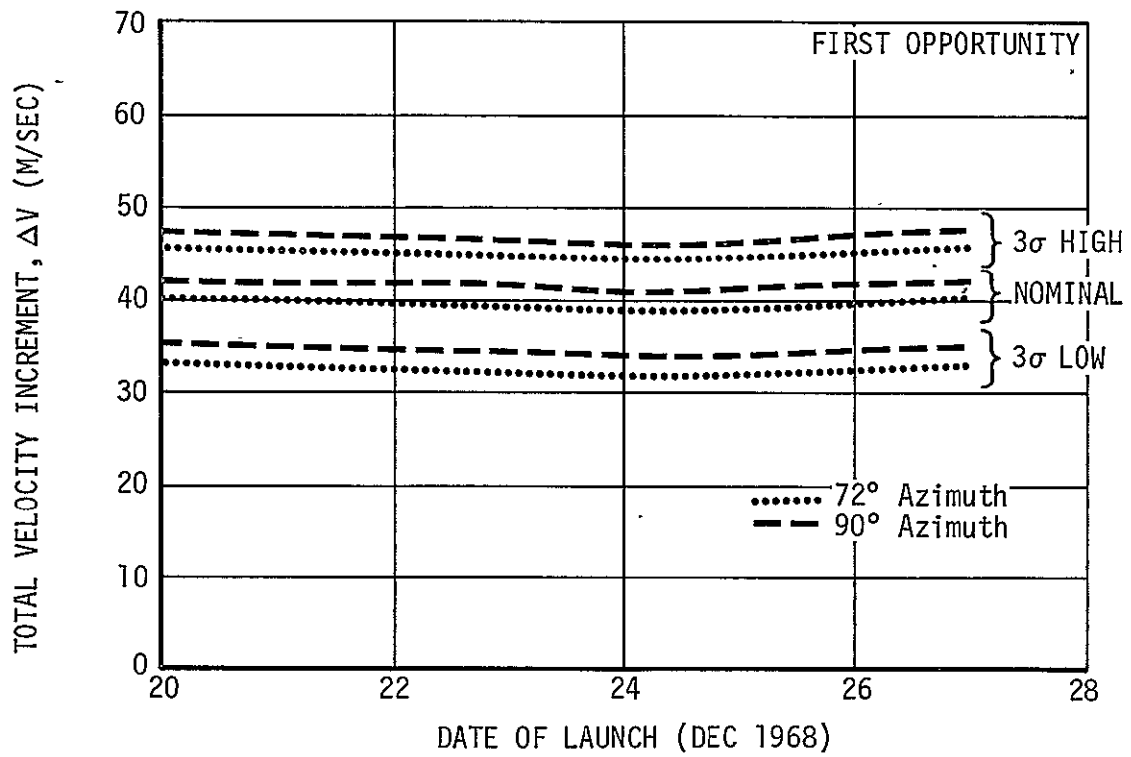
Figure 2-12b. Total Velocity Increment for LOX Dump and APS Burn

EARTH PARKING ORBIT

POSITION 1

INERTIAL HOLD	ALIGN ALONG LOCAL HORIZONTAL	S-IVB RESTART ATTITUDE (ALONG LOCAL HORIZONTAL)
TB5 +0	TB5 +20	TB6 +0

POST TRANSLUNAR INJECTION

INERTIAL HOLD	ALIGN ALONG LOCAL HORIZONTAL	START CSM SEPARATION AND S-IVB COMMUNICATIONS INERTIAL ATTITUDE	CSM SEPARATION
TB7 +0	TB7 +20	TB7 +900	TB7 +1500

S-IVB SLINGSHOT AND COMMUNICATIONS ATTITUDE	START PROPELLANT DUMP SEQUENCE	TERMINATE PROPELLANT DUMP; OPEN NPVS
TB7 +6540	TB7 +7200	TB7. +8220

Figure 2-13. AS-503 C' ATTITUDE TIMELINE

ALTITUDE AND RANGE
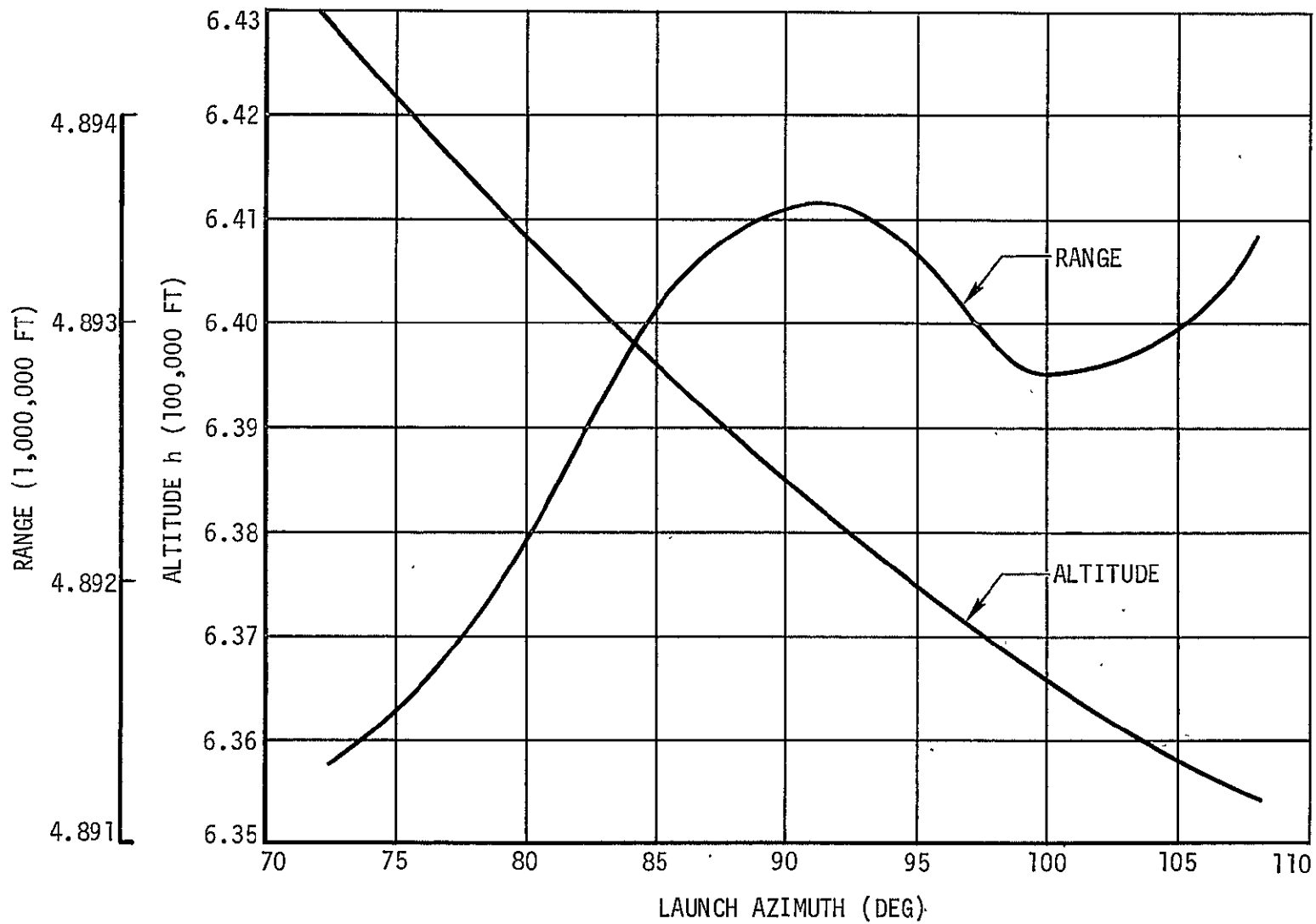
Figure 2-14.   Trajectory Conditions at S-II/S-IVB Separation (Sheet 1 of 3)

INERTIAL VELOCITY AND CROSSRANGE COMPONENT
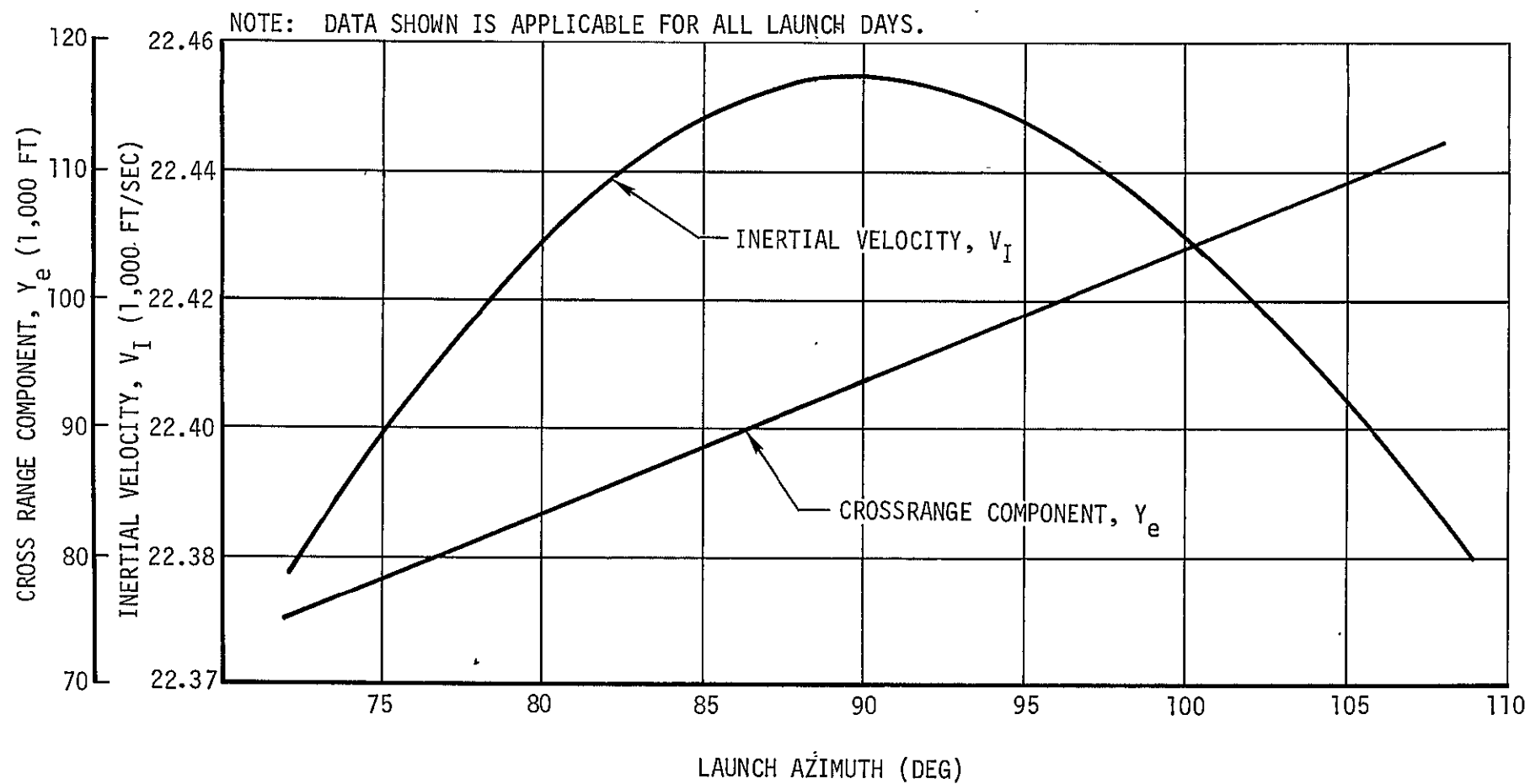
Figure 2-14. Trajectory Conditions at S-II/S-IVB Separation (Sheet 2 of 3)

INERTIAL ELEVATION AND AZIMUTH FLIGHT PATH ANGLES
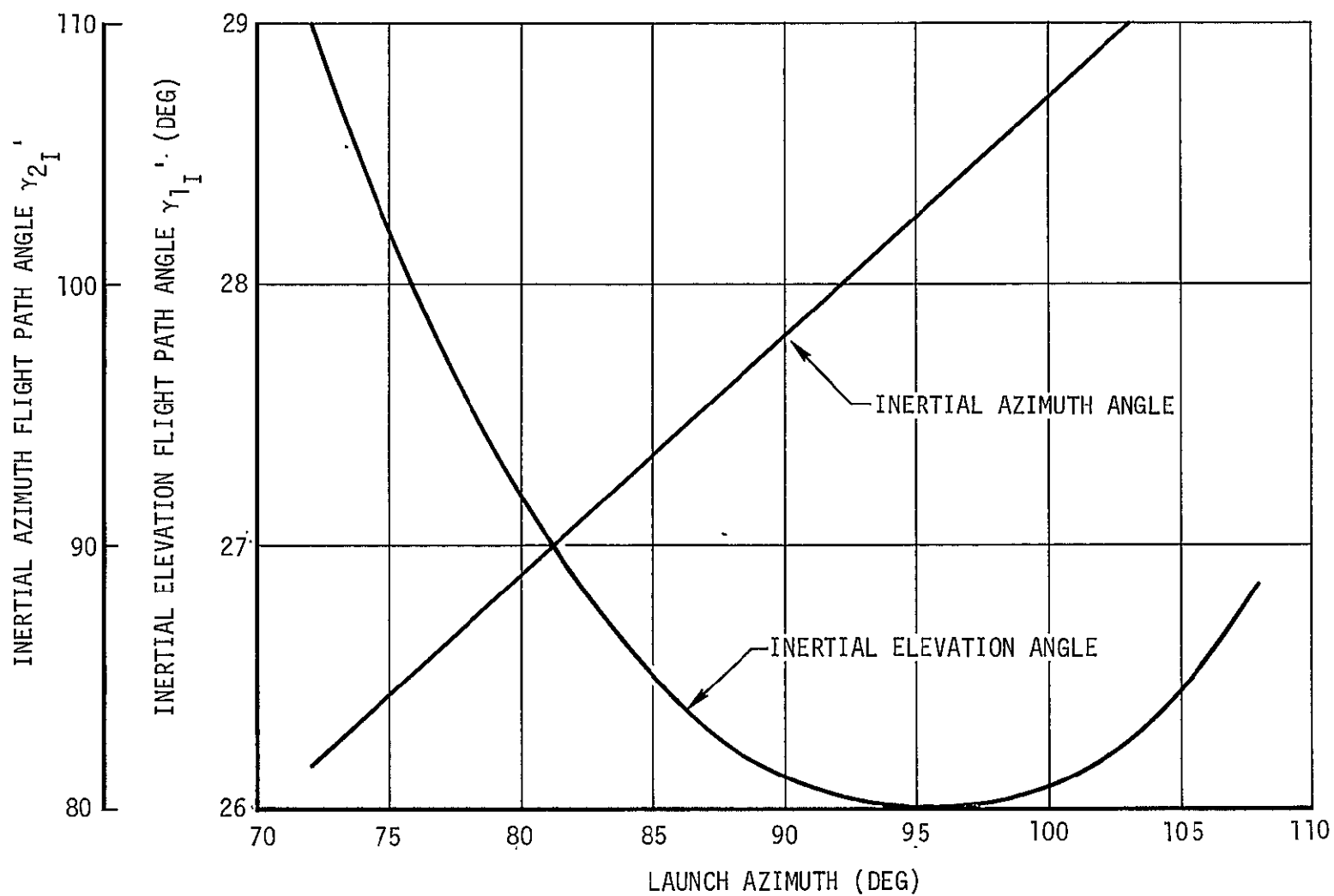
Figure 2-14. Trajectory Conditions at S-II/S-IVB Separation (Sheet 3 of 3)
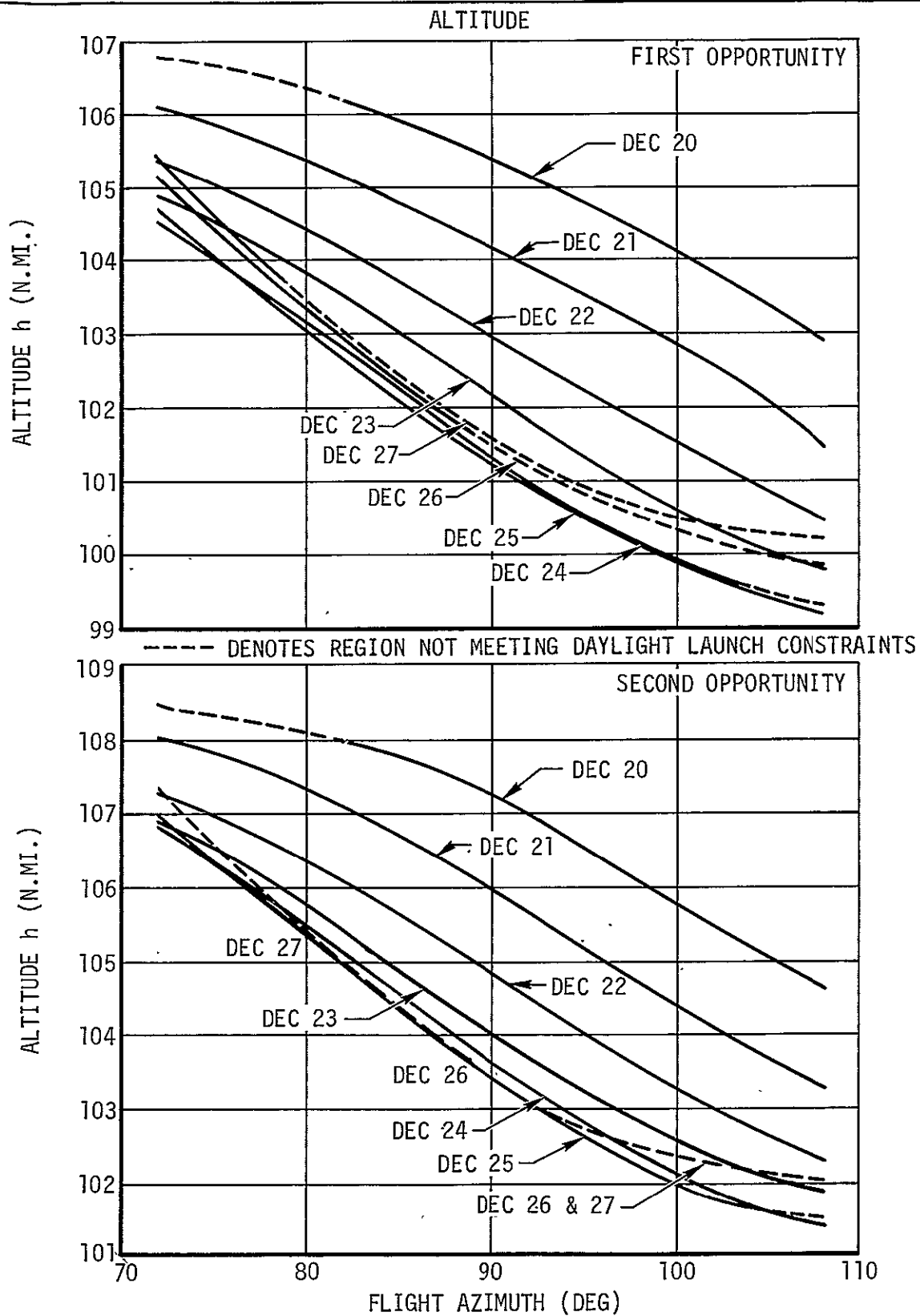
Figure 2-15. Trajectory Conditions at S-IVB Restart (Sheet 1 of 3)
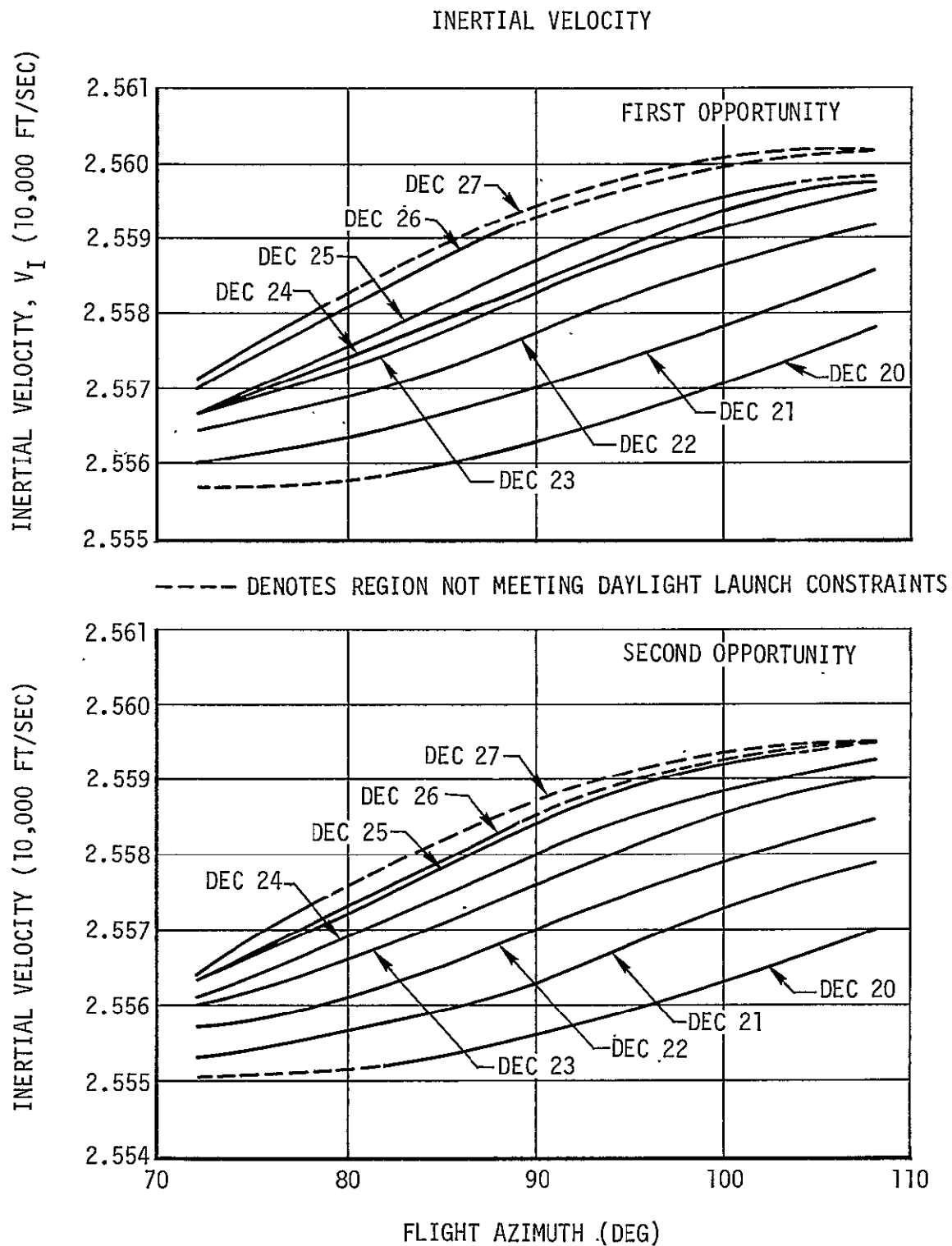
Figure 2-15. Trajectory Conditions at S-IVB Restart (Sheet 2 of 3)

Figure 2-15. Trajectory Conditions at S-IVB Restart (Sheet 3 of 3)
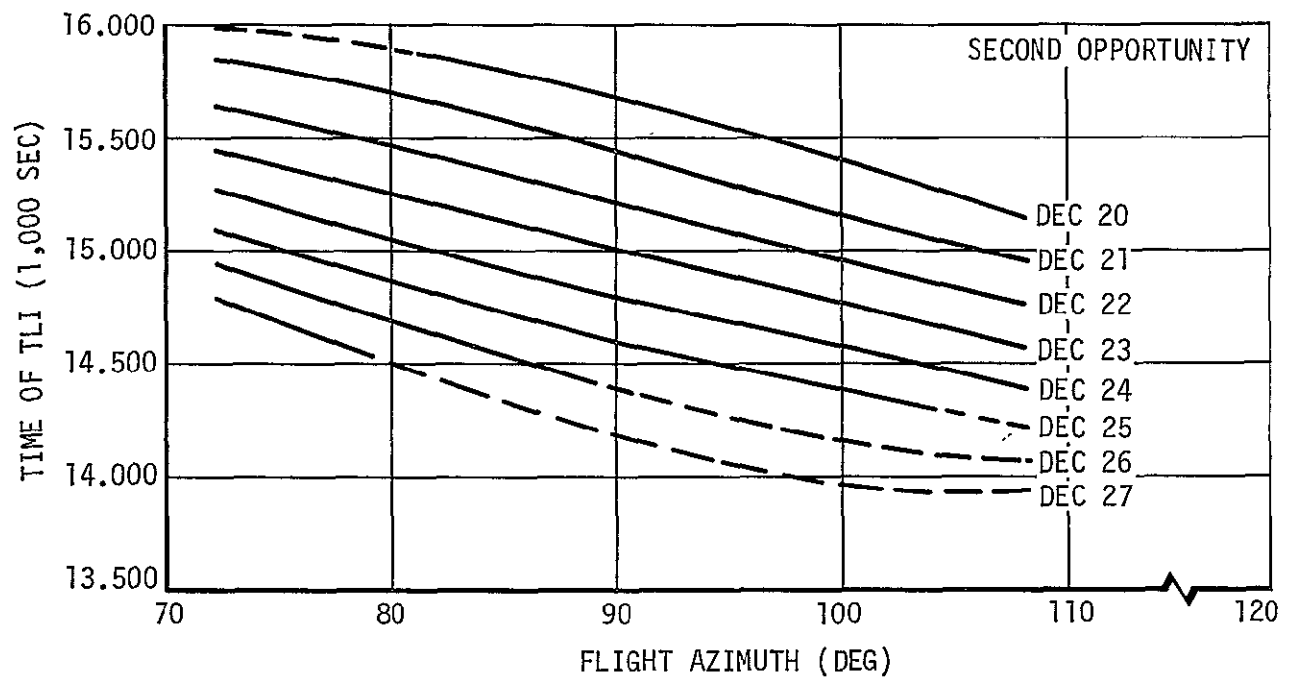
Figure 2-16. Trajectory Conditions at Translunar Orbit Insertion (Sheet 1 of 11)

ALTITUDE

FIRST OPPORTUNITY

DEC 21
DEC 22
DEC 20
DEC 23
DEC 24
DEC 25
DEC 26
DEC 27

- - - - DENOTES REGION NOT MEETING DAYLIGHT LAUNCH CONSTRAINTS

SECOND OPPORTUNITY

DEC 21
DEC 22
DEC 20
DEC 23
DEC 24
DEC 25
DEC 26
DEC 27

ALTITUDE (N.MI.)

FLIGHT AZIMUTH (DEG)

Figure 2-16. Trajectory Conditions at Translunar Orbit Insertion (Sheet 2 of 11)

Figure 2-16. Trajectory Conditions at Translunar Orbit Insertion (Sheet 3 of 11)

INERTIAL ELEVATION FLIGHT PATH ANGLE

DENOTES REGION NOT MEETING DAYLIGHT LAUNCH CONSTRAINTS

Figure 2-16. Trajectory Conditions at Translunar Orbit Insertion (Sheet 4 of 11)

ORBIT INCLINATION
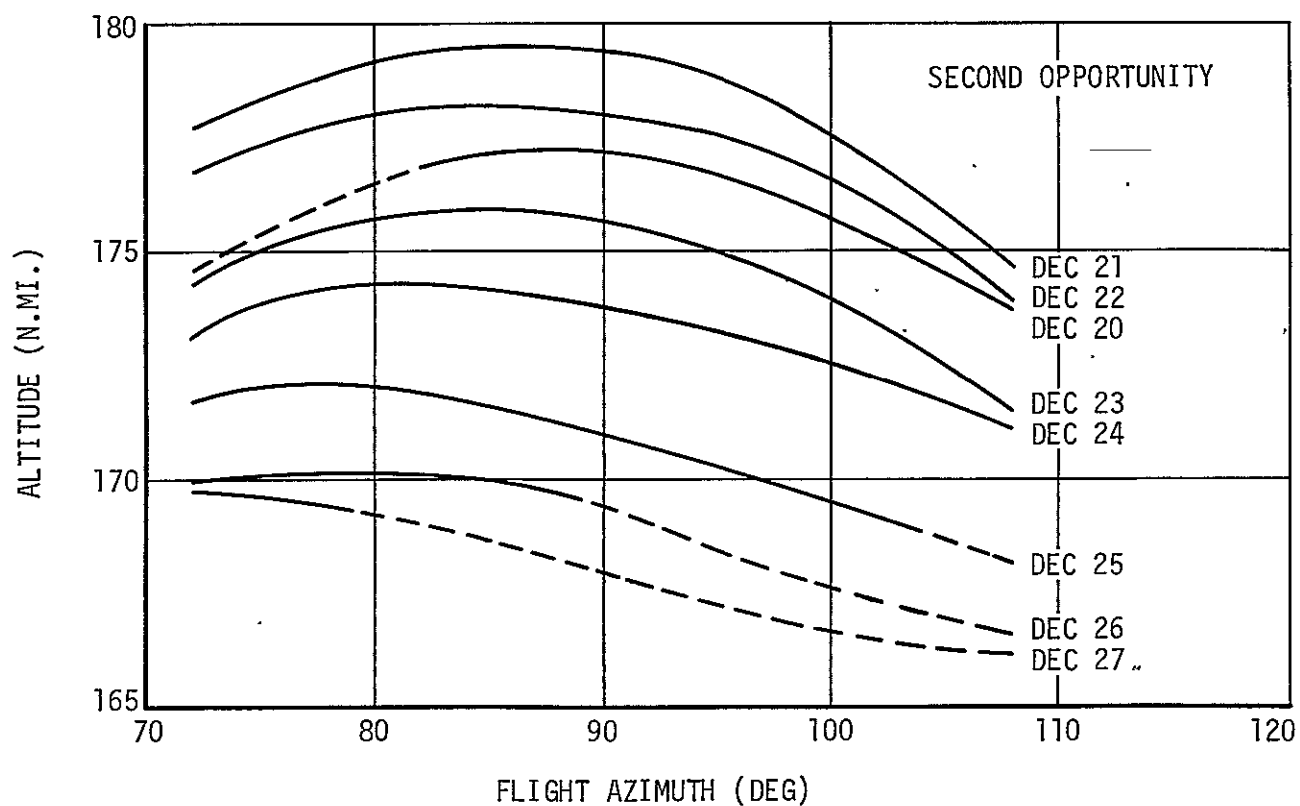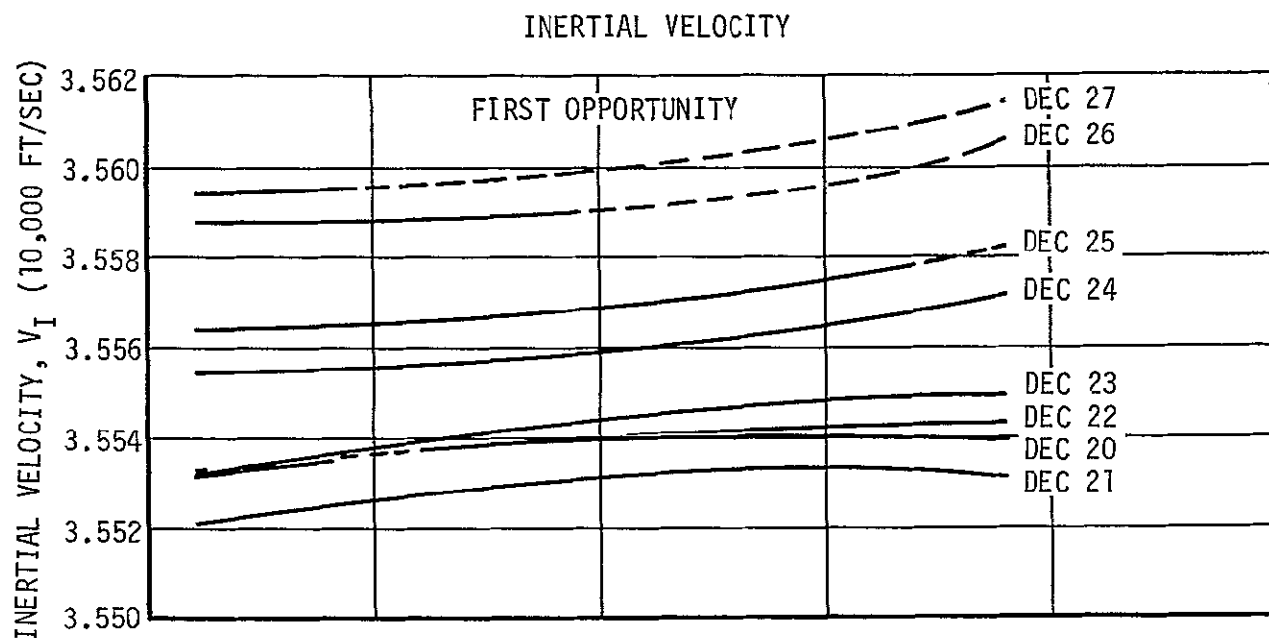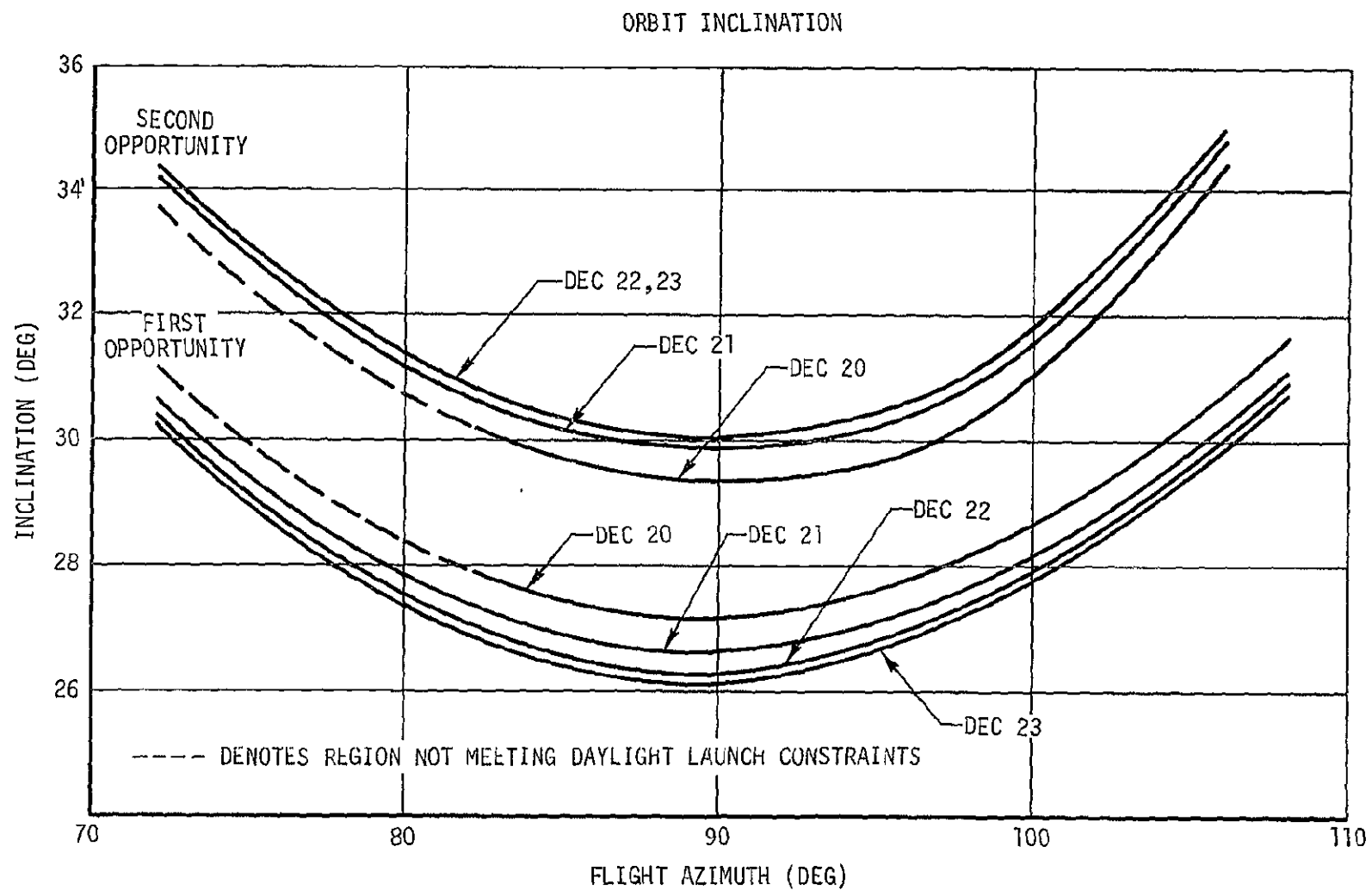
Figure 2-16. Trajectory Conditions at Translunar Orbit Insertion (Sheet 5 of 11)

ORBIT ENERGY

- - - - DENOTES REGION NOT MEETING DAYLIGHT LAUNCH CONSTRAINTS

Figure 2-16.   Trajectory Conditions at Translunar Orbit Insertion (Sheet 6 of 11)
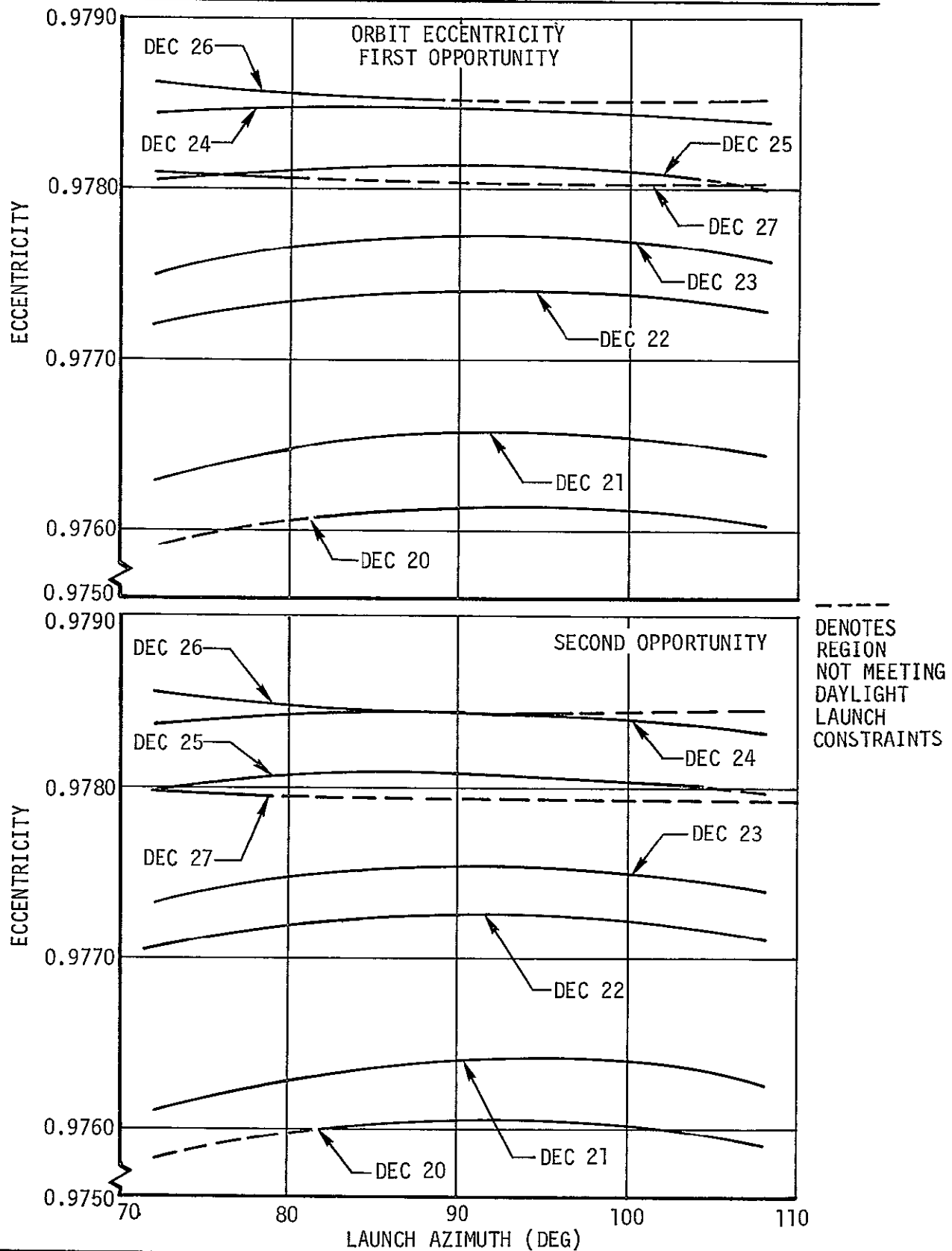
Figure 2-16. Trajectory Conditions at Translunar Orbit Insertion (Sheet 7 of 11)
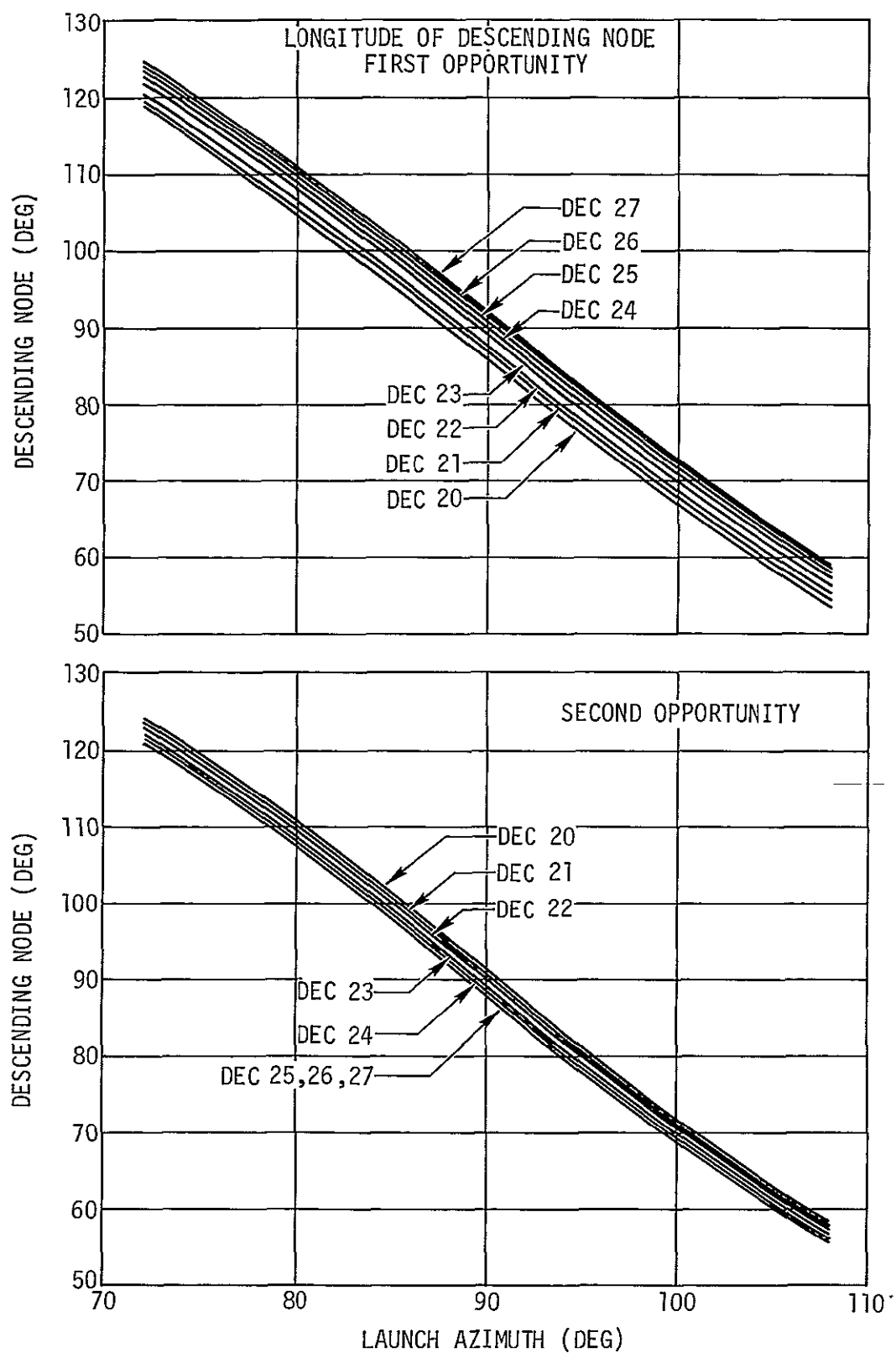
Figure 2-16. Trajectory Conditions at Translunar Orbit Insertion (Sheet 8 of 11)
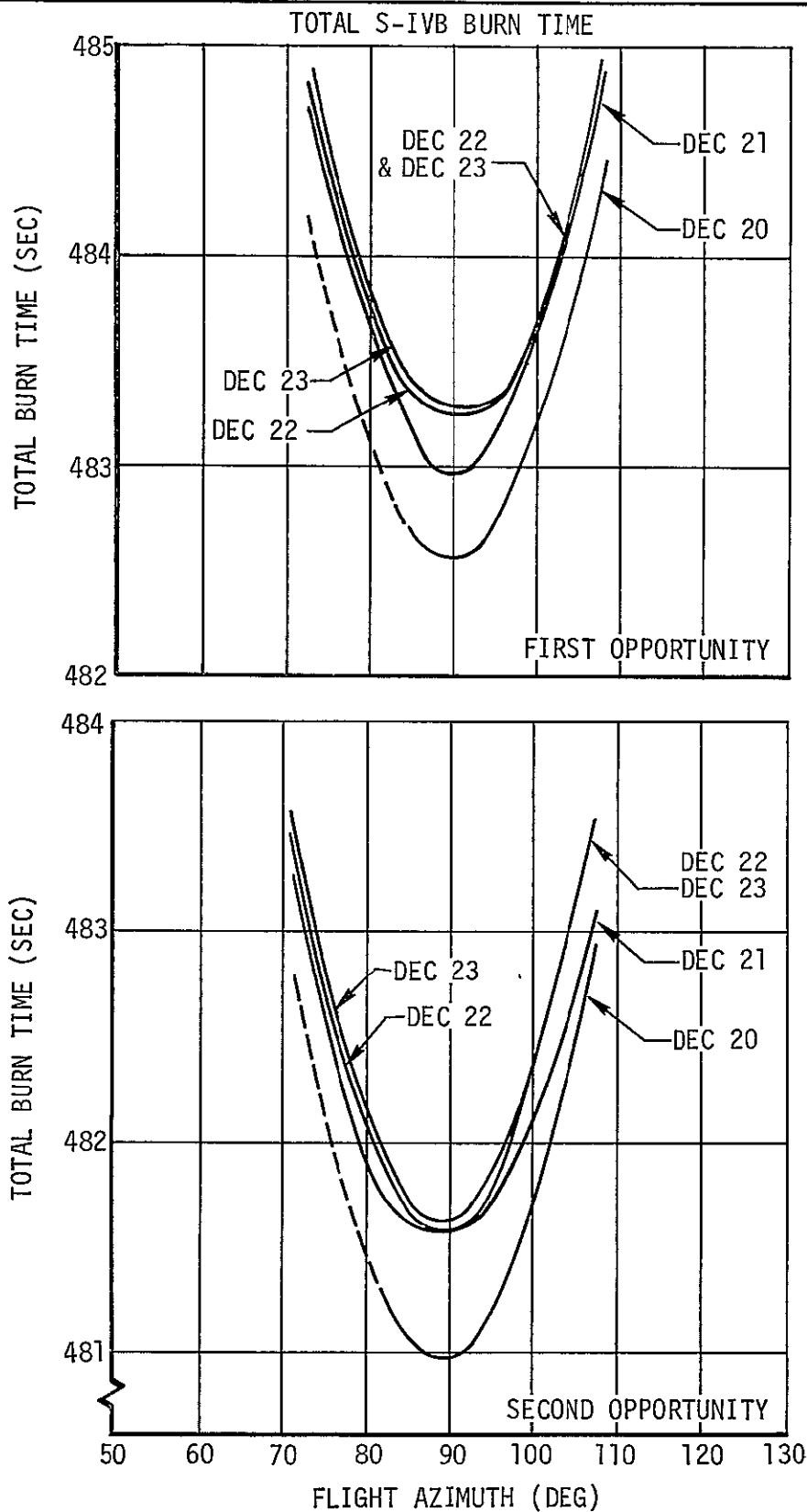
Figure 2-16. Trajectory Conditions at Translunar Orbit Insertion (Sheet 9 of 11)
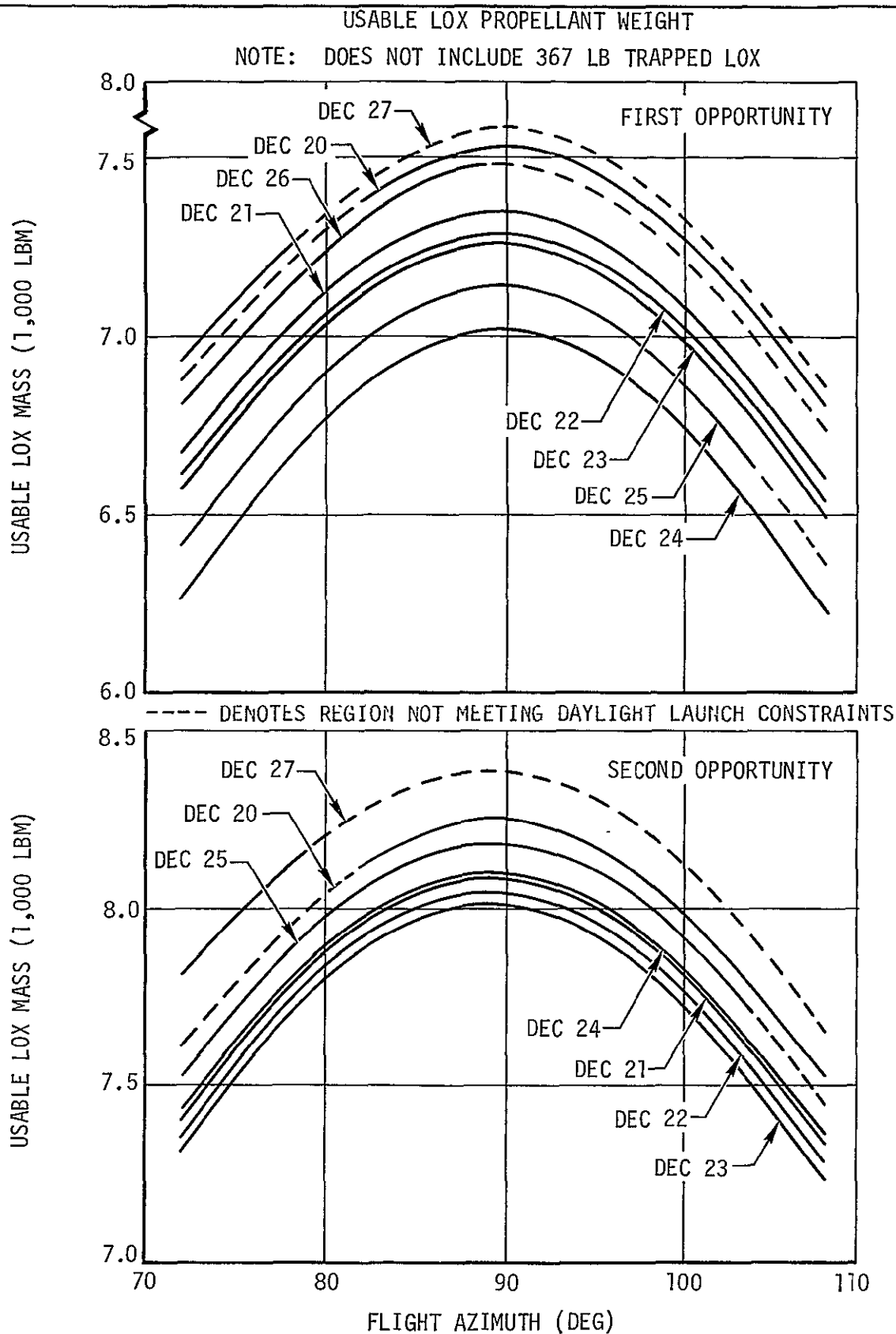
Figure 2-16. Trajectory Conditions at Translunar Orbit Insertion (Sheet 10 of 11)
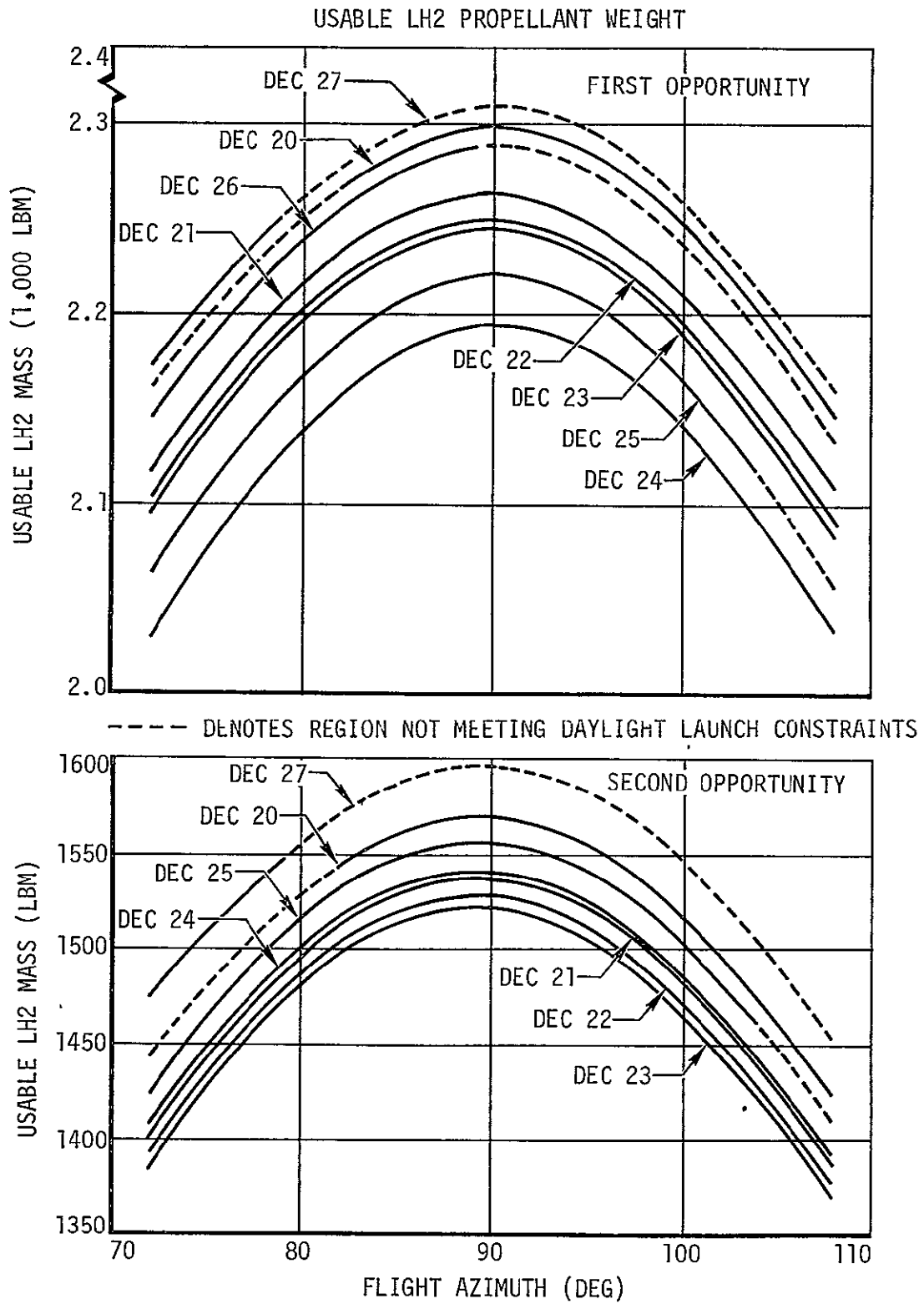
Figure 2-16. Trajectory Conditions at Translunar Orbit Insertion
(Sheet 11 of 11)
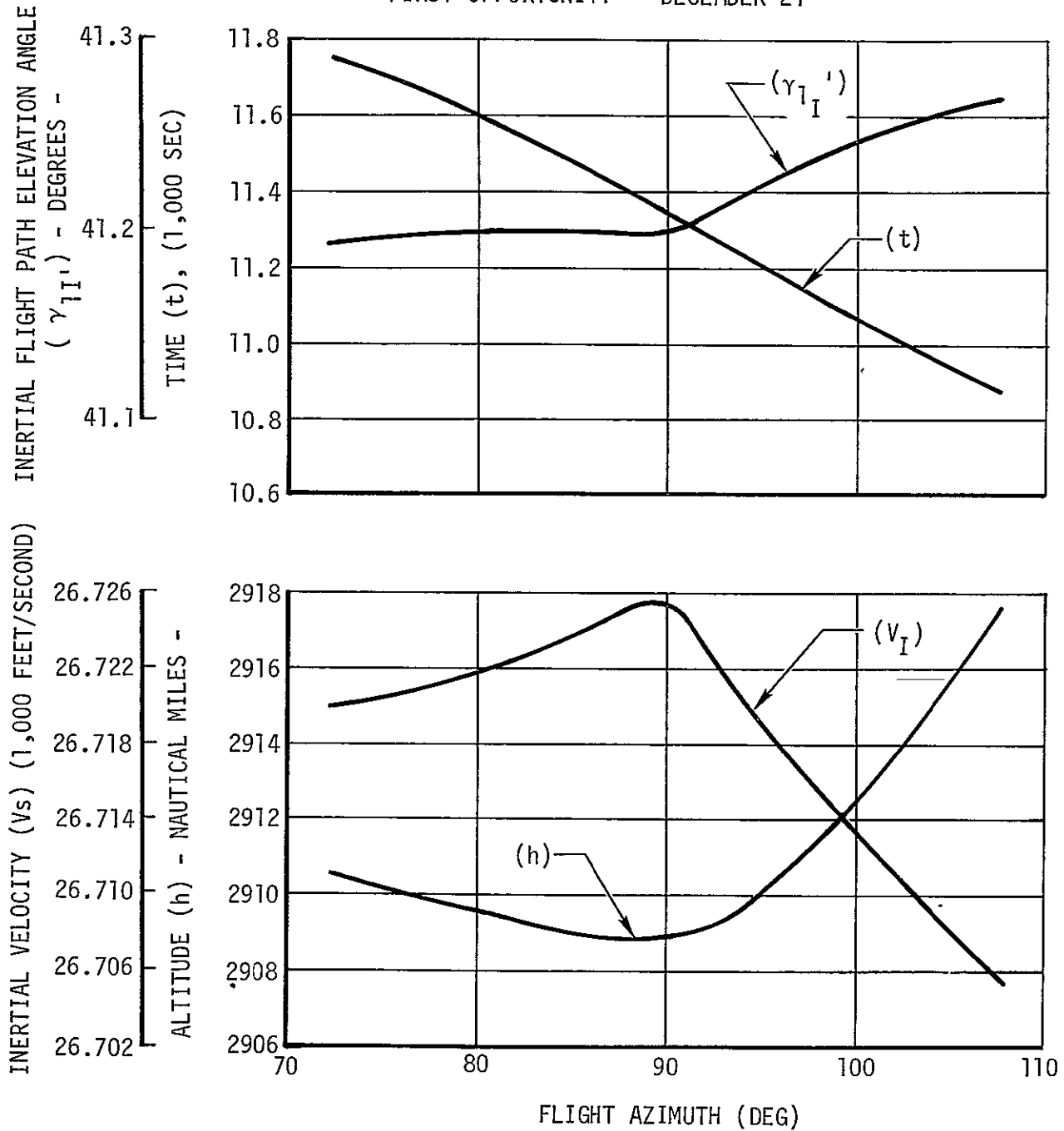
Figure 2-17. Trajectory Conditions at LV/CSM Separation (Sheet 1 of 2)
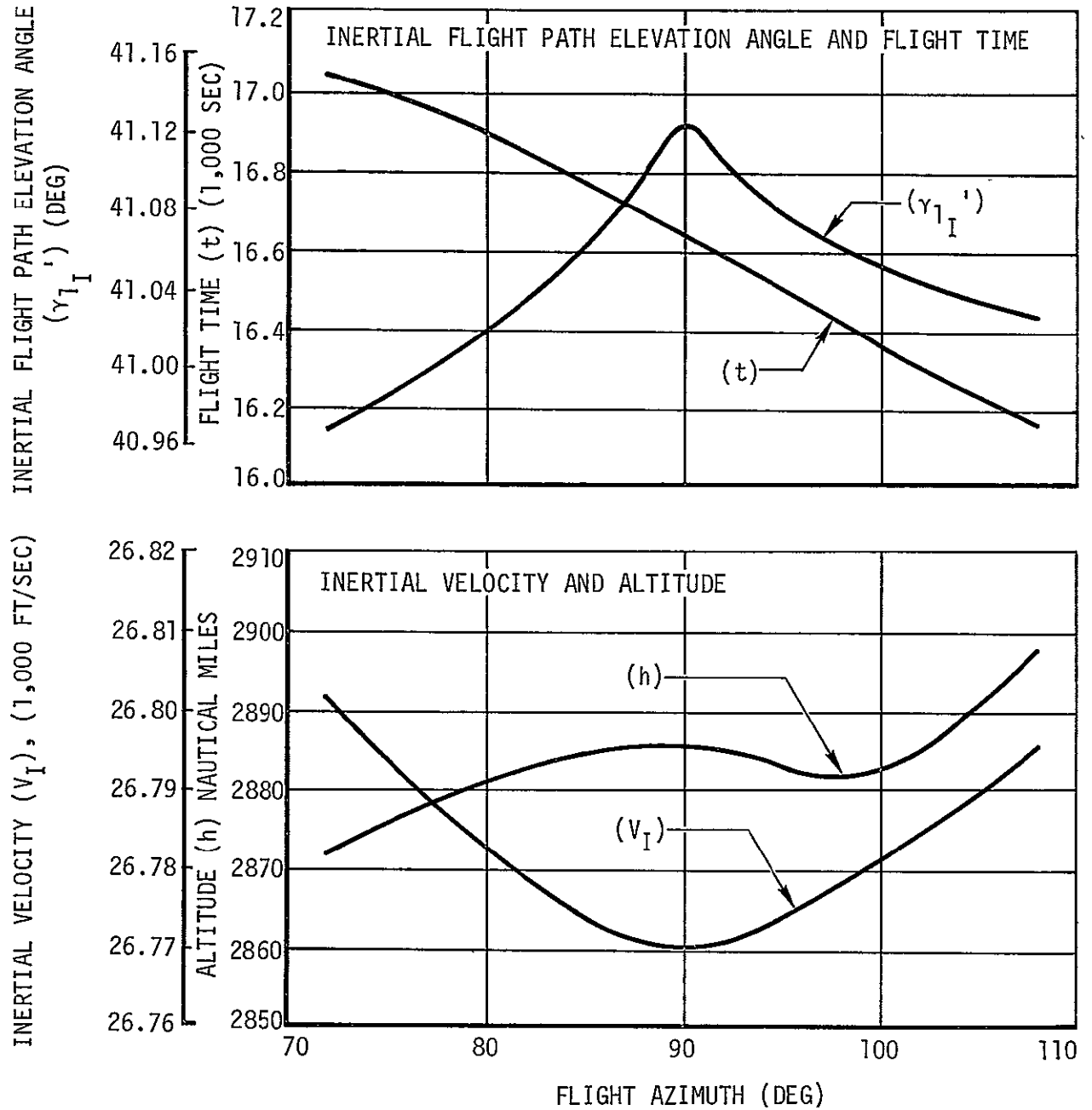
Figure 2-17. Trajectory Conditions at LV/CSM Separation (Sheet 2 of 2)
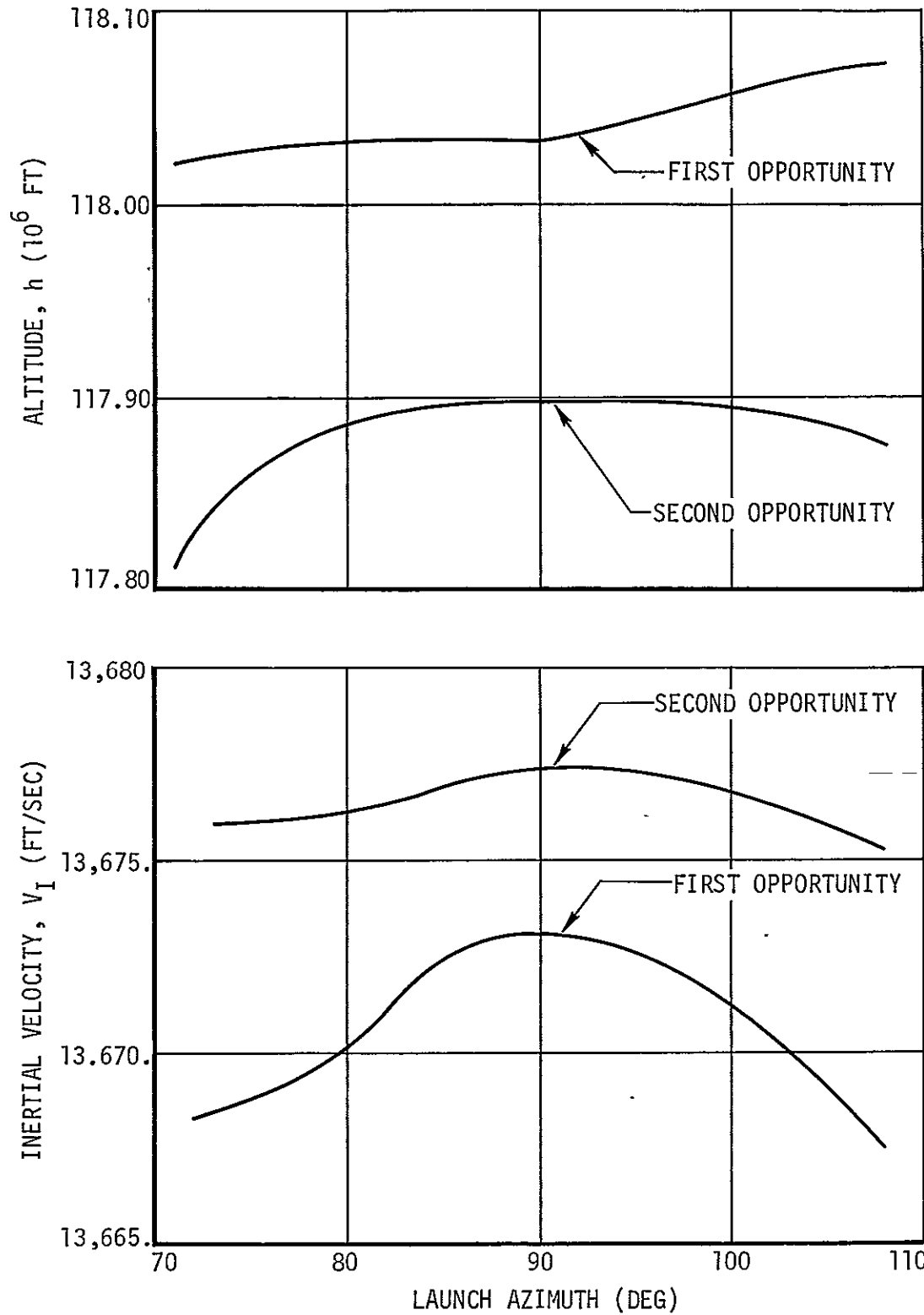
Figure 2-18. Trajectory Conditions at Initiation of LOX Dump (Sheet 1 of 2)
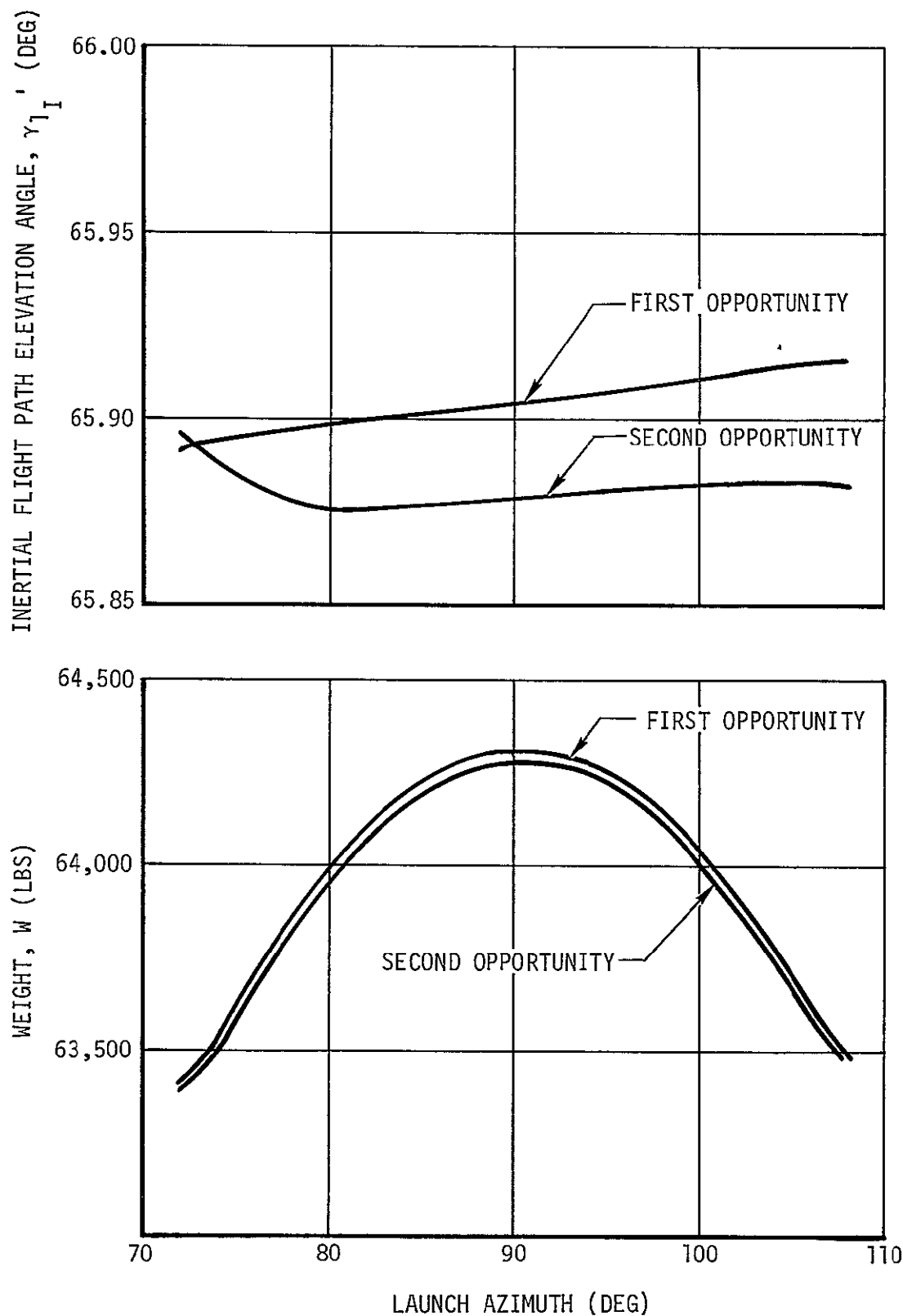
Figure 2-18. Trajectory Conditions at Initiation of LOX Dump (Sheet 2 of 2)

STAGE OBJECTIVES

3. STAGE OBJECTIVES

This section defines the S-IVB-503N stage flight objectives and evaluation criteria in support of the vehicle mission objectives presented in section 2. The S-IVB stage research and development objectives are designed to verify the performance of the S-IVB stage airframe, stage systems, S-II/S-IVB and S-IVB/IU interfaces, and to determine and evaluate the internal/external stage environments. It should be noted that the stage objectives describe the evaluation efforts to be accomplished only by MDAC-WD, and do not completely satisfy the mission objectives. The mission objectives will be satisfied by the cumulative evaluation efforts of MSFC, MDAC-WD, and the other Saturn program contractors and the results will be reported in the MSFC vehicle report.

For convenience of the evaluation and reporting tasks, the mission has been divided into the following four major phases:

a. Launch Phase* - The period from liftoff to S-IVB first J-2 engine cutoff +10 sec.

b. Parking Orbit Phase - The period from S-IVB first J-2 engine cutoff +10 sec to initiation of S-IVB restart preparations.

c. Pre-ignition Sequencing and S-IVB Second Burn Phase - The period from initiation of S-IVB restart preparations to S-IVB second burn to second J-2 engine cutoff +10 sec.

d. Translunar Coast Phase - The period from second J-2 engine cutoff +10 sec until loss of S-IVB attitude control, or until loss of communications.

3.1 Airframe Structural Integrity (Phases A, B, C, D)

Verify the structural integrity of the S-IVB stage during all phases of the mission. This objective will be achieved by the evaluation of the structural integrity of the following airframe components:

---

*This phase may be considered to encompass the prelaunch activities where required.

a. Forward skirt assembly

b. LH2 tank assembly

c. LOX tank assembly

d. Engine thrust structure

e. Aft skirt assembly

f. Aft interstage assembly

g. Common bulkhead.

3.2 Main Propulsion System (Phases A, B, C, D)

Verify the propulsion system operations during prelaunch, boost and
flight. This objective will be achieved by evaluation of the performance
of the J-2 engine system, the LH2 and LOX systems, and the stage pneu-
matic control and purge system. Predicted propulsion system performance
data are presented in appendix 5.

3.2.1 J-2 Engine Performance and Conditioning (Phases A, C)

Determine the J-2 engine chilldown, start, steady-state, and cutoff per-
formance characteristics. Evaluation of the following will verify this
objective:

a. The J-2 engine T/C chilldown performance on the ground prior
to liftoff and during fuel lead prior to start and restart.
The environmental heating of the T/C during boost and in orbit.

b. The J-2 engine start sphere chilldown and loading, performance
during start functions including refill process during J-2
engine burn and environmental heating during boost and orbital
coast periods.

c. The J-2 engine control sphere pressurization and loading
performance during burn and any nonoperational engine valve
actuations (propellant dump) and environmental heating during
boost and orbital coast periods.

d. Engine performance including thrust, specific and total impulse and propellant consumption during:

    (1) Start

    (2) Steady state

    (3) Cutoff

e. Propellant consumption by the J-2 engine using flow integral.

f. Stage pressurization systems performance.

g. The J-2 engine sequencing.

3.2.2 LH2 System (Phases A, B, C, D)

Satisfactory operation of the LH2 system will be verified by the proper operation of the LH2 propellant feed system and the LH2 vent systems.

3.2.2.1 LH2 Propellant Feed System (Phases A, C)

Demonstrate the capability of the LH2 system to provide sufficient LH2 and net positive suction pressure (NPSP) to the J-2 engine for satisfactory operation. Evaluation of the following will verify this objective:

    a. LH2 temperature and pressure and tank ullage pressure during loading operations and at liftoff

    b. Prepressurization of the LH2 tank prior to launch

    c. Transition from ground prepressurization to onboard flight pressurization system to provide tank ullage pressure during engine operation

    d. Conditions of propellant supplied to the J-2 engine LH2 pump inlet during prestart and steady-state operation

    e. LH2 recirculation chilldown

    f. Repressurization of the LH2 tank prior to second burn

    g. Orbital boiloff mass (obtained during phase B).

3.2.2.2 LH2 Vent and Relief System (Phases B, D)

Demonstrate the capability of the vent systems to provide the required LH2 tank pressures, and to provide sufficient acceleration after J-2 engine cutoff to settle the LH2 and LOX.

Evaluation of the following will verify this objective:

    a. Continuous vent system thrust, thrust imbalance, and flowrate

    b. Nonpropulsive vent system thrust, thrust imbalance, and flowrate (phase D only)

    c. Tank depressurization rate

d. Tank self-pressurization rate (phase D only)

e. Heat input rates.

3.2.3 LOX System (Phases A, B, C, D)

Satisfactory operation of the LOX system will be verified by the proper operation of the LOX feed system, LOX vent system, and pneumatic control and purge system.

3.2.3.1 LOX Feed System (Phases A, C)

Demonstrate the capability of the LOX system to provide sufficient LOX and NPSP to the J-2 engine for satisfactory operation. Evaluation of the following will verify this objective:

a. LOX temperature, LOX pressure, and tank ullage pressure during loading operations and at liftoff

b. Prepressurization of the LOX tank prior to launch

c. Transition from ground prepressurization to onboard flight pressurization and operation of the onboard LOX tank pressurization to provide tank ullage pressure during engine operation

d. Pressurization control module operation

e. Pressure and temperature of the cold helium supply

f. J-2 heat exchanger performance

g. LOX pump chilldown and recirculation

h. Repressurization of the LOX tank prior to second burn

i. Conditions of LOX supplied to the J-2 engine LOX pump inlet during prestart and steady-state operation.

3.2.3.2 LOX Vent and Relief System (Phases B, D)

Demonstrate the capability of the vent system to provide required tank pressures after J-2 engine cutoff. Evaluation of the following will verify this objective:

a. Tank depressurization rate

b. Tank self-pressurization rate

c. Heat input rates

d. Nonpropulsive vent (NPV) system thrust, flowrate, and total vented impulse. Verification of the latching capability of NPV valve.

3.2.4   Pneumatic Control and Purge System (Phases A, B, C, D)

Verify the capability of the pneumatic control and purge system to provide pneumatic power and purge gas throughout the mission.

Performance evaluation will include the following:

a. Pressure and temperature of the ambient helium supply

b. The regulation of control pressure

c. Actuation of pneumatic valves

d. Helium purge pressure and flow for the J-2 engine purge during prelaunch operations.

e. LOX recirculation chilldown pump motor container purge pressure.

3.2.5   Repressurization System (Phase C)

Demonstrate the capability of the repressurization system to repressurize both propellant tanks prior to restart of the J-2 engine. Evaluation of the ullage pressure of both propellant tanks at J-2 engine restart will verify this objective.

The O_2-H_2 burner will be installed for the first time and will be the primary mode of propellant tank repressurization in preparation for second engine burn. Secondly, the burner provides an adequate amount of thrust for propellant settling. Ambient repressurization bottles will be the backup for the O_2-H_2 burner.

3.3   Auxiliary Propulsion System (Phases A, B, C, D)

Verify the ability of the APS to provide thrust on demand for roll control during the S-IVB J-2 engine first and second burn; for roll,

pitch, and yaw control following J-2 engine cutoff, and for propellant settling. Performance evaluation will include the following:

    a. Propellant temperatures and pressures and the ullage pressures during prelaunch operations and at liftoff

    b. Temperature and pressure of the helium supply sphere

    c. Pressurization of the propellant tanks to flight pressure

    d. Response of the engines to stage commands during flight

    e. Value of the minimum impulse bit

    f. Performance of the helium pressurization, fuel supply, oxidizer supply, and engine systems in a space environment.

3.4 Ullage Rockets (Phase A)

Verify the capability of the ullage rockets to provide sufficient thrust for propellant stabilization during S-II/S-IVB separation and the J-2 engine start transient.

Performance evaluation will include the following:

    a. Response of ullage rockets to ignition signal

3.5 Retrorockets (Phase A)

Verify the capability of the retrorockets to provide sufficient thrust for S-II/S-IVB separation.

3.6 Hydraulic System (Phases A, B, C, D)

Verify the ability of the hydraulic system to supply pressurized fluid to the servo system, and verify that the servo system gimbals the engine in response to signals from the instrument unit (IU).

3.6.1 Power System (Phases A, B, C, D)

The evaluation of the power system will include the following:

a. Verification that adequate pressurized fluid flow is available to the servo-actuator and that hydraulic system pressures are maintained within expected limits (figure AP 8-1)

b. Verification that fluid temperature is maintained within expected limits during system operation

c. Verification that auxiliary hydraulic pump motor pressurization is maintained

d. Verification of engine positioning capability prior to restart.

3.6.2 Servo System (Phases A, B, C, D)

The evaluation of the servo system will include the following:

a. Verify the adequacy of actuator artificial damping mechanism performance

b. Verify the adequacy of present compensation for thrust vector deflection errors caused by gimbal "slop" and thrust structure compression effects

c. Evaluate the effects of thrust misalignment and thrust eccentricity errors on actuator performance

d. Determine and evaluate actuator start transient loads during initial start and restart

e. Determine and evaluate gimbal friction during engine burn after gimbal bearing has been exposed to space environment

f. Compare critical actuator component temperatures with predicted values

g. Verify proper pitch and yaw actuator responses to commands

h. Evaluate the effects of IU command errors in the non-S-IVB burn modes on actuator performance

i. Evaluate actuator deflections during non-S-IVB burn modes.

3.7 Flight Control System (Phases A, B, C, D)

Verify the proper operation of the flight control system during flight.

This objective will be achieved by: verification of the proper operation of the thrust vector control system and the auxiliary attitude control system; comparison of inflight body bending frequencies and propellant sloshing frequencies with those predicted.

3.7.1 Thrust Vector Control System (Phases A, C)

Demonstrate proper performance of the main engine control system during S-IVB flight. This objective will be achieved by evaluation of the following:

a. Response of the thrust vector control system to commands from the instrument unit

b. Response of the control system sensors and networks

c. Verification of control system stability during S-IVB flight, including controlability immdeiately after separation

d. Evaluation of transient regions of flight (e.g., separation, guidance initiation)

e. Demonstrate proper main engine positioning prior to engine restart

3.7.2 Auxiliary Attitude Control System (AACS) (Phases A, B, C, D)

Verification of control system stability and evaluation of performance during S-IVB flight. This objective will be achieved by consideration of the following:

a. Response of the APS and relays to commands from the instrument unit

b. Response of the control system sensors and networks

c. Comparison between theoretical and actual control system behavior during transient regions of flight

d. Comparison between actual and allocated impulse usage for vehicle maneuvers and disturbances.

3.8 Trajectory/Propulsion Compatibility (Phases A, C)

Verify compatibility of the observed trajectory and S-IVB propulsion system performance. This objective will be achieved by determining the following from trajectory data:

a. S-IVB stage thrust, specific impulse, and mass flow

b. Vehicle mass at ignition and cutoff

c. S-IVB stage thrust vector misalignment.

3.9 Stage Sequence of Events (Phases A, B, C, D)

Verify proper S-IVB acknowledgment of sequence commands issued from the IU. This objective will be verified by comparing IU command times to stage monitored command times.

3.10 Stage Separation (Phase A)

Verify clearance distance between S-II/S-IVB stage during separation. This objective will be achieved by determining the following:

a. Lateral clearance between stages

b. Separation distance history between stages

c. Causes of observed motion by simulation of stage attitude rates and accelerations.

3.11 Data Acquisition System (Phases A, B, C, D)

Verify that the data acquisition system is within design tolerances. Satisfactory completion of this objective shall be the demonstration of the data acquisition system to properly assimilate, condition, and translate stage information into proper telemetry format for transmission to a ground station. This includes evaluating the items listed in the following paragraphs.

3.11.1 Radio Frequency (RF) System (Phases A, B, C, D)

Verify the proper operation of the RF system.

The achievement of this objective will be verified by evaluation of the following:

a. RF signal strength at ground stations, to determine adequate signal strength.

b. RF power output of the transmitter power amplifier measured by means of directional couplers and RF power detectors.

c. Voltage standing wave ratio (VSWR) computed from forward and reflected power data obtained from the bi-directional coupler and RF power detectors.

3.11.2   Telemetry System (Phases A, B, C, D)

Verify the telemetry system performance. The achievement of this objective will be verified by consideration of the following:

a. Examination of output of the data reduction system for proper reference channel levels, synchronization pulses, calibrations, etc.

b. Examination of PCM data channels and synchronization words to verify consistency.

3.11.3   Instrumentation System (Phases A, B, C, D)

Verify the performance of the instrumentation system. The achievement of this objective will be verified by evaluating the following:

a. The instrumentation system acquires valid information for assigned measurements.

b. The proper RACS checkout levels are present at the correct times.

c. All elements (transducers, signal conditioning, etc.) are compatible with each other.

3.11.4   Data Acquisition System Electromagnetic Interference (Phases A, B, C, D)

Verify the following:

    a. The data acquisition system does not interfere with the other stage systems.

    b. The other stage systems do not interfere with the data acquisition system.

3.11.5 Data Validity (Phases A, B, C, D)

Verify the validity of data from the telemetry systems. The achievement of this objective will be established by determination of data validity on a channel-by-channel basis.

3.12 Electrical Control System (Phases A, B, C, D)

Verify the proper operation of the electrical control system, which includes the following:

    a. Forward and aft control distribution assemblies.

    b. Forward power distribution assembly.

    c. Aft power distribution assemblies

    d. Switch selector

    e. Sequencer

    f. Control pressure switches.

    g. Attitude control relay modules

3.13 Electrical Power System (Phases A, B, C, D)

Verify that battery currents, voltages, temperatures, chilldown inverter frequencies, and voltages remain within acceptable limits during the flight.

3.14 Separation Exploding Bridgewire (EBW) System (Phase A)

Verify that the separation EBW system responds correctly to all commands.

3.15 <u>Propellant Utilization (PU) System (Phase A, C)</u>

Demonstrate the PU system performance in a propellant loading mode and for inflight propellant measurement as defined by the criteria listed herein. (S-IVB-503N propellant loading data are presented in appendix 6).

a. Demonstrate that the PU system indicated propellant load is within 1.12 percent of the actual propellant load in each tank as determined by the statistical weighted average propellant mass history.

b. Demonstrate open-loop PU operation in the programmed mixture ratio mode during first burn. Following a two-orbit coast and restart, maintain the engine propellant mixture ratio (EMR) to a commanded mixture ratio of 5.00:1 during second burn.

3.16 <u>Secure Range Safety Command System (Phase A)</u>

The achievement of this objective will be verified by proper operation of the secure range safety command system for normal flight, or for the termination of an erratic flight.

a. <u>Normal Flight</u>

(1) An RF carrier should be received by the stage at all times, until after the systems have been safed.

(2) Indication of signal strenghts from each range safety receiver should be a nominal 4.0 ± 0.5 V (approximately -70 dbm).

b. <u>Abnormal Flight</u>

The operation of the range safety system during an abnormal flight should include these operations described for normal flight (paragraph 3.16a) plus the following:

(1) Indication of receipt of the propellant dispersion (PD) EBW Firing Arm and Engine Cutoff Command, from the range

safety decoder. Tri-level signals should show a step increase from 1.27 ± 0.15 V to 2.43 ± 0.15 V for a duration of 25 ms.

(2) The EBW firing units should show a charge of 2.300 ± 100 V within 1 sec after the receipt of the EBW arm and engine cutoff signal.

(3) After 3 sec from the arm and engine cutoff signal, a propellant dispersion command will be given to the vehicle. At this time the range safety decoder tri-level signal should show a step increase from 1.27 ± 0.15 V to 3.16 ± 0.15 V of 25 ms duration.

3.17 Stage Aero/Thermodynamics (Phases A, B, C, D)

Determine stage Aero/Thermodynamics environments during all phases of flight. This objective will include the following:

a. Stage thermal environment and the response of structure and components subjected to cryogenics, aerodynamic heating, and plume impingement are to be investigated. Areas to be evaluated include:

(1) Forward skirt

(2) LH2 tank

(3) Aft skirt and interstage

(4) Thrust structure

(5) APS

(6) O_2-H_2 burner

(7) J-2 engine

b. The propellant heat input during ground hold, boost, powered flight, and orbital coast.

c. The internal pressures within the forward and aft compartments will be compared with postflight simulations and design data.

3.18 Ordance System (Phase A)

Verify proper operation of the ordnance system during flight. The objective will be achieved by verification of the following:

a. Operation of the stage separation systems

b. Operation of the ullage rocket ignition and jettison systems

c. Operation of the retrorocket ignition system.

3.19 Environmental Control System (Phases A, B, C, D)

Verify proper environmental control system performance during all phases of flight. This objective will be achieved by verifying the following:

a. Proper S-IVB thermoconditioning fluid flowrate, supply pressure, and temperature were maintained by the IU thermoconditioning system.

b. S-IVB thermoconditioning system fluid return pressure and temperature were within normal operating ranges.

3.20 Launch Vehicle Venting, Dumping, and Safing (Phase D)

Satisfactory operation of the venting, dumping, and safing will be verified by the following:

a. LH2 tank venting at second J-2 engine cutoff using the LH2 tank latching relief valve (non-propulsive) and the LH2 tank CVS.

b. LOX tank venting at second J-2 engine cutoff using the LOX tank NPV valve.

c. Cycling the LH2 tank latching relief valve for 15 min at approximately one hour after second J-2 engine cutoff.

NOTE: The propellant tanks are vented to prevent exceeding the common bulkhead limitations and to prevent unplanned stage thrust imbalance.

d. LH2 tank CVS permanently opened 12 min prior to initiation of LOX dump to prevent exceeding bulkhead limitations when LOX pull-through occurs.

e. LOX dump for 5 min. (See slingshot in mission description.)

f. Engine start bottle safing by venting for 2.5 min.

g. Stage control helium bottle safing by dumping via the engine pump purge for one hour.

h. LH2 tank safing by permanently opening the latching relief valve.

i. LOX tank safing by permanently opening the NPV valve.

j. Cold helium bottles safing by dumping via the LH2 tank for 50 min.

k. Ambient repressurization bottle safing by dumping helium via the LH2 tank for 200 sec.

l. Engine control bottle safing by dumping helium via the engine control valve for 5 min.

STAGE CONFIGURATION

4. STAGE CONFIGURATION

This section presents the general configuration of the S-IVB-503N stage and significant stage configuration differences between the S-IVB-503N and S-IVB-502 stages.

4.1 S-IVB-503N Stage

The S-IVB-503N stage airframe (figure 4-1) consists of the following assemblies:

    a. Forward Skirt

    b. Propellant Tanks

    c. Aft Skirt

    d. Engine Thrust Structure

    e. Aft Interstage

    f. Supporting Systems

A detailed description of these assemblies is presented in the Douglas drawing No. 1B66684G, S-IVB-V End Item Test Plan (reference 4, appendix 11). A propulsion system schematic diagram of the S-IVB-503N stage is presented in figure 4-2.

4.2 Stage Configuration Differences

The following paragraphs delineate significant configuration differences between the S-IVB-503N and S-IVB-502 stages.

4.2.1 Forward Skirt

Structural elements added to the forward skirt (referred to as the flutter kit) were installed on the S-IVB-503N stage to arrest flutter. This kit was not installed on the S-IVB-502 stage. The flutter instrumentation which was installed on the S-IVB-502 stage was not installed on the S-IVB-503N stage.

4.2.2　Augmented Spark Igniter (ASI)

The ASI propellant feed system has been modified (removing all flexible hose sections) and additional flight instrumentation has been added.

4.2.3　Stage and J-2 Engine Instrumentation

Additional stage and engine instrumentation were added primarily to monitor the ASI.

4.2.4　Engine Start Tank Vent Regulator

A vent port check valve has been added to prevent moisture cryopumping into the engine start tank vent regulator. A more corrosion resistant material is now being used for the poppet and seat.

The temperature measurement (CO197-401) of the primary instrumentation package on the Rocketdyne engine was reinstated on the S-IVB-503N stage. This measurement had been deleted on the S-IVB-502 stage to provide telemetry capabilities for other measurements.

4.2.5　Additional Engine Control Bottle Capability

The LOX and LH2 ambient repressurization systems have been manifolded and a line installed connecting the manifold to the engine control bottle helium fill line. This change provides additional engine control bottle capability for burn, dump, and safing operations.

4.2.6　Cold Helium System

All conoseal gaskets on the cold helium system have been changed to aluminum 7075-0, teflon coated.

4.2.7　LH2 Tank

The LH2 tank pressure switch has been changed in order to lower the operating range (28 to 31 psia) as a result of the fracture mechanics study.

4.2.8 LH2 Vent and Relief System

Both LH2 vent and relief valve crack and reseat pressures have been
lowered to 31 to 34 psia, as a result of the fracture mechanics study.
The latching vent and relief valve has a pneumatically operated valve
latching mechanism which enables the valve to remain open without
pneumatics, after being commanded open. This valve replaced the backup
relief valve used on S-IVB-502.

4.2.9 LOX Vent System

A nonpropulsive LOX tank venting system (NPV) was installed on the
S-IVB-503N stage to increase the stability of the vehicle in flight
whenever venting of the LOX tank was necessary. The NPV control valve
has a pneumatically operated valve latching mechanism which enables the
valve to remain open without pneumatics, after being commanded open.

The following measurements were added to provide the LOX NPV system with
adequate instrumentation:

C2030-404	D0244-404
C2031-404	K0198-424
D0243-404	K0199-424

4.2.10 Repressurization

The O_2-H_2 burner will be installed for the first time and will be the
primary mode of propellant tank repressurization in preparation for
second engine burn. Ambient repressurization bottles will be the
backup for the O_2-H_2 burner.

There will be six ambient helium bottles for LH2 repressurization backup
on S-IVB-503N as compared to seven bottles on S-IVB-502. The LOX tank
repressurization backup remains the same as S-IVB-502 (2 helium bottles).

There are nine cold helium spheres installed on the S-IVB-503N stage as
compared to eight on S-IVB-502. This is the result of the additional
helium demand of the O_2-H_2 burner for repressurization.

Due to the addition of the O_2-H_2 burner for repressurization, the
following measurements were necessary for evaluation:

C0377-403	C0394-403	K0180-404
C0378-404	C0395-401	K0181-404
C0379-403	C0396-401	
C0380-403	C0397-401	
C0382-403		K0192-403
C0383-403		K0195-404
C0384-403		K0197-403
C0387-403	D0227-403	
C0388-403	D0228-403	
C0389-403	D0229-403	
C0391-403	D0230-403	M0068-411
C0392-403	D0231-403	M0073-404
C0393-403	D0233-403	M0074-404

4.2.11 Pneumatic Control System

Helium bottle No. 4 was removed for compatibility with the dual repressurization system. New measurements C2012-403 and D0236-403 replaced measurements C0205-403 and D0087-403, respectively, when the measurement locations were transferred to helium bottle No. 6.

4.2.12 Instrumentation Changes

a. Since the S-IVB-503N stage is an operational stage with some special add-on instrumentation, 287 measurements which were installed on the research and development stage (S-IVB-502) have been eliminated, leaving a total of 453 active measurements on this stage.

b. The following telemtry systems have also been deleted due to the changeover to an operational vehicle:

(1) Two FM/FM systems

(2) The three PAM/FM/FM systems

(3) One RF system

(4) The one flight tape recorder assembly

The S-IVB-503 new stage will have one (1)PCM/FM/FM Systems, one (1) FM/FM System and one (1) SS/FM System. A block diagram of the operational data acquisition system is shown in figure 4-3.

4.2.13 Hydraulic System

The auxiliary hydraulic pump will not be activated by the thermal switch. Programmed thermal cycles are being used on AS-503.
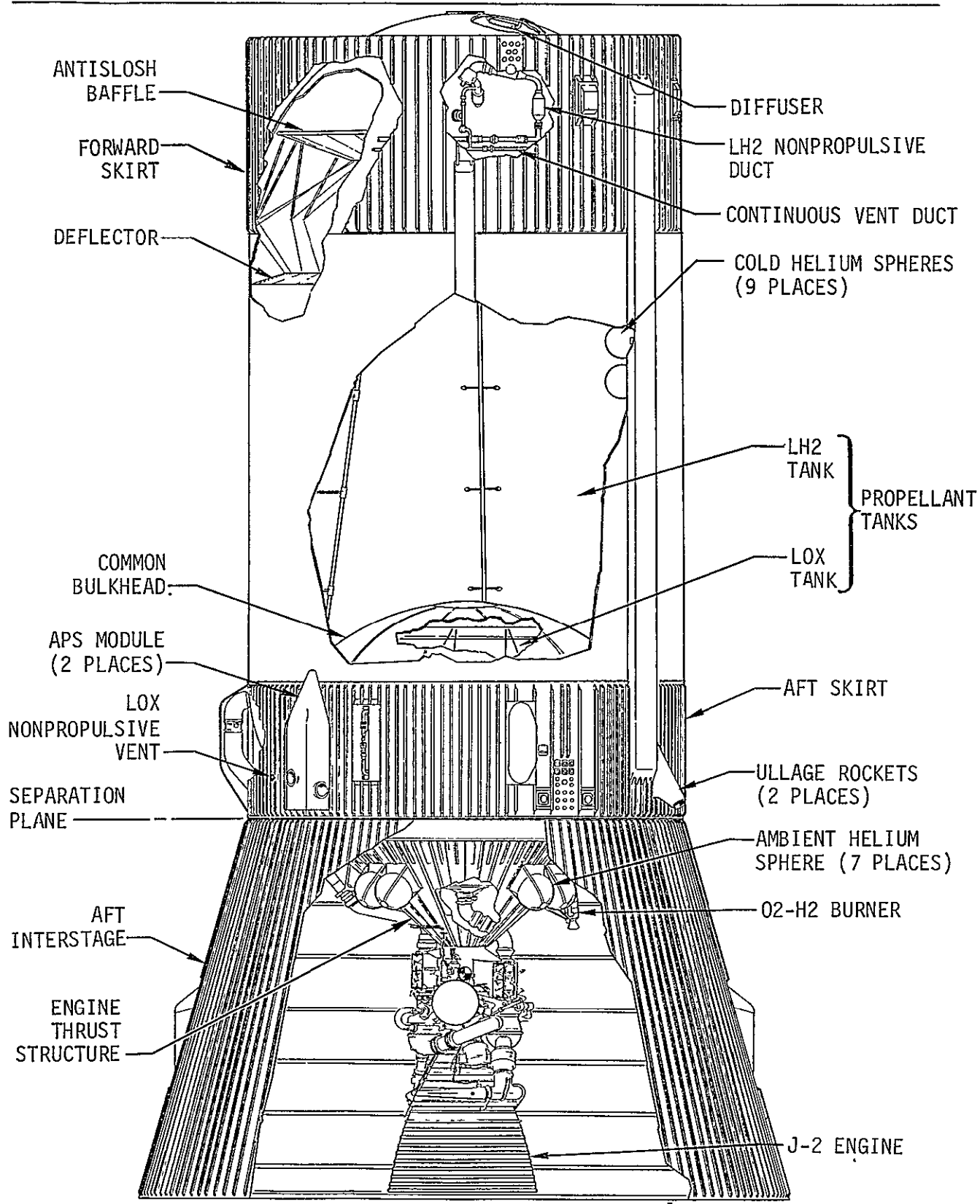
Figure 4-1. S-IVB-503N Stage Cutaway

Figure 4-2. Propulsion System Configuration and Instrumentation
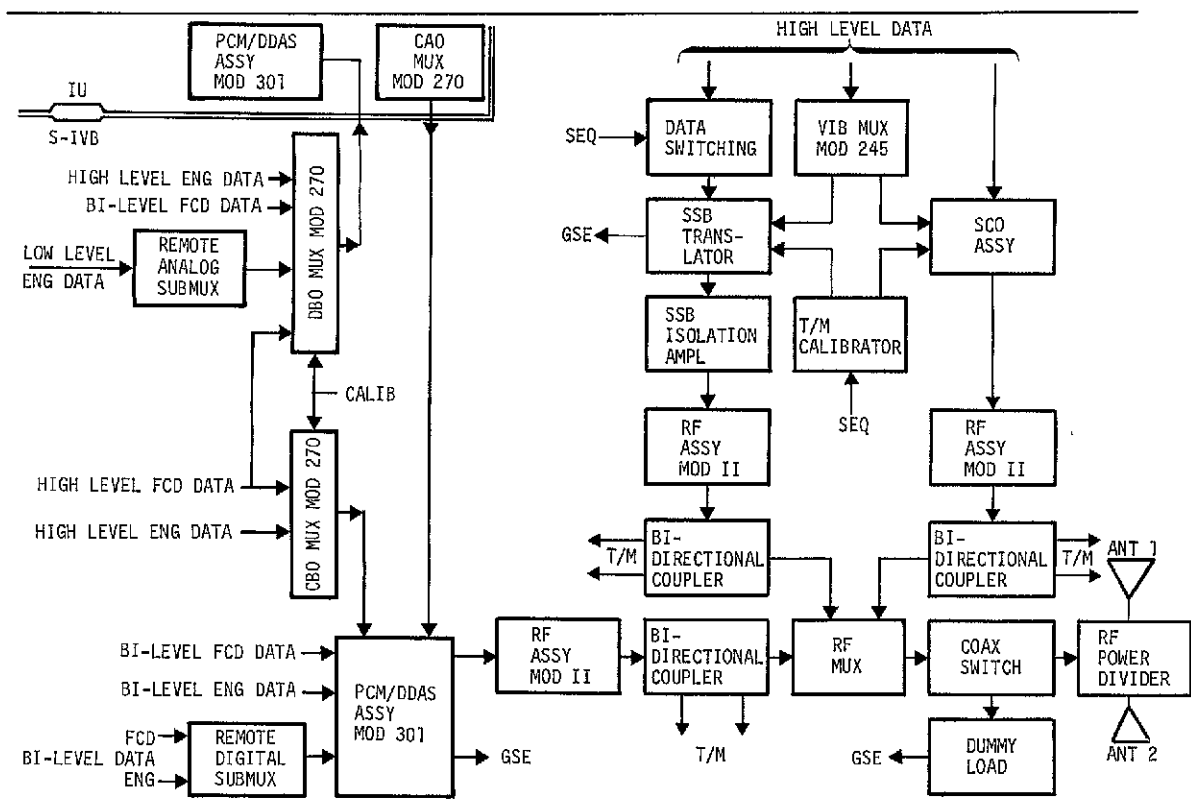
Figure 4-3. Block Diagram - Data Acquisition System

LAUNCH MISSION RULES AND REDLINES

5. LAUNCH MISSION RULES AND REDLINES

This section defines the launch mission rules pertaining to the S-IVB stage, redlines (which are a part of the launch mission rules), backup redlines, bluelines, and interlocks.

5.1 Launch Mission Rules

Launch mission rules are launch vehicle, space vehicle, and spacecraft launch constraining requirements.

Launch mission rules are developed to aid the launch director in decision making when an anomaly occurs. The launch mission rules are only a guideline and can be changed by the launch director. Before on-the-spot changes are made, the contractors are usually contacted for recommendations.

The launch mission rules are included in a document released by NASA/KSC director of launch operations. McDonnell Douglas Astronautics Company - Western Division (MDAC-WD) has received a preliminary issue of this document, Apollo/Saturn Launch Mission Rules Apollo 8 (SA-503/CSM-103), (reference 5, appendix 11).

The launch mission rules document is divided into the four following sections and each will be discussed in the following paragraphs:

Section I   - Space Vehicle Operations
Section II   - Launch Vehicle Operations
Section III - Spacecraft Operations
Section IV   - Technical Support Operations

5.1.1 Space Vehicle Operations

This section includes an introduction to the document, general launch mission rules (LMR) applied to the space vehicle, and detailed launch mission rules applied to the space vehicle. The following is a discussion on each sub-section and how it affects the S-IVB stage:

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*Definition: Space Vehicle includes S-IC stage, S-II stage, S-IVB stage, IU, and the Spacecraft.

5.1.1.1 Introduction

The introduction defines the purpose of the LMR to "Provide guidance to the launch director and launch team organization by specifying preplanned decisions which are required to minimize real time rationalization required when non-nominal situations occur during the launch countdown and applicable prelaunch tests."

5.1.1.2 Mission Rules Guidelines

The mission rules guidelines define terms, outline procedures to be taken in the event an anomaly occurs, and define duties and authority during the countdown. These guidelines are established by NASA Headquarters in NASA Management Instruction (NMI) 8020.9 and ensure compatibility between LMR and flight mission rules. Identical guidelines are included in each LMR document. The guidelines have been included in table 5-1.

5.1.1.3 General Launch Rules

The general launch rules are detailed guidelines and procedures for the development and utilization of launch mission rules. These guidelines are established in the Apollo/Saturn Launch Mission Rules Handbook, (630-23-0002) (reference 6, appendix 11). The more significant of these rules have been reiterated in table 5-2 for convenience and emphasis.

5.1.1.4 Launch Window Restrictions

A daylight launch (sunrise to sunset) for Apollo 8 is mandatory. This restriction is based on ground camera coverage of powered flight and onboard separation camera coverage requirements. The only MDAC-WD launch window restriction occurs in the event of a scrub. The rescheduled window must take into account the stage turnaround time for propellant removal and prelaunch preparations. The turnaround restrictions are reflected in NASA/KSC "Space Vehicle Turnaround From Scrub" test and checkout procedure, TCPI-40305-503.

5.1.1.5 Weather Restrictions

The weather restrictions are established by NASA and are not complete in the preliminary launch mission rules. In the past, the wind velocity, direction and elevation weather restrictions have not exceeded the stage design limits. The limits are not expected to be exceeded for this launch.

5.1.1.6 Flight Crew Safety Rules

Flight crew safety rules are established by the flight crew safety panel at KSC. MDAC-WD is represented on this panel at KSC. The following circumstances must exist for transmitting an abort request:

a. The flight crew must be endangered.

b. A catastrophic condition must be observed and reported by a forward observer and must be confirmed by another forward observer or by the launch operations manager via television.

c. The space vehicle has not reached sufficient attitude to clear the top of the umbilical tower.

The following conditions on the space vehicle would require an abort:

a. Uncontrollable fire

b. Explosion

c. Structural fire

d. Tipover

e. Fallback

5.1.1.7 Hold/Cutoff Guidelines

This subsection defines the rules for requesting holds and cutoffs. MDAC-WD does not make a direct input to these rules. However, they do affect the MDAC-WD/FTC launch operations. The more significant points of the rules are as follows:

a. A hold is stopping the clock before the start of automatic sequence.

b. A cutoff is stopping the clock after the start of automatic sequence.

c. After T -11 sec requests for cutoff will be given only if the vehicle fails to liftoff and fails to receive automatic cutoff from the ESE.

5.1.1.8 Functional Sequence

The functional sequence details actions to be followed in the event problems are encountered in the countdown, countdown sequence constraints, and recommended hold points. The functional sequence from preliminary launch mission rules document is included in table 5-3. This sequence is expected to be changed; however, the details are not available at this time.

5.1.2 Launch Vehicle

This section of the launch mission rules document (LMRD) includes constraints imposed upon stage systems and components.

Included are such items as critical systems, redlines, critical flight control measurements, and critical postflight evaluation measurements.

5.1.2.1 Critical Systems

Except for the telemetry system, the S-IVB critical systems are covered by the redlines. The S-IVB-503N stage is essentially an operational stage with added links CF-1 and CS-1 for special added instrumentation. Links available for S-IVB data acquisition are CP-1 (via S-IVB), DP-1 (via IU), CF-1 (via S-IVB) and CS-1 (via S-IVB) links. To be consistent with the postflight requirements and primary flight objectives, MDAC-WD requires that CP-1 and DP-1 links be mandatory. The data transmitted by CP-1 and DP-1 is affected by multiplexers and sub-multiplexers. Each multiplexer and sub-multiplexer provides a sufficient percentage of data and critical measurements to warrant a classification of mandatory. The critical systems are as follows:

a. Link CP-1

b. Link DP-1

c. BO Multiplexer (via CP-1)

d. BO Multiplexer (via DP-1)

e. Remote Digital Sub-multiplexer (via CP-1)

f. Remote Analog Sub-multiplexer (via DP-1)

The critical systems listed in the preliminary LMR document are consistent with the above list.

5.1.2.2 Redlines

Redlines are parameters with minimum and/or maximum values that specify acceptable systems operation. The prelaunch operations period is not to be completed if the conditions specified are not met. The LMR defines all redlines as mandatory. The latest MDAC-WD measurements monitoring the parameters with redline limits are listed in table 5-4 with their limits, expected values, and applicable time period.

The NASA/MSFC redlines submitted to NASA/KSC for inclusion into the final edition of the launch mission rules were received by MDAC-WD in letter I-V-S-IVB-L-68-419, dated November 6, 1968.

There are no significant differences between the MDAC-WD and NASA/MSFC recommended redlines; however, minor differences occurred and were transmitted to NASA by letter A3-250-KKBO-L-5256.

5.1.2.3 Critical Flight Control Measurements

The categorization of critical flight control measurements and the inclusion of these in the LMR document is to ensure that these measurements are operative at or near liftoff. These measurements are included at the request of NASA/MSFC. MDAC-WD no longer submits any requirements.

5.1.2.4 Critical Postflight Evaluation Measurements

Critical postflight evaluation measurements are those singular measurements that are mandatory or highly desirable to accomplish postflight

evaluation of a primary mission objective. MDAC-WD does not recommend any singular measurements as critical because evaluations are based upon several measurements within the system being evaluated. A failure of one measurement would not prevent the evaluation of a system.

5.1.2.5 GSE/ESE

MDAC-WD has no GSE/ESE launch constraints. The S-IVB stage, however, is affected by NASA/MSFC generated rules for pad safety. This involvement is in the area of hazardous gas detection. If a dangerous gas mixture is detected in either forward or aft interstage areas a hold or cutoff is to be initiated.

5.1.3 Section III - Spacecraft Operations

MDAC-WD has no responsibility for inputs to this section.

5.1.4 Section IV - Technical Support

This LMRD section contains launch mission rules that pertain to all operational support equipment not under the direct supervision of launch vehicle or spacecraft elements. MDAC-WD is not responsible for submitting inputs to this section.

5.2 Bluelines and Backup Redlines

5.2.1 Bluelines

Bluelines are maximum and/or minimum values of parameters which, if exceeded, shall result in an engineering judgment as to whether the countdown will be completed without corrective action. Bluelines are not included in the LMR documents and are not recognized by NASA as launch constraints. The SA-503/CSM-103 bluelines are listed in table 5-5.

The blueline philosophy and limits are implemented by instructions from the design technologies to the instrumentation observer.

5.2.2 Backup Redlines

Backup redlines are substitutions for redline measurements in the event the redline measurement becomes faulty. These measurements are to be used only after a careful investigation and assessment of data has established the primary measurement to be unacceptable. The backup redlines are listed in table 5-6.

5.2.3 Interlocks

Interlocks are stage functions which must be satisfied before automatic sequence can be initiated and the S-IC ignited. The interlock constraints are patched into the electrical support equipment (ESE) series of relays. The interlock requirements and logic are shown in figure 5-7.

The S-IVB preparations complete chain in figure 5-7 must be satisfied by T -3 min 10 sec in order to initiate the automatic terminal countdown at T -3 min 7 sec. The last function which will complete the chain will be "APS Engine Valve Power ON" at approximately T -4 min 45 sec.

Once the S-IVB preparations have been completed, the signal is fed into additional S-IC logic which results in giving the Launch Vehicle Ready for Firing Command. Once the firing command is given the S-IVB preparations complete are "locked-in" and a drop out of an interlock will not cause a cutoff until T -8.9 sec.

The S-IVB ready for launch chain in figure 5-7 must be satisfied by T -8.9 sec in order to initiate the S-IC ignition sequence. The last function to complete this chain will be "LH_2 Directional Vent in Flight Position" at T -40 sec. If the chain is not satisfied, an automatic cutoff will be initiated and the count reverted to T -24 min.

Once the S-IVB ready for launch is satisfied at T -8.9 sec a dropout of the stage function will not cause a cutoff.

TABLE 5-1 (Sheet 1 of 4)
MISSION RULES GUIDELINES

	The following mission rules guidelines are established by NASA headquarters (OMSF) in NASA management instruction (NMI) 8020.9 ''Apollo Mission Rules'', to ensure compatibility between the launch mission rules and flight mission rules:
ITEM	DESCRIPTION
1-100	Mission rules are effective during launch countdown, flight, and recovery operations, and during prelaunch tests when applicable. They are based on primary objectives as stated in the Apollo flight mission assignments document M-D MA 500-11. Proposed changes to the primary objectives stated in the mission assignments document shall require AA/MSE approval.
1-101	The director of flight operations and the director of launch operations or their designated representative will ensure coordination of their respective mission rule changes with the mission director and other appropriate organizations.
1-102	Following the CDDT or FRT, whichever occurs first, mission director approval and concurrence will be required on all rules changes affecting safety, accomplishment of test objectives, deviations from the nominal mission, and prelaunch constraints. Concurrence may be obtained verbally if time considerations so dictate.
1-103	During the conduct of the mission, the mission director will be advised of all recommendations that involve changes to: primary objectives, mission rules, flight plan content, or launch/flight safety.
1-104	Within their respective areas of responsibility, the command pilot, launch director, flight director, DOD manager for MSF support operations, and mission director may take or recommend any action required for optimum conduct of the mission.
1-105	The command pilot, spacecraft test conductor, launch vehicle test conductor, space vehicle test supervisor, launch operations manager, launch director, flight director, DOD manager or MSF support operations, or the mission director may request a hold for conditions within their respective areas of responsibility.

TABLE 5-1 (Sheet 2 of 4)
MISSION RULES GUIDELINES

ITEM	DESCRIPTION
1-106	During the countdown, the launch vehicle and spacecraft program managers and respective center operations managers shall provide technical advice and support directly to the launch operations manager and launch director. The latter two will keep the mission director fully informed of problems and proposed solutions. During the flight phase of operations, similar support as required will be provided to the flight director and the MSC director of flight operations. The mission director will be kept fully informed by these individuals of problems and proposed solutions during the applicable phases of the mission.
1-107	When time permits, the failure of a mandatory or highly desirable item will be reported to the mission director by the launch director or the flight director. The initial report will include the position or facility that detected the malfunction. Subsequently, the mission director will be informed of estimated time to repair and recommended proceed, hold, recycle, or scrub action as it develops.
1-108	If a mandatory item fails during the countdown, it will be corrected prior to launch, holding or recycling the countdown as necessary. If a mandatory item cannot be corrected to permit liftoff within the launch window, the mission director may proceed with the launch after appropriate coordination with the appropriate operations and program managers. Generally, the loss of a mandatory item will result in a scrub.
1-109	As the designated representative of the program director, only the mission director may scrub the mission. Further, the mission director retains the primary authority to downgrade a mandatory category. This authority shall be exercised as circumstances dictate and after appropriate recommendations from the program managers, launch director, and flight director.
1-110	Consideration will be given to the repair of any highly desirable item, but in no case will the launch be scrubbed for any single highly desirable item. If two or more highly desirable items fail and/or other aggravating circumstances occur, the mission director may scrub the mission after coordination with the appropriate operations and program managers.
1-111	The countdown will not be held nor the launch scrubbed for failure of desirable items.

TABLE 5-1 (Sheet 3 of 4)
MISSION RULES GUIDELINES

ITEM	DESCRIPTION
1-112	Whenever possible, the launch site and the MCC will verify telemetry readout discrepancies occurring prior to liftoff. If the MCC loses a parameter but the launch site has a valid readout, the MCC will continue on the launch site readout. This is true except for those mandatory parameters (listed in the flight mission rules) upon which mission rules action is taken. In this case, a hold may be called to evaluate the problem.
1-113	The countdown will continue where possible concurrently with correction of an existing problem.
1-114	Prior to liftoff, the launch director will be responsible for all actions in the event of launch site emergencies, except for recovery operations of the flight crew and spacecraft resulting from a pad abort.
1-115	The launch operations manager may send an abort request from the time the launch escape system is armed until the space vehicle reaches sufficient altitude to clear the top of the umbilical tower. The criteria for sending an abort request will be established in the launch mission rules.
1-116	From liftoff to umbilical tower clearance, the launch director and flight director will have concurrent responsibility for sending an abort request. The criteria for sending an abort request during this period will be established in the launch and flight mission rules.
1-117	Where possible, all manual abort command/requests from the ground during flight will be based on two independent indications of the failure. Crew abort action will normally be based upon two cues.
1-118	The launch operations manager will inform the MCC when the space vehicle clears the umbilical tower by stating ''clear tower'' over one of the loops from KSC to MCC.
1-119	In the event of non-catastrophic space vehicle collision with the umbilical tower or other contingencies which do not require immediate action, the launch operations manager will continue to evaluate the extent of the damage and provide information to the flight director for any action necessary after umbilical tower clearance.

TABLE 5-1 (Sheet 4 of 4)
MISSION RULES GUIDELINES

ITEM	DESCRIPTION
1-120	Complete ground control of the space vehicle passes from the launch director to the flight director when the space vehicle reaches sufficient altitude to clear the top of the umbilical tower.
1-121	In the MCC, the flight director, flight dynamics officer, and booster systems engineer will have the capability to send an abort request signal. The criteria for sending an abort request signal will be established in the flight mission rules.
1-122	The command pilot may initiate such inflight action, as he deems essential for crew safety.
1-123	Flight crew safety shall take precedence over the accomplishment of primary objectives.
1-124	In the event of communications loss between the manned space flight network and the spacecraft, the command pilot will assume responsibility for mission conduct as described within the flight mission rules.
1-125	The flight director , through the recovery coordinator, will provide the DOD manager for MSF support operations the predicted location and time of splashdown.
1-126	The DOD manager for MSF support operations is responsible for command and control of DOD recovery forces, and is responsive to recommendations, guidelines, and requirements as set forth by NASA to effect safe and expeditious recovery of the flight crew and spacecraft.

TABLE 5-2
GENERAL LAUNCH RULES

	Detailed guidelines and procedures for the development and utilization of launch mission rules by responsible organizations are established in the KSC Apollo/Saturn launch mission rules handbook. The following general launch rules are contained within the handbook, and are reiterated here for convenience and emphasis:
ITEM	DESCRIPTION
1-200	Applicable time periods: The applicable time period for all mandatory items will be specified in the time period/action/notes column for each such item. This time period will start at launch vehicle power up unless otherwise specified and will terminate at the specified time (no later than T-11 seconds for manual cutoff actions). The applicable time period for highly desirable items will start at launch vehicle power up and will terminate at T-3 minutes 07 seconds (automatic sequence start) unless otherwise specified in the time period/action/notes column.
1-201	Interlocks: Any function that is interlocked on an automatic sequencing device and will effect an automatic shutdown or will prevent liftoff in the event of a malfunction is defined herein as mandatory and is not reiterated within this document.
1-202	Unverifiable items: Items which were received as launch mission rules inputs but which cannot be monitored or verified during the launch mission rules effectivity period do not appear in this document. These items will be verified prior to entering the effectivity period, and appropriate organizations will be notified of malfunctions.
1-203	MSC and MSFC representatives: MSC and MSFC will designate a single point of contact within the launch control center (LCC) to consult with the director, spacecraft operations, and the director, launch vehicle operations, and with whom the launch director and launch operations manager may discuss instrumentation or hardware discrepancies and/or malfunctions that occur during the launch countdown. The MSC and MSFC representatives will be notified of LMRD discrepancies when time permits.
1-204	LMR/FMR interface: For certain operational support elements (required to be operational at lift-off) for which KSC, ETR, or GSFC are operationally responsible, redundant entries may be contained in both the launch mission rules and the flight mission rules. The LMRD will contain rules concerning only those operational support elements for which the launch director or appropriate elements of the launch team organization would call a hold or would call for cutoff in the event of malfunctions.

TABLE 5-3 (Sheet 1 of 3)
SPACE VEHICLE FUNCTIONAL SEQUENCE

The space vehicle functional sequence details actions to be followed in the event problems are encountered in the countdown. The times specified represent recommended hold-points if required:

ITEM	TIME PERIOD	CONDITION	ACTION/COMMENT
1-800	T-24 hr 30 min (L/V power up) to T-12 hr 45 min (L/V safe-and-arm)	Malfunction of any repairable space vehicle element or operational support element.	Proceed or hold. Proceed if correction of malfunction can be accomplished in parallel with other operations; otherwise hold for repair of mandatory or highly desirable items prior to removing access to the system or when the system is necessary for countdown continuation. Hold at T-12 hr 45 min if repair cannot continue in parallel with or after completion of L/V safe-and-arm.
1-801	T-12 hr 45 min (L/V safe-and-arm) to T-10 hr 45 min (MSS lift for transfer)	Malfunction of any repairable space vehicle element or operational support element.	Proceed or hold. Proceed if correction of malfunction can be accomplished in parallel with other operations; otherwise hold for repair of mandatory or highly desirable items prior to removing access to the system or when the system is necessary for countdown continuation. Hold at T-10 hr 45 min if the MSS is required for repair.
1-802	T-10 hr 45 min (MSS lift for transfer) to T-7 hr 45 min (start L/V LOX loading)	Malfunction of any repairable space vehicle element or operational support element.	Proceed or hold. Proceed if correction of malfunction can be accomplished in parallel with other operations; otherwise hold for repair of mandatory or highly desirable items prior to removing access to the system or when the system is necessary for countdown continuation. Hold at T-7 hr 45 min if repair cannot continue in parallel with or after completion of L/V cryogenic loading.

TABLE 5-3 (Sheet 2 of 3)
SPACE VEHICLE FUNCTIONAL SEQUENCE

ITEM	TIME PERIOD	CONDITION	ACTION/COMMENT
1-803	T-7 hr 45 min (start L/V LOX loading) to T-2 hr 55 min (SC) (start cabin closeout) to T-43 min (LV)	Malfunction of any repairable space vehicle element or operational support element.	Proceed if correction can be accomplished in parallel with normal functions; otherwise hold for mandatory or highly desirable items, if repair is not possible, review criticality; evaluate performance degradation and make decision to proceed, hold, or scrub. Hold at T-2 hr 55 min for completion of internal CM work if required.
1-804	T-2 hr 55 min (start of cabin closeout) to T-43 min (clear access arm)	Problem in spacecraft closeout.	Hold at T-43 min for completion of cabin closeout.
1-805	T-43 min (clear access arm) to T-22 min (S-II start bottle chilldown)	Malfunction of any repairable space vehicle element or operational support element.	Proceed or hold. Proceed if correction of malfunction can be accomplished in parallel with other operations; otherwise hold for repair of mandatory or highly desirable items. If repair is not possible, review criticality, evaluate performance degradation, and make the decision to proceed, hold, or scrub.
1-806	T-22 min (S-II start bottle chilldown) to T-10 min (S-IVB thrust chamber chilldown)	Malfunction of any mandatory or highly desirable space vehicle element or operational support element applicable to this time period.	Hold. An accumulated hold of 17 min maximum can be tolerated without recycling provided S-II start bottle chilldown operations continue uninterrupted. If additional time is required, recycle to T-24 min and hold. At least a 4-min hold is required after recycle to T-24 min in order to allow reconfiguration of the S-II start bottle chilldown procedure.

TABLE 5-3 (Sheet 3 of 3)
SPACE VEHICLE FUNCTIONAL SEQUENCE

ITEM	TIME PERIOD	CONDITION	ACTION/COMMENT
1-810	T-19 sec (2.3 sec prior to S-IC forward umbilical disconnect) to T-11 sec (2.1 sec prior to S-IC time for ignition)	Malfunction of any mandatory space vehicle element or operational support element applicable after S-IC forward umbilical disconnect.	Cutoff. An automatic or manual cutoff will result in a scrub due to a 10-min limitation on the S-IC interstage electronic equipment after loss of environmental control.
1-811	T-11 sec (2.1 sec prior to S-IC time for ignition) to T-0 (liftoff)	Not applicable.	None. No holds will be called. No manual cutoff will be given except for failure of the space vehicle to lift off. An automatic or manual cutoff will result in a scrub.

TABLE 5-4 (Sheet 1 of 6)
S-IVB-503N REDLINE REQUIREMENTS

MEAS NO.	TITLE	UNITS	LIMITS		EXPECTED VALUE	APPLICABLE TIME PERIOD FROM LIFTOFF (T) AND REMARKS
			MINIMUM	MAXIMUM		
C0003-403	Temperature, Fuel Pump Inlet	deg R	Fig 5-1	Fig 5-1	Fig 5-1	Check at T-19 sec.
C0006-401	Temperature, GH2 Start Bottle	deg R	Fig 5-1	Fig 5-2	290	Check from immediately prior to initiation of automatic sequence (T-187 sec to T-19 sec).
C0022-415	Temperature, Attitude Control Oxidizer Mod 2 (S-IVB APS)	deg R	535	560	550	Check at T-15 min.
C0050-401	Temperature, Hydraulic Pump Inlet Oil	deg R	None	620	490 to 570	Check from auxiliary hydraulic pump flight mode ON to initiation of automatic sequence.
C0051-403	Temperature, Reservoir Oil (Aux Pump OFF)	deg R	Fig 5-3	Fig 5-3	Fig 5-3	See L0007-403.
C0132-414	Temperature, Attitude Control Oxidizer Mod 1 (S-IVB APS)	deg R	535	560	550	Check at T-15 min.
C0199-401	Temperature, Thrust Chamber Jacket	deg R	None	360°R		Check immediately prior to initiation of automatic sequence (T-187 sec) and verify that thrust chamber jacket chill is continuing.
		deg R	None	320°R		Check at T-19 sec.

TABLE 5-4 (Sheet 2 of 6)
S-IVB-503N REDLINE REQUIREMENTS

MEAS NO.	TITLE	UNITS	LIMITS		EXPECTED VALUE	APPLICABLE TIME PERIOD FROM LIFTOFF (T) AND REMARKS
			MINIMUM	MAXIMUM		
D0014-403	Pressure, Control He Reg Discharge	psia	455	585	540	Monitor from sphere pressurization complete to T-187 sec. (See Note 1)
D0016-425	Pressure, Cold Helium Sphere	psia	2,800	3,200	3,000	Check from sphere pressurization complete to T-19 sec.
D0017-401	Pressure, GH2 Start Bottle	psia	Fig 5-2	Fig 5-2	1,250	Check from immediately prior to initiation of automatic sequence (T-187 sec) to T-19 sec.
D0019-401	Pressure, Engine Control Helium Sphere	psia	2,800	3,200	3,100	From sphere pressurization complete to initiation of automatic sequence (T-187 sec).
		psia	2,800	3,280	3,150	From initiation of automatic sequence (T-187 sec) to T-19 sec.
D0020-403	Pressure, Fuel Tank He Bottle Repress (Repress Sphere)	psia	2,800	3,200	3,000	Check from sphere pressurization complete to T-187 sec.
D0035-414	Pressure, Attitude Control He Pressure Tank 1 (S-IVB APS)	psia	2,800	3,200	3,000	Check from sphere pressurization complete to T-187 sec.
D0036-415	Pressure, Attitude Control He Pressure Tank 2 (S-IVB APS)	psia	2,800	3,200	3,000	Check from sphere pressurization complete to T-187 sec.

Notes: (1) Violation of the minimum redline for a period not greater than 2 sec is expected and allowable at times of valve actuation.

TABLE 5-4 (Sheet 3 of 6)
S-IVB-503N REDLINE REQUIREMENTS

MEAS NO.	TITLE	UNITS	LIMITS		EXPECTED VALUE	APPLICABLE TIME PERIOD FROM LIFTOFF (T) AND REMARKS
			MINIMUM	MAXIMUM		
D0041-403	Pressure, Hydraulic System (Aux Pump ON)	psia	3,400	4,100	3,600	Check from FLIGHT MODE ON to start of automatic sequence (T-187 sec). Auxiliary hydraulic pump ON.
D0042-403	Pressure, Reservoir Oil (Aux Pump OFF)	psia	45	None	67 to 89	Check from INITIATION OF PRO- PELLANT LOADING to flight mode ON. Auxiliary Hydraulic pump OFF.
D0071-414	Pressure, Oxidizer Supply Manifold Mod 1 (S-IVB APS)	psia	206	219	211	Check from system pressurization complete to start of automatic sequence (T-187 sec).
D0073-415	Pressure, Oxidizer Supply Manifold Mod 2 (S-IVB APS)	psia	206	219	211	Check from system pressurization complete to start of automatic sequence (T-187 sec).
D0088-403	Pressure, LOX Tank He Repress Sphere	psia	2,800	3,200	3,000	Check from sphere pressurization complete to T-187 sec).
D0223-403	Pressure, Auxiliary Hydraulic Pump Air Tank	psia	Fig 5-4	Fig 5-4	65 to 490	Check from application of stage power to initiation of propellant loading.
		psia	65*	None	490	From initiation of propellant loading to initiation of automatic sequence (T-187 sec). *CAUTION: Notify Huntsville Operations Support Center (HOSC) for disposition if pressure falls below 200 psia from initiation of propellant loading to initiation of automatic sequence.

TABLE 5-4 (Sheet 4 of 6)
S-IVB-503N REDLINE REQUIREMENTS

MEAS NO.	TITLE	UNITS	LIMITS		EXPECTED VALUE	APPLICABLE TIME PERIOD FROM LIFTOFF (T) AND REMARKS
			MINIMUM	MAXIMUM		
D0236-403	Pressure, Ambient Helium Pneumatic Sphere	psia	2,800	3,200	3,000	Check from sphere pressurization complete to T-19 sec.
D0576-408	Pressure, Fuel Tank Ullage Umb - H/W	psia	Fig 5-1	Fig 5-1	Fig 5-1	Check at T-19 sec (pressurized).
		psia	N/A	17.4	16.5	From T-30 min to initiation of tank pressurization.
		psia	---	34	---	Check from initiation of tank pressurization to T-19 sec.
D0577-406	Pressure, Oxidizer Tank Ullage Umb - H/W	psia	Fig 5-1	Fig 5-1	40	Check at T-19 sec.
		psia	None	44	---	Check from initiation of tank pressurization to T-19 sec.
F0004-424	Flow, LOX Recirculation Pump	gpm	30	None	42	From start of recirculation to T-19 sec.
F0005-404	Flow, Fuel Recirculation Pump	gpm	120	None	142	From start of fuel tank pre-pressurization to T-19 sec. (See Note 2)

Notes: (2) While in the unpressurized condition and with the recirculation system operating, the flowrate of the fuel will be in band between 80 and 110 gpm. It would be noted that when prepress is initiated, sharp fluctuations in the flowrate may result. These fluctuations have lasted from 15 to 60 sec on previous chilldowns. This is a normal condition and monitoring of this parameter should not be started until the flowrate has attained a steady-state value.

TABLE 5-4 (Sheet 5 of 6)
S-IVB-503N REDLINE REQUIREMENTS

MEAS NO.	TITLE	UNITS	LIMITS		EXPECTED VALUE	APPLICABLE TIME PERIOD FROM LIFTOFF (T) AND REMARKS
			MINIMUM	MAXIMUM		
G0001-403	Position, Pitch Actuator	deg	-1.5	+1.5	±0.5	Check from FLIGHT MODE ON to start of automatic sequence.
G0002-403	Position, Yaw Actuator	deg	-1.5	+1.5	±0.5	Auxiliary hydraulic pump ON. (See Note 3)
G0010-401	Posit, PU System Ratio Valve		Null -2°	Null +2°	Null	Check from T-5 min to start of automatic sequence (T-187 sec).
K0013-401	Event, Cutoff Signal (Lock-In)		N/A See Remark	N/A See Remark	OFF	Observe drop from ON indication at engine ignition power ON to T-33 sec.
N0063-411	PU Oven Stability Monitor	vdc	-0.3 (below stab. strip chart level)	+0.3 (above stab. strip chart level)	See Note 4	From 45 min after PU power ON to T-19 sec (See Note 5).
L0007-403	Level, Reservoir Oil (Aux Pump ON)	per-cent	6	None	25 to 45	Check from INITIATION OF PROPELLANT LOADING to T-19 sec. Auxiliary hydraulic pump ON.

Redline Notes: (3) Redline does not apply when actuators are being commanded to move. Recorded in flight control recorder. Continuous from S-IVB; not channel shared.

(4) This value shall be determined from PU stabilization and stripchart centering.

(5) This redline applies after measurement has come on-scale and stabilized.

TABLE 5-4 (Sheet 6 of 6)
S-IVB-503N REDLINE REQUIREMENTS

MEAS NO.	TITLE	UNITS	LIMITS		EXPECTED VALUE	APPLICABLE TIME PERIOD FROM LIFTOFF (T) AND REMARKS
			MINIMUM	MAXIMUM		
L0007-403	Level, Reservoir Oil (Aux Pump OFF)	per-cent	Fig 5-3	None	84 to 99	Check from INITIATION OF PRO-PELLANT LOADING to flight mode ON. Auxiliary hydraulic pump OFF. (See Note 6).
M0151-340 (Ground DDAS)	4D11 Vehicle Bus Volt (Aft Number 1)	vdc	26 See Note 7	31 See Note 7	28 See Note 7	While buses are energized either by ground or internal power to T-33 sec.
M0152-340 (Ground DDAS)	4D21 Vehicle Bus Volt (Fwd Number 2)	vdc	24.5 See Notes 8 and 9	32 See Notes 8 and 9	28 See Notes 8 and 9	While buses are energized either by ground or internal power to T-33 sec.
M0153-340 (Ground DDAS)	4D41 Vehicle Bus Volt (Aft Number 2)	vdc	51	61	56	While buses are energized either by ground or internal power to T-33 sec.
M0154-340 (Ground DDAS)	4D31 Vehicle Bus Volt (Fwd Number 1)	vdc	26	32	28	While buses are energized either by ground or internal power to T-33 sec.

Notes: (6) Level is temperature dependent (C0051-403) as shown in figure 5-3.

(7) Transients normally occur when various loads are switched on, during power transfer tests, and at power transfer. Transients during these times are not to be considered as exceeding redline values.

(8) 30 vdc when on external power and RACS is being used.

(9) During the initial application of voltage to the engine buses the maximum allowable voltage may be 32 vdc maximum for a period not to exceed 60 sec.

TABLE 5-5 (Sheet 1 of 4)
S-IVB-503N BLUELINE REQUIREMENTS

MEASUREMENT NO.	TITLE	UNITS	LIMITS		EXPECTED VALUE	APPLICABLE TIME
			MINIMUM	MAXIMUM		
C0011-401	Temp – Electrical Control Assy	deg F	80	110	90	Anytime engine control power is applied.
C0102-411	Temp – Fwd Battery No. 1	deg F	60	110	80	
C0103-411	Temp – Fwd Battery No. 2	deg F	60	110	80	
C0104-404	Temp – Aft Battery No. 1	deg F	60	110	80	
C105-404	Temp – Aft Battery No. 2	deg F	60	110	80	After battery temperature is stabilized.
C0131-404	Temp – Aft Battery No. 1, Unit 2	deg F	60	110	80	
C0211-411	Temp – Fwd Battery No. 1, Unit 2	deg F	60	110	80	
C0212-404	Temp – Aft Battery No. 2, Unit 2	deg F	60	110	80	
D0237-407	Press – Common Bulkhead Internal	psia	None	5.5	<5.5	Anytime prior to liftoff.
M001-411	Volt – Static Inverter-Converter	xac	111.5	118.5	115	During inverter-converter operation.
M0012-411	Freq – Static Inverter-Converter	Hz	396	404	400	During inverter-converter operation.

TABLE 5-5 (Sheet 2 of 4)
S-IVB-503N BLUELINE REQUIREMENTS

MEASUREMENT NO.	TITLE	UNITS	LIMITS		EXPECTED VALUE	APPLICABLE TIME
			MINIMUM	MAXIMUM		
M0014-404	Voltage - Output Aft Battery No. 1	vdc	29	36	29.5	Open circuit voltages from installation to transfer to internal power.
M0015-404	Volt - Output Aft Battery No. 2	vdc	64	75	72	
M0016-411	Volt - Output Fwd Battery No. 1	vdc	29	36	29.5	
M0018-411	Volt - Output Fwd Battery No. 2	vdc	29	36	29.5	
M0019-411	Current - Load Fwd Battery No. 1	amp	None	*32	*27	During internal power.
M0020-411	Current - Load Fwd Battery No. 1	amp	None	5	4	*Battery heater loads are not included.
M0021-404	Current - Load Aft Battery No. 1	amp	None	**7	**2	**Battery heater, APS, and engine valve loads are not included.
M0022-404	Current - Load Aft Battery No. 2	amp	None	110	80	
M0026-404	Volt - Phase A-B Fuel Chilldown Inverter	vac	52	57.5	55	During inverter operation.
M0027-404	Volt - Phase A-B LOX Chilldown Inverter	vac	52	57.5	55	During inverter operation.
M0040-404	Volt - Phase A-B LOX Chilldown Inverter	vac	52	57.5	55	During inverter operation.

TABLE 5-5 (Sheet 3 of 4)
S-IVB-503N BLUELINE REQUIREMENTS

MEASUREMENT NO.	TITLE	UNITS	LIMITS		EXPECTED VALUE	APPLICABLE TIME
			MINIMUM	MAXIMUM		
M0041-404	Volt - Phase A-B LOX Chilldown Inverter	vac	52	57.5	55	During inverter operation.
M0146-340	Volt - 4D110 Bus	vdc	26.5	30	28	
M0147-340	Volt - 4D210 Bus	vdc	26.5	30	27.5	
M0148-340	Volt - 4D130 Bus	vdc	26.5	31	28	
M0151-340	Volt - 4D11 Bus	vdc	26.5	30	28	
M0152-340	Volt - 4D21 Bus	vdc	26.5	30	27.5	Whenever power is on.
M0153-340	Volt - 4D41 Bus	vdc	53.5	59	56	†21 amp during RACS command.
M0154-340	Volt - 4D31 Bus	vdc	26.5	30	28	††Battery heater, aps and engine valve loads are not included.
M0169-340	Current - 4D100 Bus	amp	None	38	15	
M0170-340	Current - 4D200 Bus	amp	None	†10	†7.5	†††Battery heater loads are not included.
M0171-340	Current - 4D300 Bus	amp	None	61	33	
M0174-340	Current - 4D111 Bus	amp	None	††7	††2	
M0175-340	Current - 4D211 Bus	amp	None	†10	7.5	
M0176-340	Current - 4D311 Bus	amp	None	†††33	†††27	
M0177-340	Current - 4D411 Bus	amp	None	110	0 to 90	

TABLE 5-5 (Sheet 4 of 4)
S-IVB-503N BLUELINE REQUIREMENTS

MEASUREMENT NO.	TITLE	UNITS	LIMITS		EXPECTED VALUE	APPLICABLE TIME
			MINIMUM	MAXIMUM		
M0554-411	Volt - Fwd Battery No. 2	vdc	TBD	TBD	---	Open circuit voltages from battery connection to T-50 sec.
M0555-404	Volt - Aft Battery No. 2	vdc	TBD	TBD	---	
M0556-404	Volt - Aft Battery No. 1	vdc	TBD	TBD	---	
M0557-411	Volt - Fwd Battery No. 1	vdc	TBD	TBD	---	
M0559-411	Volt - F/U No. 1 EBW range safety	vdc	2200	2400	2300	Charged condition during RSCR checks.
M0560-411	Volt - F/U No. 2 EBW range safety	vdc	2200	2400	2300	
N0002-411	Misc - PU system LH2 fine mass	legs	TBD	TBD	TBD	Fill and drain valve closed to T-11 sec.
N0004-411	Misc - PU system LOX fine mass	legs	TBD	TBD	TBD	

TABLE 5-6 (Sheet 1 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
C0003-403	Temperature, Fuel Pump Inlet	a. Recirculation system failure b. Excessive facility back-pressure	Temperature – GG Fuel Bleed Valve C0012-401 (figure 5-5)	1. Measures LH2 temperature flowing through the bleed valve during chilldown. 2. Bleed valve is located downstream of LH2 pump. 3. If satisfactory chilldown has been accomplished, the LH2 bleed valve temperature will be approximately 1.0°R higher than the LH2 inlet temperature (C0003-403). 4. Must satisfy requirements defined in figure 5-5, at T-19 sec (in conjunction with fuel ullage pressure (D0576-406).
C0006-401	Temperature, GH2 Start Bottle	a. Improper chilldown b. Excessive hold time	Temperature-Engine Control Helium C0007-401 (figure 5-6)	1. Start bottle chilldown is reflected by the temperature of the control helium sphere which is located within the GH2 start bottle. 2. The two sphere temperatures will converge and stabilize after start bottle pressurization. 3. The control helium sphere temperature may be used as a backup from T-3 min 7 sec to T-19 sec (see figure 5-6 for requirements).

TABLE 5-6 (Sheet 2 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
C0022-415	Temperature, Attitude Control Oxidizer Mod 2 (APS)	Failure of stage environmental control purge system	Temperature, Fuel Tank Outlet Mod 2 (APS) C0021-415 Minimum: 535°R Maximum: 560°R Nominal: 550°R	Fuel and oxidizer temperature will be stable and equal after approximately 3 hr of ECS operation. Consequently, the fuel temperature may be monitored as a redline backup and must be between 535°R and 560°R at T-15 min.
C0050-401	Temperature – Hydraulic Pump Inlet Oil	a. Auxiliary pump overheating b. High pressure relief valve failed open	Temperature Reservoir Oil C0051-403 Nominal: 70°F	1. Reservoir oil temperature usually lags pump inlet oil temperature by approximately 20°F. 2. Auxiliary pump overheating may be due to excessive heat transfer from the electric motor which may be accompanied by higher than normal aft bus No. 2 current. 3. High pressure relief valve failing open is accompanied by lower than normal hydraulic system pressure.
C0051-403	Temperature, Reservoir Oil		Temperature – Hydraulic Pump Inlet Oil C0050-403 Nominal: 70°F	This measurement is to be used to determine whether adequate reservoir oil level (L0007-403) exists at the indicated oil temperature.

TABLE 5-6 (Sheet 3 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
C0132-414	Temperature, Attitude Control Oxidizer Mod 1 (APS)	Failure of stage environmental control purge system	Temperature, Att Control Fuel Mod 1 (APS)C0136-414 Minimum: 535°R Maximum: 560 R Nominal: 550 R	Fuel and oxidizer temperature will be stable and equal after approximately 3 hr of ECS operation. Consequently, the fuel temperature may be monitored as a redline backup and must be between 535°R and 560°R at T-15 min.
C0199-401	Temperature, Thrust Chamber Jacket	Insufficient GSE pe iance	Temperature-LH2 Injection C0200-401 For the time period prior to initiation of auto sequence: Minimum: None Maximum: 370°R Nominal: 315°R For the time period at T-19 sec: Minimum: None Maximum: 330°R Nominal: 270°R	In the event of C0199 failure, C0200 can be used. The expected injection temperature will be higher than the T/C jacket temperature. The temperature (C0200) shall be below 310°R at liftoff, allowing for boost heating, to prevent turbopump stall at J-2 engine ignition which would result from an excessively high thrust chamber jacket temperature.
D0014-403	Pressure, Control He Regulator Discharge	a. Regulator failure b. Excessive leakage	Pressure-Continuous Helium Regulator Discharge Backup Measurement D0247-403 Minimum: 455 psia Maximum: 585 psia Nominal: 540 psia	The alternate measurement is a direct backup with the same location, limits, time period and nominal value as the redline.

TABLE 5-6 (Sheet 4 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
D0016-425	Pressure, Cold Helium Sphere	a. Ground regulator failure b. Improper regulator setting c. Check valve failed closed d. Vent and/or dump relief valve failure e. Excessive leakage	Pressure-Cold He Spheres Backups No. 1 & No. 2 D0263-403 and D0261-403 Minimum: 2,800 psia Maximum: 3,200 psia Nominal: 3,000 psia	The alternate measurement is a direct backup with the same location, limits, time period and nominal value as the redline.
D0017-401	Pressure, GH2 Start bottle	a. Check valve between start bottle and LH2 injector fails open b. Vent and relief valve failed to close c. Excessive ground pressure d. Excessive hold time e. Excessive heating rate f. Excessive leakage	Pressure-GH2 Bottle Backup D0241-401 (figure 5-2)	1. The backup requirements are the same as for primary redline when used in conjunction with temperature GH2 start bottle (C0006-401) (figure 5-2) 2. In the event the primary parameters (C0006-401 and D0017-401) are unavailable, the backup measurement D0241-401 should be used in conjunction with C0007-401 (figure 5-6)

TABLE 5-6 (Sheet 5 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
D0019-401	Pressure, Engine Control He Sphere	a. Improper ground supply pressure b. Relief valve failure c. Excessive hold time d. Excessive start bottle temperature e. Excessive leakage	Pressure–Engine Control He Sphere Backup Measurement D0242-401 Minimum: 2,800 psia Maximum: 3,200 psia Nominal: 3,100 psia Minimum: 2,800 psia Maximum: 3,280 psia Nominal: 3,150 psia	1. The backup requirements are the same as for the primary redline. 2. Check from time of sphere pressurization to initiation of auto sequence (IAS). 1. Same comment as above. 2. Check from IAS to T –19 sec.
D0020-403	Pressure, LH2 Repress Spheres	a. Ground regulator failure b. Improper regulator setting c. Check valves failed closed d. Vent and/or relief valve failed open e. Excessive leakage	Pressure–LH2 Repress Sphere Backup Measurement D0249-403 Minimum: 2,800 psia Maximum: 3,200 psia Nominal: 3,000 psia	The alternate measurement is a direct backup with the same location, limits, time period and nominal value as the redline.
D0035-414	Pressure, Attitude Control He Press Tank Mod 1 (APS)	a. Ground regulator failure b. Check valves failed closed	Pressure–Attitude Control Helium Pressure Tank Mod 1 Backup Measurement D0250-414 Minimum: 2,800 psia Maximum: 3,200 psia Nominal: 3,000 psia	The alternate measurement is a direct backup with the same location, limits, time period and nominal value as the redline.

TABLE 5-6 (Sheet 6 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
D0036-415	Pressure, Attitude Control He Press Tank Mod 2 (APS)	a. Ground regulator failure b. Check valves failed closed	Pressure-Attitude Control Helium Pressure Tank Mod 2 Backup Measurement D0251-415 Minimum: 2,800 psia Maximum: 3,200 psia Nominal: 3,000 psia	The alternate measurement is a direct backup with the same location, limits, time period and nominal value as the redline.
D0041-403	Pressure, Hydraulic System	a. Auxiliary hydraulic pump motor or pressure compensator failure b. Leak or break in hydraulic system c. High pressure relief valve setting drops to lower pressure	a. Pressure-GN2 Accumulator D0043-403 Nominal: 3,600 psia b. Pressure-Reservoir Oil D0042-403 Nominal: 170 psia	Loss of excessive fluid from hydraulic lines or reservoir will cause auxiliary hydraulic pump to cavitate and fluctuate in pressure level. High pressure relief valve is set to relieve at 4,000 psid. If pressure setting of valve decays below setting of pump pressure compensator, the system pressure will decay proportionately.
D0042-403	Pressure, Reservoir Oil (Aux Pump OFF)	a. Accumulator gas leakage b. External oil leakage	Pressure-GN2 Accumulator D0043-403 Nominal: 2,350 psia	1. Required to insure adequate auxiliary pump inlet pressure at pump start. 2. Reservoir oil pressure is developed through a piston powered by GN2 accumulator pressure.

TABLE 5-6 (Sheet 7 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
D0071-414	Pressure, Oxidizer Supply Manifold Mod 1 (APS)	a. Ground regulator failure b. Check valves failed closed	Pressure, Fuel Tank Ullage Volume Mod 1 (APS) D0097-414 Minimum: 203 psia Maximum: 216 psia Nominal: 208 psia Pressure, Oxid Tank Ullage Volume Mod 1 (APS) D0098-414 Minimum: 203 psia Maximum: 216 psia Nominal: 208 psia Pressure, Fuel Tank Supply Manifold Mod 1 (APS) D0070-414 Minimum: 205 psia Maximum: 218 psia Nominal: 211 psia	Subtracting the fluid head and in a static condition, the primary and alternate pressures will be equal.
D0073-415	Pressure, Oxidizer Supply Manifold Mod 2 (APS)	a. Helium control module failure b. Quad check valves sticking	Pressure, Fuel Tank Ullage Volume Mod 2 (APS) D0100-415 Minimum: 203 psia Maximum: 216 psia Nominal: 208 psia Pressure, Oxidizer Tank Ullage Volume Mod 2 (APS) D0099-415 Minimum: 203 psia Maximum: 216 psia Nominal: 203 psia	Subtracting the fluid head and in a static condition, the primary and alternate pressures will be equal.

TABLE 5-6 (Sheet 8 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
D0073-415	(Continued)		Pressure, Fuel Supply Manifold Mod 2 (APS) D0072-415 Minimum: 205 psia Maximum: 218 psia Nominal: 211 psia	
D0088-403	Pressure, LOX Tank Repress Spheres 1 & 2	a. Ground regulator failure b. Improper regulator setting c. Check valves failed closed d. Vent and/or relief valve failed open e. Excessive leakage	Pressure-LOX Tank Repress Spheres 1 and 2 D0254-403 Minimum: 2,800 psia Maximum: 3,200 psia Nominal: 3,000 psia	The alternate measurement is a direct backup with the same location, limits, time period and nominal value as the redline.
D0236-403	Pressure, Stage Pneumatic Control He Sphere	a. Ground regulator failure b. Improper regulator setting c. Check valve failed closed d. Excessive leakage e. Vent and/or dump relief valve failure	Pressure-Stage Pneumatic Control Helium Sphere Backup Measurement D0256-403 Minimum: 2,800 psia Maximum: 3,200 psia Nominal: 3,000 psia	The alternate measurement is a direct backup with the same location, limits, time period and nominal value as the redline.

TABLE 5-6 (Sheet 9 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
D0223-403	Pressure, Auxiliary Pump Air Tank	a. External leakage b. System underfilled	None	Air pressure in auxiliary pump electric motor is required to prevent arcing of brushes, provide conduction of heat from motor to system oil and acts as a lubricating media for brushes.
D0576-408	Pressure, Fuel Tank Ullage	a. Vent valve open or excessive leakage b. Ground regulator malfunction c. Pressurization switch malfunction d. GSE pressurization valve malfunction	Pressure-Fuel Tank Ullage EDS 1, D0177-408 and Pressure-Fuel Tank Ullage EDS 2, D0178-408 From T-30 min to tank pressurization the limits are: Minimum: None Maximum: 17.4 psia Nominal: 16.5 psia From tank pressurization to T-19 sec the limits are in figure 5-5.	Must satisfy the requirements as defined in figure 5-5 (in conjunction with GG fuel bleed valve temperature C0012-401).

TABLE 5-6 (Sheet 10 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
D0577-406	Pressure, Oxidizer Tank Ullage	a. Vent valve open or excessive leakage b. Ground regulator malfunction c. Pressurization switch malfunction d. GSE pressurization malfunction	Pressure-Oxidizer Tank Ullage EDS 1 D0179-406 or Pressure-Oxidizer Tank Ullage EDS 2 D0180-406 Minimum: 38 psia Maximum: 44 psia Nominal: 40 psia	1. This parameter may be used directly as a backup for the ullage pressure. 2. Ullage pressure must be between the limits of 38 to 44 psia at T-19 sec.
F0004-424	Flow, Oxidizer Recirculation Pump	Recirculation System Failure	Temperature-Oxidizer Pump Inlet C0004-403 Minimum: None Maximum: 166°R Nominal: 164°R Pressure-Oxidizer Pump Inlet minus Pressure-Oxidizer Tank Ullage D0003-403 minus D0577-408 Minimum: 13 psid Maximum: 18 psid Nominal: 16 psid	In order to detect recirculation system failure, flowrate and pump inlet pressure were selected as new redline and backup redlines, respectively. The pump inlet temperature (C0004-403) can be used as a backup for the time period from initiation of automatic sequence to T-19 sec. The differential pressure (D0003-403 minus D0577-408) can be used as a backup for the time period from start of recirculation to T-19 sec.

TABLE 5-6 (Sheet 11 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
F0005-404	Flow, LH2 Recirculation Pump	Recirculation system failure.	Pressure-Fuel Pump Inlet minus Pressure-Fuel Tank Ullage D0002-403 minus D0576-406 Minimum: 6 psid Maximum: 10 psid Nominal: 8 psid	In order to detect recirculation system failure, flowrate and pump inlet pressure were selected as new redline and backup redlines, respectively.
G0001-403	Position, Pitch Actuator	a. Bias on servo signal from IU guidance computer b. Loss of hydraulic pressure due to auxiliary hydraulic pump failure, hose failure, etc.	During S-IVB burn mode the measurement G0001-403 (via IU) can be used for an alternate. Minimum: -1.5 deg Maximum: +1.5 deg Nominal: 0 deg	The only alternate or backup for this redline is during S-IVB burn mode. The burn mode is a small part of the total applicable time. Essentially there is no backup for this redline.
G0002-403	Position, Yaw Actuator	a. Bias on servo signal from IU guidance computer b. Loss of hydraulic pressure due to auxiliary hydraulic pump failure, hose failure, etc.	During S-IVB burn mode the measurement G0002-403 (via IU) can be used for an alternate. Minimum: -1.5 deg Maximum: +1.5 deg Nominal: 0 deg	The only alternate or backup for this redline is during S-IVB burn mode. The burn mode is a small part of the total applicable time. Essentially there is no backup for this redline.

TABLE 5-6 (Sheet 12 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
G0010-401	Position, PU Valve	a. PU Activate OFF failure b. Mechanical failure in PU valve motor gear assembly	Volts-PU valve feedback M0061-411 Minimum: Null -1.526 vdc Maximum: Null +1.526 vdc Nominal: Null	PU activate is interlocked for start of automatic sequence.
K0013-401	Event, Cutoff Signal	Loss of engine ready signal when engine cutoff is ON	None	The signal should drop from ON to OFF following Engine Ignition Power ON and remain OFF. The following test can be conducted to verify if the cutoff circuit is operative and in the proper state. Verify that K0140 (Switch Selector Cutoff) is ON; cutoff indication on the C4EN panel is ON; nonprogrammed cutoff is OFF; engine control and ignition power are ON, and Engine Ready (K0012) is ON. a. Send RACS and verify strip chart operation to check instrumentation. b. Remove ignition power.(verify Engine Ready goes OFF).

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
K0013-401 (Continued)				c. Remove K0140 (Switch Selector Cutoff OFF). Verify cutoff indication on C4EN remains On.) NOTE: If C4EN cutoff indication goes OFF with the removal of K0140, immediately turn off engine control power. d. Send Engine Ready Bypass. (Verify cutoff indication on C4EN goes OFF.) e. Send K0140 (Switch Selector Cutoff) to Safe Engine. A negative finding will require additional electronics analysis and disposition.
L0007-403	Level, Reservoir Oil (Aux Pump ON)	a. External leakage b. System under-filled	a. Pressure- Hydraulic System D0041-403 Nominal: 3,600 psia b. Pressure- Reservoir Oil D0042-403 Nominal: 170 psia (Aux Pump ON)	If reservoir oil is too low, the pump will cavitate after start and hydraulic system pressure will not rise to minimum level. Observe low level light. Light indicates when oil level drops below 9.54 percent to 11.02 percent.

TABLE 5-6 (Sheet 14 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION, (SAFETY MARGINS, ETC.)
L0007-403	Level, Reservoir Oil, (Aux Pump OFF)	a. System Leakage b. System under-filled	Pressure-Reservoir Oil D0042-403 Nominal: 170 psia (Aux Pump ON)	1. If auxiliary pump is OFF, turn ON and check alternate pressure measurement. 2. If auxiliary pump is OFF, turn ON and observe low level light. Light indicates below 9.54 percent to 11.02 percent.
M0151-340	Voltage, Aft Bus No. 1	Ground power malfunction when on external power or battery malfunction when on internal power	M0146-340 4D110 ESE Bus Volt/28 vdc M0014-404 Volt, Output Aft Battery No. 1/28 vdc	1. With proper allowances for the potential difference between GSE and vehicle voltage buses, measurement M0146-340 is a redline alternate when on external power and measurement M0014-404 is a redline alternate when on internal power. 2. Within the limitations of T/M monitoring, the engine control (M0006-401) and ignition bus (M0007-401) measurements give an indication of aft bus No. 1 during engine power ON. 3. The design limits of the engine control bus (Rocketdyne Specification R-3825-1) established the redline limits of the bus. 4. S-IVB ready for launch interlock is provided. 5. S-IVB voltage malfunction interlock is provided.

TABLE 5-6 (Sheet 15 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
M0152-340	Voltage, Fwd Bus No. 2	Ground power malfunction when on external power or battery malfunction when on internal power	M0147-307 4D210 ESE Bus Volt/28 vdc M0018-411 Volt, Output Fwd Batt No. 2/28 vdc	1. With proper allowances for the potential difference between GSE and vehicle voltage buses, measurement M0147-307 is a redline alternate when on external power and measurement M0018-401 is a redline alternate when on internal power. 2. During the time when the inv-conv is energized (M0001-411, M0004-411 and M0023-411), it will give a gross indication of whether fwd bus No. 2 is ON or OFF. 3. The design limits of the PU inv-conv and PU elect assy established the redline limits of the bus. 4. S-IVB ready for launch interlock is provided. 5. S-IVB voltage malfunction interlock is provided.
M0153-340	Voltage, Aft Bus No. 2	Ground power malfunction when on external power or battery malfunction when on internal power	Meter M8 C4NP 4D410 ESE Bus Volt/56 vdc M0015-404 Volt, Output, Aft Battery No. 2/ 56 vdc	1. With proper allowances for the potential difference between GSE and vehicle, voltage buses, Meter M8 is a redline alternate when on external power and measurement M0015-404 is a redline alternate when on internal power.

TABLE 5-6 (Sheet 16 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
M0153-340 (Continued)				2. During the time that the chilldown inverters are energized, the inverter phase voltages (M0026-404, M0027-404, M0040-404 and M0041-404), will give a gross indication of whether aft bus No. 2 is ON or OFF. 3. The design limits of the chilldown inverters established the redline limits of the bus. 4. S-IVB ready for launch interlock is provided. 5. S-IVB voltage malfunction interlock is provided.
M0154-340	Voltage, Fwd Bus No. 1	Ground power malfunction when on external power or battery malfunction when on internal power	M0148-307 4D310 ESE Bus Volt/ 28 vdc M0016-411 Volt, Output Fwd Batt 1/ 28 vdc	1. With proper allowances for the potential difference between GSE and vehicle voltage buses, measurement M0148-307 is a redline alternate when on external power and measurement M0016-411 is a redline alternate when on internal power. 2. During the time that the fwd and aft 5-volt excitation modules are energized (M0024-411 and M0025-404), they will give a gross indication of whether fwd bus No. 1 is ON or OFF.

TABLE 5-6 (Sheet 17 of 17)
REDLINE BACKUP INFORMATION

REDLINE MEASUREMENT NO.	REDLINE MEASUREMENT TITLE	PROBABLE CAUSES OF EXCEEDING REDLINE LIMITS	ALTERNATIVES/MEAS NUMBER/NOMINALS	OTHER INFORMATION (SAFETY MARGINS, ETC.)
M0154-340 (Continued)				3. S-IVB ready for launch inter-lock is provided. 4. S-IVB voltage malfunction interlock is provided. 5. The design limits of the switch selector (NASA Spec 50M71765) established this redline limit.
N0063-411	Misc PU Oven Stability Monitor	Temperature in PU oven drops below 80°C due to heater power failure	No Backup	An out of tolerance indication at liftoff would indicate a propellant loading error and the possibility of a depletion cutoff in flight.
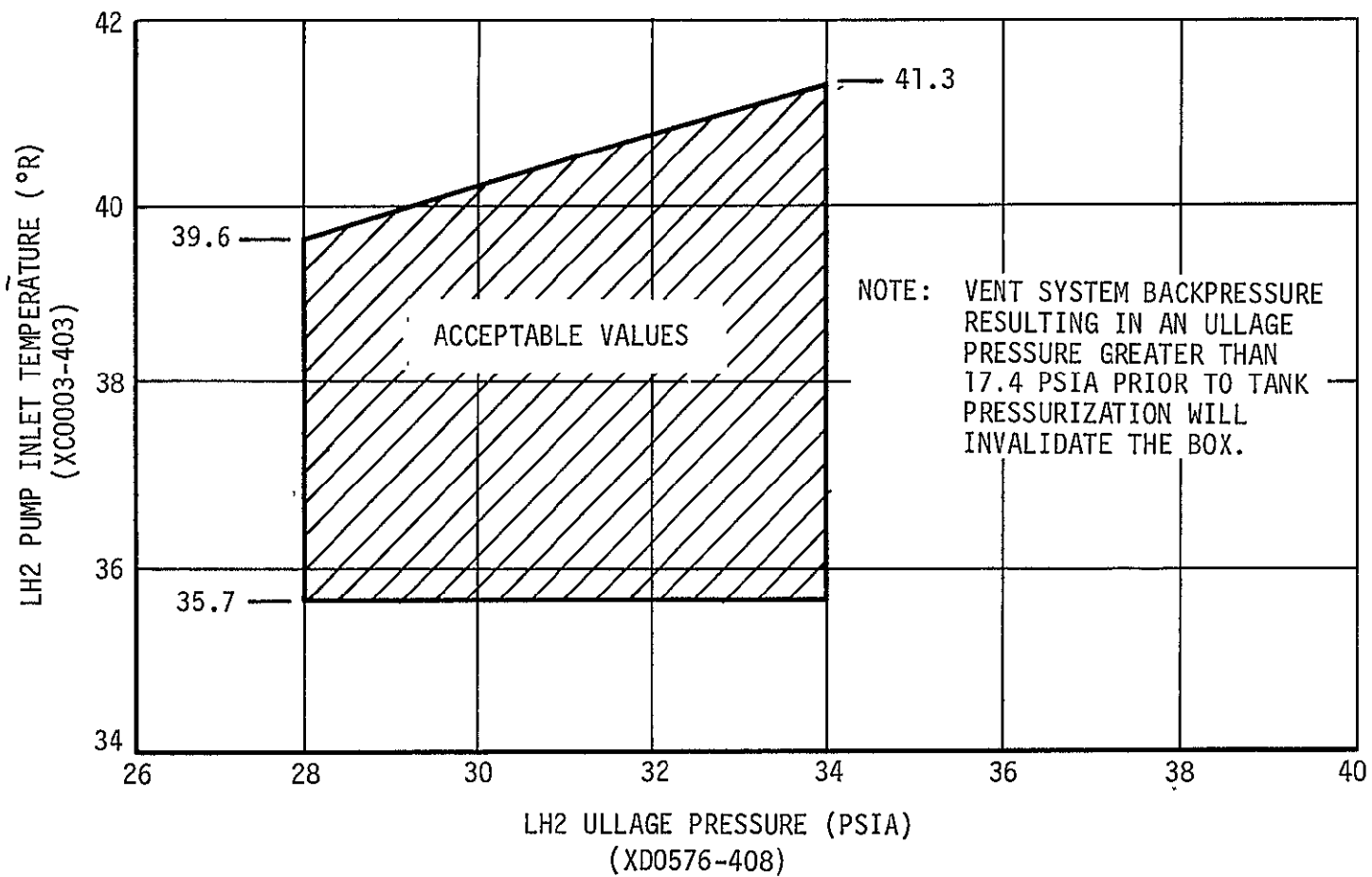
Figure 5-1. LH2 Critical Limits
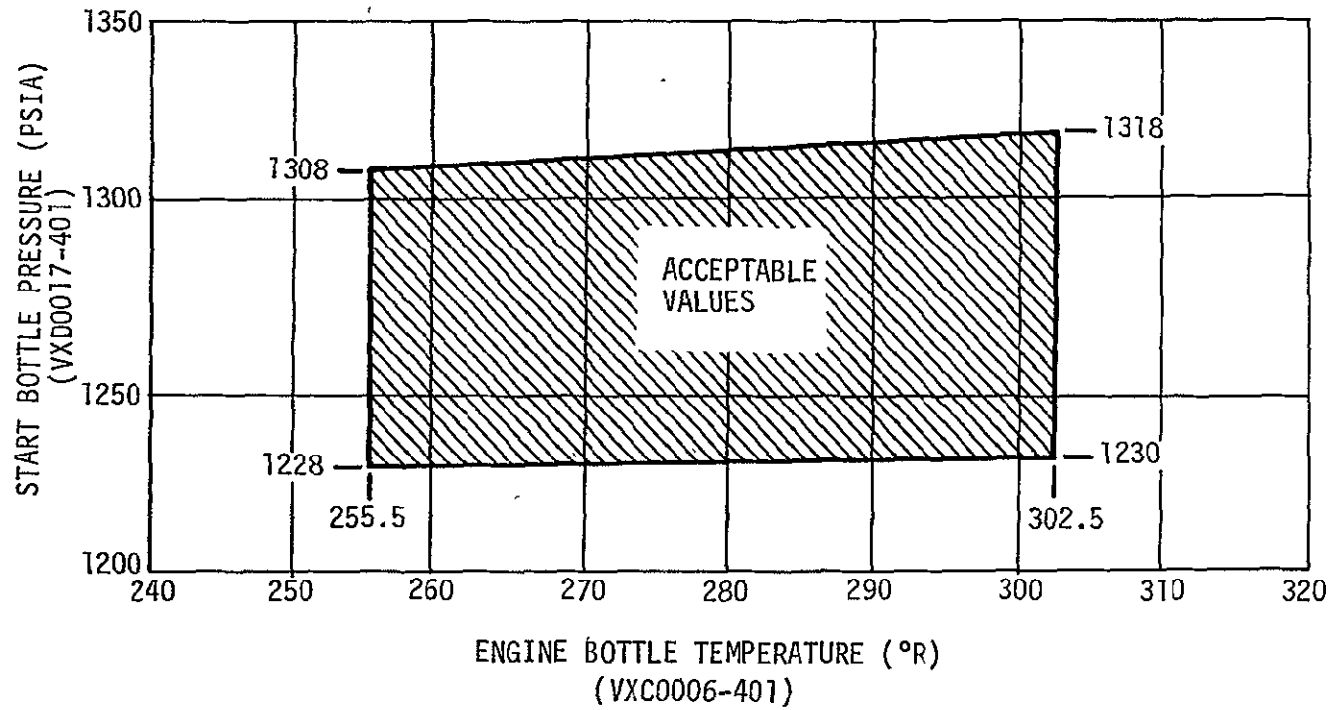
Figure 5-2. GH2 Start Bottle Box S-IVB/V Vehicles
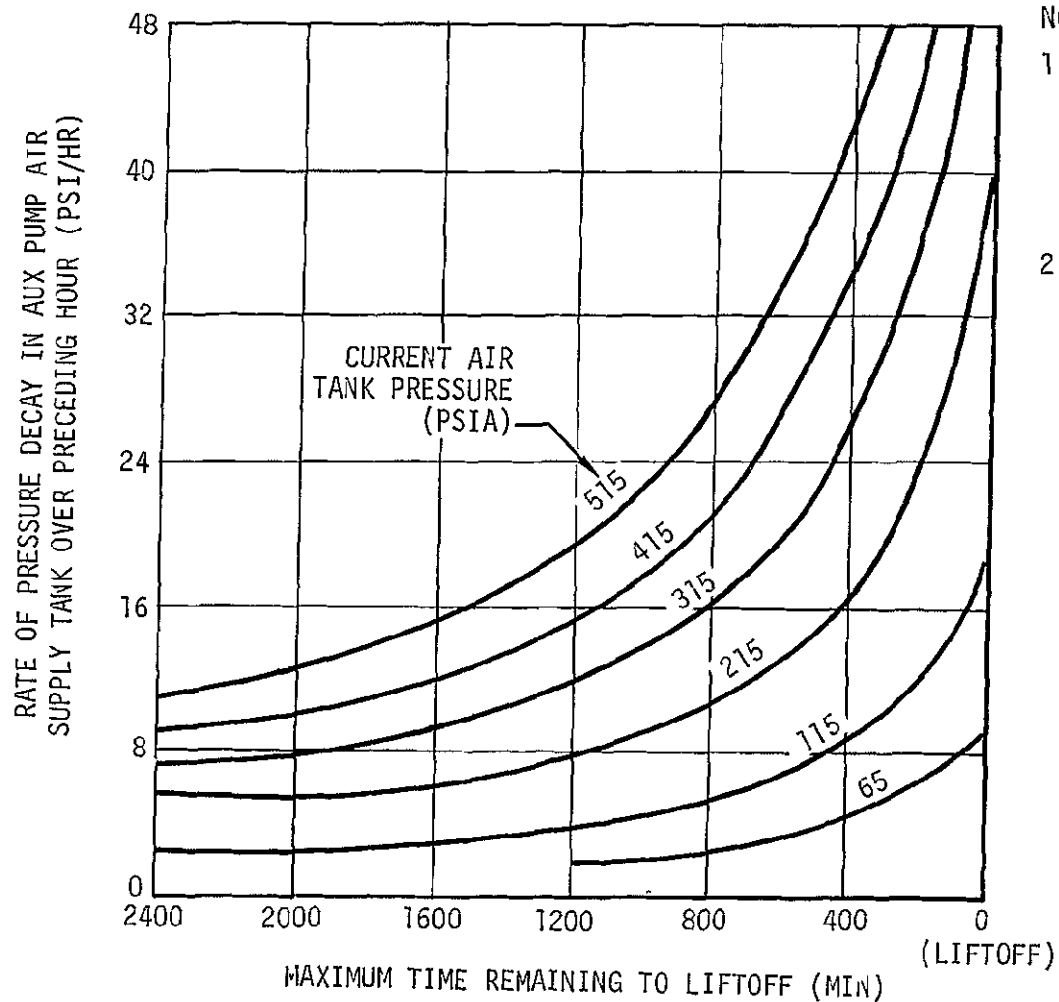
Figure 5-3. Critical Limits, Auxiliary Pump Air Supply Tank

RESERVOIR OIL LEVEL (%)
AUXILIARY PUMP OFF
(VXL0007-403)

ACCEPTABLE VALUES

RESERVOIR OIL TEMPERATURE (°F)
(VXC0051-403)
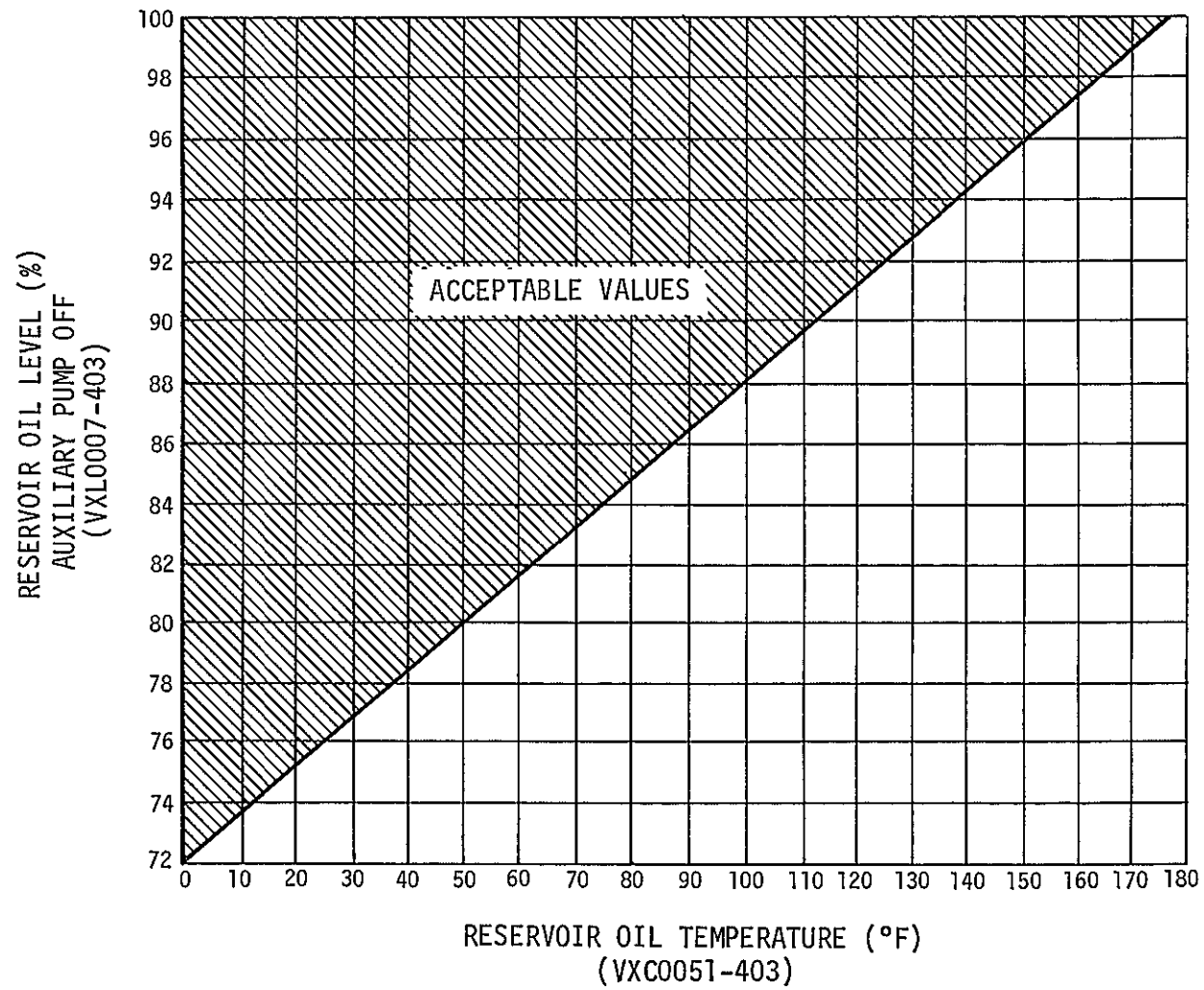
Figure 5-4. Hydraulic Reservoir Level Critical Limits

GG FUEL BLEED VALVE TEMPERATURE (°R)
(C0012-401)

FUEL ULLAGE PRESSURE (PSIA)
(D0576-408)

ACCEPTABLE VALUES

NOTE: VENT SYSTEM BACK PRESSURE
RESULTING IN AN ULLAGE
PRESSURE GREATER THAN
17.4 PSIA PRIOR TO TANK
PRESSURIZATION WILL IN-
VALIDATE THE BOX.
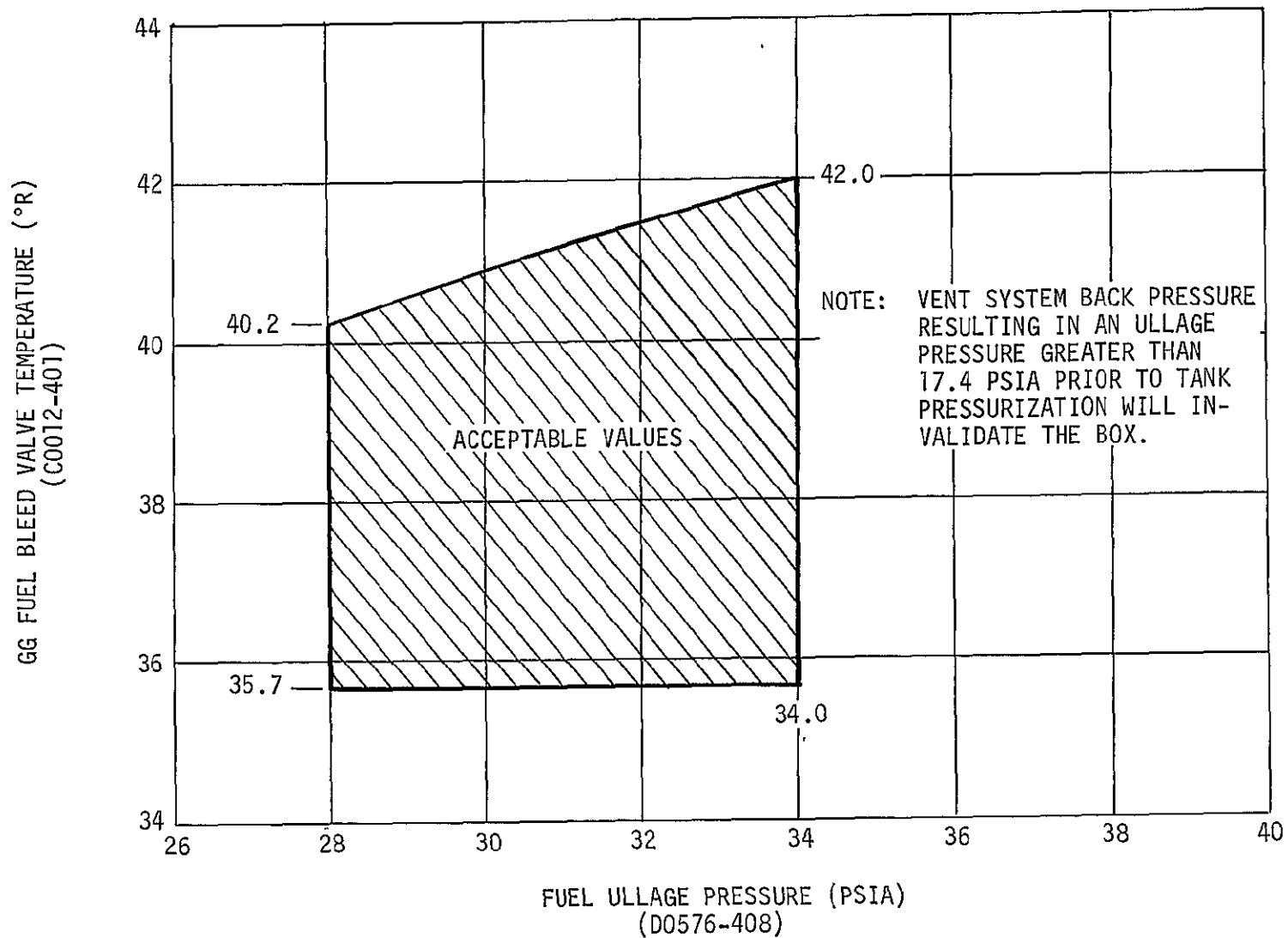
Figure 5-5. Fuel Critical Limits (Backup)
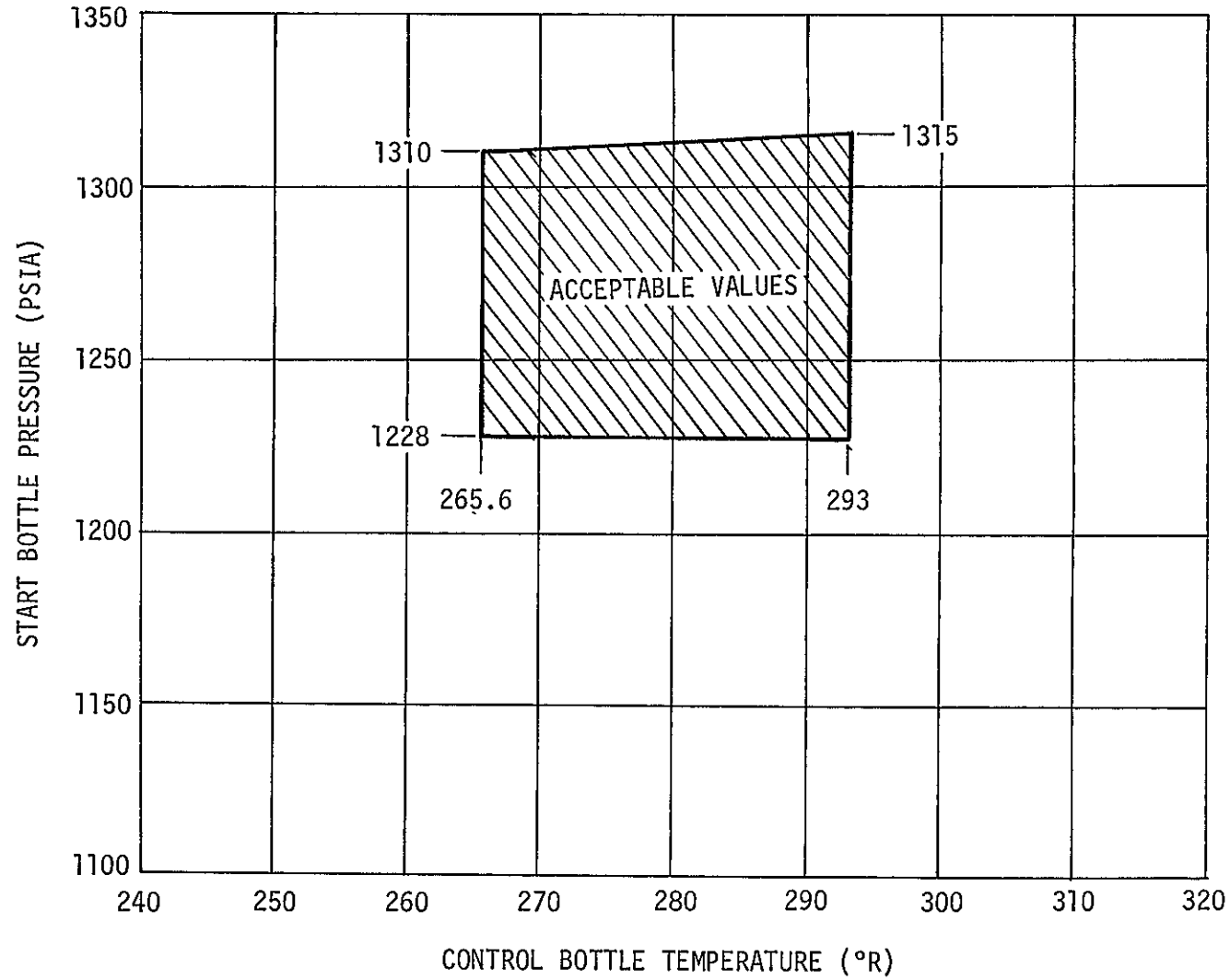
Figure 5-6. GH2 Start Bottle Box (Backup)
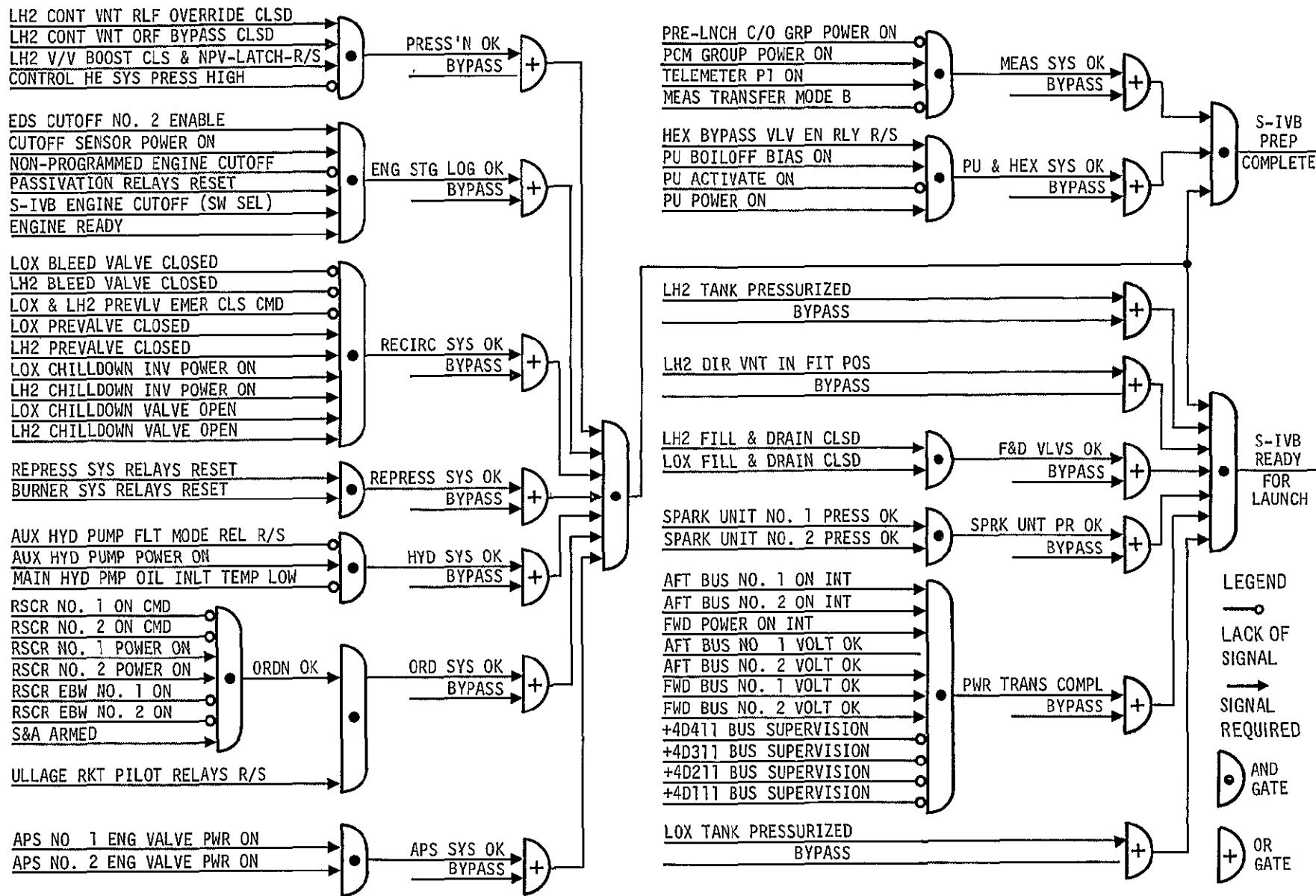
Figure 5-7. S-IVB-503N Interlock Logic Diagram

FLIGHT TEST MANAGEMENT

6. FLIGHT TEST MANAGEMENT

This section defines the responsibilities of the McDonnell Douglas Astronautics Company - 'Western Division (MDAC-WD) relative to the data flow, flight test evaluation, and documentation of the S-IVB-503N stage flight test.

6.1 Flight Test Responsibilities

MDAC-WD personnel will perform postflight evaluations of the S-IVB-503N stage at the following locations:

  a. Kennedy Space Center (KSC), Cape Kennedy, Florida

  b. Marshall Space Flight Center (MSFC), Huntsville, Alabama

  c. McDonnell Douglas Astronautics Company - Western Division (MDAC-WD) Huntington Beach, California.

At KSC, MDAC-WD is represented by the Florida Test Center (FTC) Test Planning and Evaluation (TP&E) Committee, and at MSFC, by the MDAC-WD/MSFC liaison team.

The MDAC-WD/HB and MDAC-WD/FTC TP&E Committees consist of personnel assigned from Saturn Engineering sections and branches. Their functions are to:

  a. Coordinate postflight evaluation

  b. Provide information for all contractual documentation

  c. Coordinate test planning for future flights.

The onsite quick-look postflight evaluation, consisting primarily of analog data evaluation, is performed by the MDAC-WD/FTC TP&E Committee, and the results are transmitted to:

  a. National Aeronautics and Space Administration (NASA), Kennedy Space Center

  b. MDAC-WD/HB TP&E Committee

  c. MDAC-WD/MSFC liaison team.

The major postflight evaluation is conducted at MDAC-WD/HB and consists primarily of analyses from digital data.

All analyses conducted at MDAC-WD/FTC and MDAC-WD/HB are transmitted to the MDAC-WD/MSFC liaison team. This liaison team transmits information between MDAC-WD and MSFC, provides the MSFC Flight Evaluation Working Group (FEWG) with required information, and performs rapid analyses in response to FEWG requests. In addition, the liaison team participates in many of the MSFC postflight evaluations which contribute to, or parallel, MDAC-WD postflight evaluation efforts.

6.2 Postflight Communication

The following means of communication have been established to expedite transmittal of evaluation information:

a. Teletype (TWX) communications between MDAC-WD/HB, MDAC-WD/MSFC, and MDAC-WD/FTC

b. Facsimile communications between MDAC-WD/HB, MDAC-WD/MSFC, and MDAC-WD/FTC

c. Data phone link between MDAC-WD/MSFC and MDAC-WD/HB.

Transmittal of classified material between MDAC-WD facilities by any of the above means is not authorized. A standard format is used for transmission of unclassified data by TWX or facsimile.

To ensure rapid and controlled data transmission between locations, it is highly desirable that all information be channeled through one coordinator of flight information at each location.

6.3 Documentation

MDAC-WD prepares and publishes certain documents for each S-IVB stage flight. The documents, listed in the approximate order in which they will be published, are as follows:

Preflight

a. Contractor Drawing 1B43569, Saturn S-IVB-503N Instrumentation Program and Components List (reference 7, appendix 11)

b. Contractor Report No. DAC-56334, MDAC-WD S-IVB Stage Data Acquisition Requirements Document for Saturn V Flights (reference 8, appendix 11)

c. Douglas Report No. SM-47000, S-IVB-503N Stage Flight Test Plan
(reference 9, appendix 11)

d. Douglas Report No. DAC-56636, S-IVB-503N Technical Performance
Criteria Document (reference 10, appendix 11)

Postflight

a. Quick-Look Assessment Report (second morning following launch)

b. FTC Ground Systems Evaluation Report (10 days)

c. FTC Preliminary Flight Evaluation Summary (2 weeks)

d. Written Informal Evaluation Inputs to MSFC/FEWG (28 days)

e. Douglas Report No. SM-47006, S-IVB-503N Stage Flight Evaluation
Report (60 days) (reference 11, appendix 11)

Descriptions of these documents are presented in the following paragraphs.

6.3.1 Saturn S-IVB-503N Instrumentation Program and Components List,
1B43569

This drawing contains all the telemetry measurements of the S-IVB-503N
stage. A partial list of its contents is as follows:

a. Measurement numbers

b. Component part numbers

c. Reference designation numbers

d. Telemetry channel coding definitions

e. Measurement list

f. Measurement matrix by area and function

g. Measurement locations, illustrations, and index

All sections of the Instrumentation Program and Components List are
revised as necessary to reflect current instrumentation information.

Revisions are controlled by the Saturn Project Office - Test at MDAC-WD.

6.3.2 Douglas S-IVB Stage Data Acquisition Requirements Document for Saturn V Flights, DAC-56344

This document describes the detailed data requested by MDAC-WD/HB for evaluation of the S-IVB stage of the Saturn V flights. The requested data will be provided by KSC, Goddard Space Flight Center (GSFC), and MSFC.

6.3.3 S-IVB-503N Stage Flight Test Plan, SM-47000

The contents of the S-IVB-503N Stage Flight Test Plan are described in section 1 of this document. This document is prepared by the MDAC-WD/HB Saturn S-IVB TP&E Committee.

6.3.4 S-IVB-503N Stage Technical Performance Criteria Document, DAC-56636

This document contains the S-IVB-503N stage technical performance criteria which will be used to determine the Contractors cost plus incentive fee bonus or penalty pertaining to mission accomplishment, payload capabilities and telemetry performance. This document is prepared by the MDAC-WD/HB Saturn S-IVB TP&E Committee.

6.3.5 Quick-Look Assessment Report (second morning following launch)

On the second morning following launch, the MDAC-WD/FTC TP&E Committee supplies to KSC an input to the quick-look assessment report. This input is based upon available data on the stage and stage oriented GSE. Included in the quick-look evaluation is a brief description of system performance, mission objective accomplishment, and any malfunction which may have occurred. The time period covered is from the last day of launch countdown through powered flight.

6.3.6 FTC Ground Systems Evaluation Report (10 days)

The MDAC-WD/FTC TP&E Committee will prepare an evaluation report on the performance of the MSFC and KSC supplied, S-IVB oriented GSE. This covers evaluation of both mechanical and electrical GSE used during launch countdown. This report will be transmitted to KSC.

6.3.7 FTC Preliminary Flight Evaluation Summary (2 weeks)

The MDAC-WD/FTC TP&E Committee will compile, publish, and distribute the Preliminary Flight Evaluation Summary for internal use only approximately 2 weeks after launch. It will be the final FTC effort and will summarize test objectives, discuss possible causes of malfunctions, and recommend any corrective action required.

6.3.8 MDAC-WD Inputs to MSFC/FEWG

The MDAC-WD/MSFC liaison team will summarize the results of the MDAC-WD/ FTC flight evaluations as they are completed during the four weeks subsequent to launch. These summaries, as they become available, will be input to the FEWG and will constitute the Douglas input to the MSFC Saturn Vehicle Flight Evaluation Report.

In addition, 44 days after launch, MDAC-WD will review its portion of the FEWG report to ensure the technical accuracy and adequacy of evaluation.

6.3.9 S-IVB-503N Stage Flight Evaluation Report (60 days)

Sixty days after launch, the MDAC-WD/HB TP&E Committee will write, publish, and distribute Douglas Report No. SM-47006, S-IVB-503N Stage Flight Evaluation Report. The data for evaluation will be required at MDAC-WD/HB 15 days after launch, thereby allowing 45 days for preparation of the report. Tentative evaluation meetings and documentation schedules are shown in tables 6-1 and 6-2. A flight evaluation report outline delineating the responsible design technologies is presented in table 6-3.

TABLE 6-1
TENTATIVE AS-503 FLIGHT EVALUATION MEETING SCHEDULE

DAYS AFTER LAUNCH	EVENT SCHEDULES	MEETING LOCATION
2	Flight Review Meeting	MSFC
6	First "How-Goes-It" Meeting	MDAC-WD/HB
13	First General Evaluation Meeting	MSFC
13	Second "How-Goes-It" Meeting	MDAC-WD/HB
20	Third "How-Goes-It" Meeting	MDAC-WD/HB
	FEWG Summary Meeting	MSFC
25	Fourth "How-Goes-It" Meeting	MDAC-WD/HB
26	S-IVB Stage Instrumentation Splinter Meeting	MSFC
27	Summary Meeting	MSFC

TABLE 6-2
EVALUATION AND DOCUMENTATION SCHEDULE FOR S-IVB-503N STAGE FLIGHT EVALUATION REPORT

DAYS AFTER LAUNCH	EVENT
0	Launch
2	Support FEWG Flight Review Meeting
13	Support FEWG First General Evaluation Meeting
15	All Final Data Due at A3
26	Support S-IVB Stage Instrumentation Splinter Meeting
27	Support FEWG Summary Meeting
28	Written Informal Evaluation Inputs to MSFC/FEWG Report Due
33	First Inputs Due from Design Sections
45	Management Review Copy to Reproduction
47	All Final Evaluation Inputs Due for 60-Day Report*
48	Review of FEWG Flight Evaluation Report
55	Management Review Copy Distributed
57	Management Review Comments Due
60	Final Report to Reproduction
67	Final 60-Day Evaluation Report Distributed

*A detailed outline will be published immediately after launch, indicating when inputs are due during the 33 to 47 day period.

| | ENGINEERING |
| SECTION | SECTION |

1. INTRODUCTION . . . . S-IVB Project

    1.1   General

    1.2   History

2. FLIGHT AND STAGE SUMMARY . . . . S-IVB Project*

    2.1   Flight Description

    2.2   Mission Objectives

    2.3   Countdown Operations

    2.4   CPIF Summary

    2.5   Trajectory

    2.6   Mass Characteristics

    2.7   Engine System

    2.8   Solid Rockets

    2.9   Oxidizer System

    2.10 Fuel System

    2.11 Auxiliary Propulsion System

    2.12 Pneumatic Control and Purge

    2.13 Propellant Utilization

    2.14 S-II/S-IVB Stage Separation

    2.15 Data Acquisition System

    2.16 Electrical System

    2.17 Range Safety System

    2.18 Flight Control

    2.19 Hydraulic System

    2.20 Stage Structure and
           Environment

    2.21 Forward Skirt Thermo-
           conditioning

    2.22 Acoustic and Vibration
           Environment

*Each Design Technology will summarize its individual areas. The S-IVB TP&E
Section will ensure compatibility between the various analyses. The S-IVB
Project Office will summarize mission, anomalies and objectives.

SECTION

ENGINEERING
SECTION

2.23 Aero/Thermodynamic
Environment

2.24 Propellant Dump

3. TEST CONFIGURATION*

3.1 General Configuration . . . . MDAC-WD/FTC TP&E Committee
& Propulsion

3.2 Stage and Hardware Modifications . . . MDAC-WD/FTC TP&E Committee
& Propulsion

4. SEQUENCE OF EVENTS

4.1 Predicted and Monitored Times . . . . . Flight Dynamics & Control
(FD&C)

4.2 Time Bases . . . . FD&C

4.3 Ground Commands . . . . FD&C

4.4 Ground Sequence of Events . . . . Electronics

5. COUNTDOWN OPERATIONS

5.1 AS-503 Launch Countdown . . . . Propulsion

5.2 Redline Limits . . . . Propulsion and Electronics

5.3 Countdown Problems . . . . Propulsion

5.4 Atmospheric Conditions . . . . S-IVB Project Office

6. COST PLUS INCENTIVE FEE . . . . S-IVB Project Office

6.1 Flight Mission Accomplishment . . . . . FD&C

6.2 Payload Capability . . . . FD&C

6.3 Telemetry Performance . . . . Electronics

7. TRAJECTORY . . . . FD&C

7.1 Scope

7.2 Postflight Predicted Trajectory
Evaluation

7.3 Comparison Between Actual and
Predicted Trajectories

*Includes serial numbers of significant stage end items, orifices sizes,
nominal pressure switch settings, and nominal regulator settings. Signifi-
cant modifications to the stage since acceptance firing are listed, if any.

SECTION   ENGINEERING
                                                              SECTION

7.4   Powered Flight Simulated
      Trajectory Evaluation

7.5   Translunar Orbital Analysis

8.   MASS CHARACTERISTICS . . . . Weight Control

8.1   Mass Characteristics Summary

8.2   Mass Properties Dispersion
      Analysis

8.3   Third Flight Stage Best Estimate
      Ignition and Cutoff Masses

9.   ENGINE SYSTEM**

9.1   Engine Chilldown Conditioning . . . . . Propulsion

9.2   Engine Start and Cutoff Sequencing . . Propulsion

9.3   Start Sphere Performance . . . . Propulsion

9.4   Engine Performance . . . . Propulsion

9.5   Component Operation . . . . Propulsion

9.6   Engine Environment During Orbital
      Coast . . . . Propulsion

9.7   Flight Simulation Analysis . . . . . . FD&C

10.   SOLID ROCKET PERFORMANCE . . . . Propulsion

10.1 Retrorockets

10.2 Ullage Rockets

11.   OXIDIZER SYSTEM** . . . . Propulsion

11.1 LOX Pump Chilldown

11.2 Engine LOX Supply

11.3 LOX Tank Pressurization Control

11.4 Pressurization System Conditions
      During Orbit

12.   FUEL SYSTEM** . . . . Propulsion

12.1 LH2 Pump Chilldown

12.2 Engine LH2 Supply

**Report required on both first and second burn performance.

| | ENGINEERING |
| SECTION | SECTION |

19. ELECTRICAL SYSTEM PERFORMANCE . . . . Electronics

    19.1 Electrical Control System

    19.2 Electrical Power System

20. RANGE SAFETY SYSTEM PERFORMANCE . . . . Electronics

    20.1 Controllers

    20.2 Firing Unit Monitors

    20.3 Receivers Signal Strength

21. FLIGHT CONTROL . . . . FD&C

    21.1 Attitude Control (Powered Flight)

    21.2 Attitude Control During Orbit
          and Translunar Injection

    21.3 Propellant Sloshing During S-IVB
          Powered Flight

22. HYDRAULIC SYSTEM PERFORMANCE . . . . Structural/Mechanical

    22.1 Hydraulic Systems Operation

23. STAGE STRUCTURE AND ENVIRONMENT . . . . Structural/Mechanical

    23.1 Flight Load Conditions and
          Structural Integrity

    23.2 Explosive Ordnance Equipment

24. FORWARD SKIRT THERMOCONDITIONING . . . . . . Structural/Mechanical

    24.1 Temperture

    24.2 Pressure

    24.3 Flowrate

25. ACOUSTIC & VIBRATION ENVIRONMENT . . . . . . Acoustics and Structural
                                             Dynamics (A&SD)

    25.1 Data Acquisition and Reduction

    25.2 Vibration Environment

    25.3 Acoustic Environment

26. AERO/THERMO ENVIRONMENT . . . . Aerodynamics/Thermodynamics

27. PROPELLANT DUMP . . . . Propulsion

| | | ENGINEERING |
| SECTION | | SECTION |

APPENDICES

1. MASS CHARACTERISTICS DATA (WS11) . . . . . . Weight Control

2. ENGINE PERFORMANCE PROGRAM (PA49) . . . . . . Propulsion

3. OBSERVED TRAJECTORY (AA83) . . . . FD&C

4. FLIGHT SIMULATED DATA (AC77) . . . . FD&C

5. METEOROLOGICAL DATA (AA99) . . . . MDAC-WD/FTC TP&E Committee

1.   SEQUENCE OF EVENTS

This appendix presents the predicted AS-503 flight sequence of events and their time base definitions. Definitions are given in table AP 1-1; sequence of events are given in table AP 1-2.

The sequence of events is based on the Marshall Space Flight Center's sequence requirements, as indicated in references 1 through 3 (appendix 11).

TABLE AP 1-1
DEFINITION OF TIME BASES

TB1   Time base 1 (TB1) is initiated by a liftoff signal provided by the
       deactivation of the liftoff relay in the IU at the umbilical
       disconnect.

TB2   Time base 2 (TB2) is initiated by S-IC inboard engine cutoff which
       is commanded at a predetermined time.

TB3   Time base 3 (TB3) is initiated at S-IC outboard engine cutoff by
       either of two redundant outboard engines cutoff signals.

TB4   The LVDC will initiate time base 4 (TB4) after receiving either of
       two signals, S-II Engines Cutoff or S-II Engines Out.

TB5   After a predetermined time, sufficient to allow the S-IVB engine to
       establish thrust OK, the LVDC will start time base 5 (TB5) after
       receiving any two of four functions monitored by the LVDC. The
       functions are (1) S-IVB Engine Out "A," (2) S-IVB Engine Out "B,"
       (3) S-IVB Velocity Cutoff which is issued by the LVDC, and (4) Loss
       Of Thrust as determined by the LVDC using accelerometer readings.

TB6   After a predetermined time in TB5, time base 6 (TB6) will be initiated
       by the LVDC upon solving the restart equation.

TB7   After a predetermined time, sufficient to allow the S-IVB engine to
       establish thrust OK, the LVDC will start time base 7 (TB7) after
       receiving any two of four functions monitored by the LVDC. The
       functions are (1) S-IVB Engine Out "A," (2) S-IVB Engine Out "B,"
       (3) S-IVB Velocity Cutoff which is issued by the LVDC, and (4) Loss
       Of Thrust as determined by the LVDC using accelerometer readings.

TB4a   Alternate time base 4a (TB4a) will be programmed for use in early
       staging of the S-IVB stage (initiated by crew action).

TB5a   Alternate time base 5a (TB5a) will be programmed for use should the
       spacecraft separate either in parking orbit prior to TB6 +560.0 sec
       or in TB7.

TB6a   Alternate time base 6a (TB6a) will be programmed for use should the
       O_2-H_2 burner malfunction between TB6 +48.0 sec and TB6 +341.3 sec.

TB6b   Alternate time base 6b (TB6b) will be programmed for use should the
        O_2-H_2 burner malfunction between TB6 +341.3 sec and TB6 +496.7 sec.

TB6c   Alternate time base 6c (TB6c) will be programmed for use should the
        decision be made to delay the S-IVB restart attempt after T6 +41.0 sec.

TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 1 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
00:00:00.0	Liftoff - Start of Time Base 1 (TB1)			TB1 +0.0
00:00:01.0	Start Yaw Maneuver	–	–	N/A
00:00:05.0	Sensor Bias On	IU	109	TB1 +5.0
00:00:09.4	End Yaw Maneuver	–	–	N/A
00:00:10.0	Begin Pitch and Roll Maneuver	–	–	N/A
00:00:14.0	Multiple Engine Cutoff Enable	S-IC	3	TB1 +14.0
00:00:19.8	S-IC Outboard Engines Cant On "A"	IU	83	TB1 +19.8
00:00:20.0	S-IC Outboard Engines Cant On "B"	IU	84	TB1 +20.0
00:00:20.2	S-IC Outboard Engines Cant On "C"	IU	85	TB1 +20.2
00:00:24.0	Telemeter Calibrate On	S-IC	2	TB1 +24.0
00:00:27.0	Telemetry Calibrator Inflight Calibrate On	IU	23	TB1 +27.0
00:00:29.0	End Roll Maneuver	–	–	N/A
00:00:29.0	Telemeter Calibrate Off	S-IC	1	TB1 +29.0
00:00:30.0	Launch Vehicle Engines EDS Cutoff Enable	IU	38	TB1 +30.0
00:00:32.0	Telemetry Calibrator Inflight Calibrate Off	IU	24	TB1 +32.0
00:00:49.5	Fuel Pressurizing Valve No. 2 Open & Tape Recorder Record	S-IC	5	TB1 +49.5
00:01:14.0	Start Data Recorders	S-II	71	TB1 +74.0
00:01:15.0	Cooling System Electronic Assembly Power Off	IU	110	TB1 +75.0
00:01:16.0	Maximum Dynamic Pressure	–	–	N/A
00:01:30.0	Telemetry Calibrator Inflight Calibrate On	IU	23	TB1 +90.0
00:01:35.0	Telemetry Calibrator Inflight Calibrate Off	IU	24	TB1 +95.0

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
00:01:35.3	Fuel Pressurizing Valve No. 3 Open	S-IC	6	TB1 +95.3
00:01:45.0	Flight Control Computer Switch Point No. 1	IU	26	TB1 +105.0
00:01:55.1	Telemeter Calibrate On	S-IC	2	TB1 +115.1
00:02:00.0	Flight Control Computer Switch Point No. 2	IU	21	TB1 +120.0
00:02:00.1	Telemeter Calibrate Off	S-IC	1	TB1 +120.1
00:02:03.5	Fuel Pressurizing Valve No. 4 Open	S-IC	7	TB1 +123.5
00:02:03.8	Tape Recorder Record On	IU	39	TB1 +123.8
00:02:04.1	LOX Tank Strobe Lights Off	S-IC	4	TB1 +124.1
00:02:04.3	S-IC Two Engines Out Auto-Abort Inhibit Enable	IU	51	TB1 +124.3
00:02:04.5	S-IC Two Engines Out Auto-Abort Inhibit	IU	35	TB1 +124.5
00:02:04.7	Excess Rate (P,Y,R) Auto-Abort Inhibit Enable	IU	15	TB1 +124.7
00:02:04.9	Excess Rate (P,Y,R) Auto-Abort Inhibit and Switch Rate Gyro SC Indication "A"	IU	2	TB1 +124.9
00:02:05.1	Two Adjacent Outboard Engines Out Cutoff Enable	S-IC	17	TB1 +125.1

TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 3 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
00:02:05.2	Inboard Engine Cutoff – Start of Time Base 2 (TB2)	S-IC	8	TB2 +0.0
00:02:05.4	Inboard Engine Cutoff Backup	S-IC	16	TB2 +0.2
00:02:05.6	Start First PAM – FM/FM Calibration	S-II	30	TB2 +0.4
00:02:05.8	Auto-Abort Enable Relays Reset	IU	16	TB2 +0.6
00:02:06.0	Excessive Rate (Roll) Auto-Abort Inhibit Enable	IU	34	TB2 +0.8
00:02:06.2	Excessive Rate (Roll) Auto-Abort Inhibit and Switch Rate Gyro SC Indication "B"	IU	50	TB2 +1.0
00:02:10.6	Stop First PAM – FM/FM Calibration	S-II	9	TB2 +5.4
00:02:21.1	S-II Ordnance Arm	S-II	11	TB2 +15.9
00:02:21.3	Separation and Retro No. 1 EBW Firing Units Arm	S-IC	10	TB2 +16.1
00:02:21.5	Separation and Retro No. 2 EBW Firing Units Arm	S-IC	20	TB2 +16.3
00:02:24.3	Telemetry Measurement Switchover	S-IC	13	TB2 +19.1
00:02:24.5	Separation Camera On	S-IC	12	TB2 +19.3
00:02:24.6	Q-Ball Power Off	IU	1	TB2 +19.4
00:02:24.7	Outboard Engines Cutoff Enable	S-IC	9	TB2 +19.5
00:02:24.9	Outboard Engines Cutoff Backup Enable	S-IC	14	TB2 +19.7
00:02:27.0	End Pitch Maneuver	–	–	N/A

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
00:02:30.6	Outboard Engines Cutoff-Start of Time Base 3 (TB3)			TB3 +0.0
00:02:30.7	LH2 Tank High Pressure Vent Mode	S-II	38	TB3 +0.1
00:02:30.8	S-II LH2 Recirculation Pumps Off	S-II	48	TB3 +0.2
00:02:31.1	S-II Ullage Trigger	S-II	24	TB3 +0.5
00:02:31.3	S-IC/S-II Separation (No. 1)	S-IC	15	TB3 +0.7
00:02:31.4	S-IC/S-II Separation (No. 2)	S-IC	19	TB3 +0.8
00:02:31.5	S-II Engines Cutoff Reset	S-II	31	TB3 +0.9
00:02:31.6	Engines Ready Bypass	S-II	20	TB3 +1.0
00:02:31.7	Prevalves Lockout Reset	S-II	19	TB3 +1.1
00:02:31.8	Switch Engine Control to S-II and S-IC Outboard Engine Cant Off "A"	IU	33	TB3 +1.2
00:02:31.9	S-IC Outboard Engines Cant Off "B"	IU	86	TB3 +1.3
00:02:32.0	S-II Engine Start	S-II	33	TB3 +1.4
00:02:32.1	S-II Engine Out Indication "A" Enable; S-II Aft Interstage Separation Indication "A" Enable	IU	28	TB3 +1.5
00:02:32.3	S-II Engine Out Indication "B" Enable; S-II Aft Interstage Separation Indication "B" Enable	IU	48	TB3 +1.7
00:02:32.5	Engines Ready Bypass Reset	S-II	49	TB3 +1.9
00:02:32.6	Measurement Transfer Mode Position "B"	S-IVB	52	TB3 +2.0
00:02:33.6	S-II Hydraulic Accumulators Unlock	S-II	12	TB3 +3.0
00:02:36.8	PU System Open Loop Arm	S-II	60	TB3 +6.2
00:02:37.0	Chilldown Valves Close	S-II	25	TB3 +6.7
00:02:37.3	S-II Start Phase Limiter Cutoff Arm	S-II	25	TB3 +6.7

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
00:02:37.5	High (5.5) Engine Mixture Ratio On	S-II	59	TB3 +6.9
00:02:38.3	S-II Start Phase Limiter Cutoff Arm Reset	S-II	6	TB3 +7.7
00:02:38.4	Prevalves Close Arm	S-II	99	TB3 +7.8
00:02:42.3	Tape Recorder Record Off	IU	17	TB3 +11.7
00:02:42.5	Stop Data Recorders	S-II	104	TB3 +11.9
00:03:01.3	S-II Aft Interstage Separation	S-II	23	TB3 +30.7
00:03:01.6	Water Coolant Valve Open	IU	107	TB3 +31.0
Variable	LET Jettison	--	--	Variable
00:03:32.0	Flight Control Computer Switch Point No. 3	IU	22	TB3 +61.4
00:04:35.6	Start Second PAM-FM/FM Calibration	S-II	30	TB3 +125.0
00:04:40.6	Stop Second PAM-FM/FM Calibration	S-II	9	TB3 +130.0
00:05:42.0	Flight Control Computer Switch Point No. 4	IU	4	TB3 +191.4
00:05:53.3	Telemetry Calibrator In-Flight Calibrate On	IU	23	TB3 +202.7
00:05:58.3	Telemetry Calibrator In-Flight Calibrate Off	IU	24	TB3 +207.7
00:06:03.3	Measurement Control Switch No. 2 Activate	S-II	90	TB3 +212.7
00:06:15.6	Start Third PAM-FM/FM Calibration	S-II	30	TB3 +225.0
00:06:20.6	Stop Third PAM-FM/FM Calibration	S-II	9	TB3 +230.0
00:07:21.5	Telemetry Calibrator In-Flight Calibrate On	IU	23	TB3 +290.9
00:07:26.5	Telemetry Calibrator In-Flight Calibrate Off	IU	24	TB3 +295.9
00:07:30.6	S-II LH2 Step Pressurization	S-II	7	TB3 +300.0
00:08:01.8	Charge Ullage Ignition On	S-IVB	54	TB3 +331.2
00:08:02.0	S-II/S-IVB Ordnance Arm	S-II	8	TB3 +331.4

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
00:08:02.9	Tape Recorder Record On	IU	39	TB3 +332.3
00:08:03.1	Start Data Recorders	S-II	71	TB3 +332.5
00:08:05.7	S-II LOX Depletion Sensors Cutoff Arm	S-II	3	TB3 +335.1
00:08:05.9	S-II LH2 Depletion Sensors Cutoff Arm	S-II	42	TB3 +335.3
00:08:28.9	Begin Chi Freeze; End IGM Phase 2	--	--	N/A

TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 7 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
00:08:39.7	Cutoff S-II Engines - Start of Time Base 4 (TB4)	S-II	18	TB4 +0.0
00:08:40.0	Start Recorder Timers	S-II	66	TB4 +0.1
00:08:40.1	Prevalves Close Off	S-IVB	83	TB4 +0.2
00:08:40.2	S-IVB Engine Cutoff Off	S-IVB	13	TB4 +0.3
00:08:40.3	LOX Tank Flight Pressure System On	S-IVB	103	TB4 +0.4
00:08:40.4	Engine Ready Bypass	S-IVB	10	TB4 +0.5
00:08:40.5	LOX Chilldown Pump Off	S-IVB	23	TB4 +0.6
00:08:40.6	Fire Ullage Ignition On	S-IVB	56	TB4 +0.7
00:08:40.7	S-II/S-IVB Separation	S-II	5	TB4 +0.8
00:08:40.9	S-IVB Engine Start On	S-IVB	9	TB4 +1.0
00:08:41.1	Flight Control Computer Burn Mode On "A"	IU	31	TB4 +1.2
00:08:41.2	Flight Control Computer Burn Mode On "B"	IU	74	TB4 +1.3
00:08:42.1	Fuel Chilldown Pump Off	S-IVB	59	TB4 +2.2
00:08:42.4	S-IVB Engine Out Indication "A" Enable	IU	9	TB4 +2.5
00:08:42.6	S-IVB Engine Out Indication "B" Enable	IU	11	TB4 +2.7
00:08:43.9	Fuel Injector Temperature OK Bypass	S-IVB	11	TB4 +4.0
00:08:44.1	S-IVB Engine Start Off	S-IVB	27	TB4 +4.2
00:08:45.7	First Burn Relay On	S-IVB	68	TB4 +5.8
00:08:47.7	IGM Initiation	-	-	N/A
00:08:49.7	Charge Ullage Jettison On	S-IVB	55	TB4 +9.8
00:08:52.7	Fire Ullage Jettison On	S-IVB	57	TB4 +12.8

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
00:08:53.7	Ullage Charging Reset	S-IVB	88	TB4 +13.8
00:08:53.9	Ullage Firing Reset	S-IVB	73	TB4 +14.0
00:08:54.1	Fuel Injection Temperature OK Bypass Reset	S-IVB	16	TB4 +14.2
00:08:54.3	Tape Recorder Record Off	IU	17	TB4 +14.4
00:08:56.7	Telemetry Calibrator Inflight Calibrate On	IU	23	TB4 +16.8
00:09:01.7	Telemetry Calibrator Inflight Calibrate Off	IU	24	TB4 +21.8
00:09:03.9	Heat Exchanger Bypass Valve Control Enable	S-IVB	50	TB4 +24.0
00:09:05.6	Inflight Calibration Mode On	S-IVB	48	TB4 +25.7
00:09:06.1	TM Calibrate On	S-IVB	62	TB4 +26.2
00:09:11.1	TM Calibrate Off	S-IVB	63	TB4 +31.2
00:09:11.6	Inflight Calibration Mode Off	S-IVB	49	TB4 +31.7
00:10:46.2	Chi Tilde Guidance Mode Initiation	-	-	C.O. -35.0
00:11:02.3	Engine Pump Purge Control Valve Enable On	S-IVB	24	C.O. -7.0
00:11:13.2	Chi Freeze	-	-	C.O. -8.0

TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 9 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	<u>Velocity Cutoff of S-IVB Engine – Start of Time Base 5 (TB5)</u>	S-IVB	12	TB5 +0.0
	S-IVB Engine Cutoff	S-IVB	12	TB5 +0.1
	Point Level Sensor Disarming	S-IVB	98	TB5 +0.2
	S-IVB Ullage Engine No. 1 On	S-IVB	42	TB5 +0.3
	S-IVB Ullage Engine No. 2 On	S-IVB	101	TB5 +0.4
	S-IVB Ullage Thrust Present Indication On	IU	43	TB5 +0.6
	First Burn Relay Off	S-IVB	69	TB5 +0.8
	LOX Tank Flight Pressure System Off	S-IVB	104	TB5 +1.2
	LOX Tank Pressurization Shutoff Valves Close	S-IVB	79	TB5 +1.4
	Engine Pump Purge Control Valve Enable On	S-IVB	24	TB5 +1.6
	Flight Control Computer S-IVB Burn Mode Off "A"	IU	12	TB5 +3.5
	Flight Control Computer S-IVB Burn Mode Off "B"	IU	75	TB5 +3.7
	Aux Hydraulic Pump Flight Mode Off	S-IVB	29	TB5 +4.1
	Telemetry Calibrator In-Flight Calibrate On	IU	23	TB5 +4.2
	S/C Control of Saturn Enable	IU	68	TB5 +5.0
	In-Flight Calibration Mode On	S-IVB	48	TB5 +6.5
	TM Calibrate On	S-IVB	62	TB5 +7.0
	Telemetry Calibration In-Flight Calibrate Off	IU	24	TB5 +9.2
	S-IVB Engine Out Indication "A" Enable Reset	IU	18	TB5 +10.0
	S-IVB Engine Out Indication "B" Enable Reset	IU	53	TB5 +10.2
	S-I RF Assembly Power Off	IU	106	TB5 +10.4
Variable	Tape Recorder Playback Reverse On	IU	19	TB5 +11.3

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	TM Calibrate Off	S-IVB	63	TB5 +12.0
	In-Flight Calibration Mode Off	S-IVB	49	TB5 +12.5
	Maneuver to Local Horizontal and Hold	-	-	TB5 +20.0
	Single Sideband FM Transmitter Off	S-IVB	47	TB5 +22.0
	LH2 Tank Continuous Vent Orifice Shutoff Valve Open On	S-IVB	111	TB5 +59.0
	LH2 Tank Continuous Vent Relief Override Shutoff Valve Open On	S-IVB	107	TB5 +59.1
	LH2 Tank Continuous Vent Orifice Shutoff Valve Open Off	S-IVB	112	TB5 +61.0
	LH2 Tank Continuous Vent Relief Override Shutoff Valve Open Off	S-IVB	108	TB5 +61.1
	Tape Recorder Playback Reverse Off	IU	3	TB5 +82.1
	S-IVB Ullage Engine No. 1 Off	S-IVB	43	TB5 +87.0
	S-IVB Ullage Engine No. 2 Off	S-IVB	102	TB5 +87.1
	S-IVB Ullage Thrust Present Indication Off	IU	46	TB5 +87.2
	PU Inverter and DC Power Off	S-IVB	8	TB5 +500.0
	Engine Pump Purge Control Valve Enable Off	S-IVB	25	TB5 +602.6
	Aux Hydraulic Pump Flight Mode On	S-IVB	28	TB5 +2,600.0
	Aux Hydraulic Pump Flight Mode Off	S-IVB	29	TB5 +2,648.0
	PU Inverter and DC Power On	S-IVB	7	TB5 +5,000.0
	Aux Hydraulic Pump Flight Mode On	S-IVB	28	TB5 +5,400.0
	Aux Hydraulic Pump Flight Mode Off	S-IVB	29	TB5 +5,448.0
	Aux Hydraulic Pump Flight Mode On	S-IVB	28	TB5 +10,500.0
Variable	Aux Hydraulic Pump Flight Mode Off	S-IVB	29	TB5 +10,980.0

. TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 11 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	Begin Restart Preparations – Start of Time Base 6 (TB6)			TB6 +0.0
	S-IVB Restart Alert ON	IU	80	TB6 +0.1
	S/C Control of Saturn Disable	IU	69	TB6 +0.3
	In-Flight Calibration MOde ON	S-IVB	48	TB6 +1.0
	Telemetry Calibration In-Flight Calibrate On	IU	23	TB6 +1.2
	TM Calibrate On	S-IVB	62	TB6 +1.4
	Telemetry Calibration In-Flight Calibrate Off	IU	24	TB6 +6.2
	TM Calibrate Off	S-IVB	63	TB6 +6.4
	In-Flight Calibration Mode Off	S-IVB	49	TB6 +7.0
	S-IVB Engine Cutoff Off	S-IVB	13	TB6 +10.0
	Single Sideband FM Transmitter On	S-IVB	46	TB6 +10.5
	LH2 Tank Vent and Latching Relief Valve Boost Close On	S-IVB	77	TB6 +36.3
	LOX Tank Vent and NPV Valves Boost Close On	S-IVB	95	TB6 +36.5
	S-IVB Restart Alert Off	IU	81	TB6 +37.3
	LH2 Tank Vent and Latching Relief Valve Boost Close Off	S-IVB	78	TB6 +38.3
	LOX Tank Vent and NPV Valves Boost Close Off	S-IVB	96	TB6 +38.5
	Repressurization System Mode Selector Off (Amb)	S-IVB	37	TB6 +41.1
	Burner LH2 Propellant Valve Open On	S-IVB	26	TB6 +41.3
	Burner Exciters On	S-IVB	70	TB6 +41.6
	Burner LOX Shutdown Valve Open On	S-IVB	89	TB6 +42.0
	LH2 Tank Continuous Vent Valve Close On	S-IVB	84	TB6 +42.2
Variable	Burner LH2 Propellant Valve Open Off	S-IVB	72	TB6 +42.8

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	Burner LOX Shutdown Valve Open Off	S-IVB	90	TB6 +43.5
	LH2 Tank Continuous Vent Valve Close Off	S-IVB	87	TB6 +44.2
	Burner Exciters Off	S-IVB	71	TB6 +45.4
	Burner Automatic Cutoff System Arm	S-IVB	85	TB6 +48.0
	LH2 Tank Repressurization Control Valve Open On	S-IVB	39	TB6 +48.1
	LOX Tank Repressurization Control Valve Open On	S-IVB	3	TB6 +48.3
	Aux Hydraulic Pump Flight Mode On	S-IVB	28	TB6 +219.0
	LOX Chilldown Pump On	S-IVB	22	TB6 +249.0
	Fuel Chilldown Pump On	S-IVB	58	TB6 +254.0
	Prevalves Close On	S-IVB	82	TB6 +259.0
	In-Flight Calibration Mode On	S-IVB	48	TB6 +400.0
	Telemetry Calibration In-Flight Calibrate On	IU	23	TB6 +400.2
	TM Calibrate On	S-IVB	62	TB6 +400.4
	Telemetry Calibration In-Flight Calibrate Off	IU	24	TB6 +405.2
	TM Calibrate Off	S-IVB	63	TB6 +405.4
	In-Flight Calibration Mode Off	S-IVB	49	TB6 +406.0
	Second Burn Relay On	S-IVB	32	TB6 +450.0
	PU Valve Hardover Position ON	S-IVB	17	TB6 +450.1
	S-IVB Restart Alert On	IU	80	TB6 +493.6
	S-IVB Ullage Engine No. 1 On	S-IVB	42	TB6 +496.3
Variable	S-IVB Ullage Engine No. 2 On	S-IVB	101	TB6 +496.4

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	S-IVB Ullage Thrust Present Indication On	IU	43	TB6 +496.5
	LOX Tank Repressurization Control Valve Open Off	S-IVB	4	TB6 +496.6
	LH2 Tank Repressurization Control Valve Open Off	S-IVB	81	TB6 +496.7
	Burner LH2 Propellant Valve Close On	S-IVB	60	TB6 +496.8
	Burner Automatic Cutoff System Disarm	S-IVB	86	TB6 +497.0
	LH2 Tank Continuous Vent Valve Close On	S-IVB	84	TB6 +497.2
	Repressurization System Mode Selector On (Amb)	S-IVB	36	TB6 +497.6
	LH2 Tank Continuous Vent Valve Close Off	S-IVB	87	TB6 +499.2
	Burner LH2 Propellant Valve Close Off	S-IVB	61	TB6 +499.8
	LOX Tank Repressurization Control Valve Open On	S-IVB	3	TB6 +500.0
	Burner LOX Shutdown Valve Close On	S-IVB	74	TB6 +501.3
	Burner LOX Shutdown Valve Close Off	S-IVB	75	TB6 +504.3
	LH2 Tank Repressurization Control Valve Open On	S-IVB	39	TB6 +520.0
	Prevalves Close Off	S-IVB	83	TB6 +559.4
	S-IVB Restart Alert Off	IU	81	TB6 +560.0
	Engine Ready Bypass	S-IVB	10	TB6 +568.6
	Fuel Chilldown Pump Off	S-IVB	59	TB6 +569.4
	LOX Chilldown Pump Off	S-IVB	23	TB6 +569.6
	S-IVB Engine Start On	S-IVB	9	TB6 +570.0
	S-IVB Ullage Engine No. 1 Off	S-IVB	43	TB6 +573.0
	S-IVB Ullage Engine No. 2 Off	S-IVB	102	TB6 +573.1
Variable	S-IVB Ullage Thrust Present Indication Off	IU	46	TB6 +573.2

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	S-IVB Engine Out Indication "A" Enable	IU	9	TB6 +577.2
	LOX Tank Repressurization Control Valve Open Off	S-IVB	4	TB6 +577.3
	S-IVB Engine Out Indication "B" Enable	IU	11	TB6 +577.4
	LH2 Tank Repressurization Control Valve Open Off	S-IVB	81	TB6 +577.5
	Flight Control Computer S-IVB Burn Mode On "A"	IU	31	TB6 +577.6
	Flight Control Computer S-IVB Burn Mode On "B"	IU	74	TB6 +577.8
	Fuel Injection Temperature OK Bypass	S-IVB	11	TB6 +578.0
	LOX Tank Flight Pressure System On	S-IVB	103	TB6 +578.2
	LOX Tank Pressurization Shutoff Valves Open	S-IVB	80	TB6 +578.4
	S-IVB Engine Start Off	S-IVB	27	TB6 +578.6
	PU Valve Hardover Position Off	S-IVB	18	TB6 +583.0
	Fuel Injection Temperature OK Bypass Reset	S-IVB	16	TB6 +588.0
	Flight Control Computer Switch Point No. 6	IU	5	TB6 +383.0
	Second Burn Relay Off	S-IVB	33	TB6 +850.0
	Chi Tilde Guidance Mode Initiation	--	--	C.O. -30.0
	Point Level Sensor Arming	S-IVB	97	TB6 +892.1
Variable	Chi Freeze	--	--	C.O. 3.0

TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 15 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	S-IVB Engine Cutoff - Start of Time Base No. 7 (TB7)	S-IVB	12	TB7 +0.0
	S-IVB Engine Cutoff	S-IVB	12	TB7 +0.1
	LH2 Tank Continuous Vent Orifice Shutoff Valve Open On	S-IVB	111	TB7 +0.5
	LH2 Tank Continuous Vent Relief Override Shutoff Valve Open On	S-IVB	107	TB7'+0.6
	LOX Tank NPV Valve Open On	S-IVB	105	TB7 +0.7
	LH2 Tank Latching Relief Valve Open On	S-IVB	99	TB7 +0.8
	Point Level Sensor Disarming	S-IVB	98	TB7 +0.9
	LOX Tank Pressurization Shutoff Valves Close	S-IVB	79	TB7 +1.0
	LOX Tank Flight Pressure System Off	S-IVB	104	TB7 +1.1
	Second Burn Relay Off	S-IVB	33	TB7 +1.2
	LH2 Tank Continuous Vent Orifice Shutoff Valve Open Off	S-IVB	112	TB7 +2.5
	LH2 Tank Continuous Vent Relief Override Shutoff Valve Open Off	S-IVB	108	TB7 +2.6
	LOX Tank NPV Valve Latch Open On	S-IVB	44	TB7 +2.7
	LH2 Tank Latching Relief Valve Latch On	S-IVB	64	TB7 +2.8
	Flight Control Computer S-IVB Burn Mode Off "A"	IU	12	TB7 +3.6
	LOX Tank NPV Valve Open Off	S-IVB	106	TB7 +3.7
	LH2 Tank Latching Relief Valve Open Off	S-IVB	100	TB7 +3.8
	Flight Control Computer S-IVB Burn Mode Off "B"	IU	75	TB7 +3.9
	Aux Hydraulic Pump Flight Mode Off	S-IVB	29	TB7 +4.1
	LOX Tank NPV Valve Latch Open Off	S-IVB	45	TB7 +4.7
	LH2 Tank Latching Relief Valve Latch Off	S-IVB	65	TB7 +4.8
Variable	S/C Control of Saturn Enable	IU	68	TB7 +5.0

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	S-IVB Engine Out Indication "A" Enable Reset	IU	18	TB7 +10.0
	S-IVB Engine Out Indication "B" Enable Reset	IU	53	TB7 +10.2
	Maneuver to Local Horizontal	--	--	TB7 +20.0
	Single Sideband FM Transmitter Off	S-IVB	47	TB7 +25.0
	LOX Tank NPV Valve Open On	S-IVB	105	TB7 +149.7
	LOX Tank NPV Valve Open Off	S-IVB	106	TB7 +150.7
	LOX Tank Vent and NPV Valves Boost Close On	S-IVB	95	TB7 +153.7
	LOX Tank Vent and NPV Valves Boost Close Off	S-IVB	96	TB7 +155.7
	LH2 Tank Latching Relief Valve Open On	S-IVB	99	TB7 +899.0
	LH2 Tank Continuous Vent Valve Close On	S-IVB	84	TB7 +899.8
	LH2 Tank Latching Relief Valve Open Off	S-IVB	100	TB7 +900.0
	Start Maneuver to Separation Attitude and Hold	--	--	TB7 +900.0
	LH2 Tank Continuous Vent Valve Close Off	S-IVB	87	TB7 +901.8
	LH2 Tank Vent and Latching Relief Valve Boost Close On	S-IVB	77	TB7 +903.0
	LH2 Tank Vent and Latching Relief Valve Boost Close Off	S-IVB	78	TB7 +905.0
	CCS Coax Switch Low Gain Antenna	IU	65	TB7 +1,200.0
	PCM Coax Switch Low Gain Antenna	IU	60	TB7 +1,200.2
	IU Command System Enable	IU	82	TB7 +1,200.4
	Aux Hydraulic Pump Flight Mode On	S-IVB	28	TB7 +3,200.0
	Aux Hydraulic Pump Flight Mode Off	S-IVB	29	TB7 +3,248.0
Variable	LH2 Tank Latching Relief Valve Open On	S-IVB	99	TB7 +3,600.4

TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 17 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	LH2 Tank Latching Relief Valve Latch On	S-IVB	64	TB7 +3,602.4
↑	LH2 Tank Latching Relief Valve Open Off	S-IVB	100	TB7 +3,603.4
	LH2 Tank Latching Relief Valve Latch Off	S-IVB	65	TB7 +3,604.4
	LH2 Tank Latching Relief Valve Open On	S-IVB	99	TB7 +4,449.0
	LH2 Tank Latching Relief Valve Open Off	S-IVB	100	TB7 +4,500.0
	LH2 Tank Vent and Latching Relief Valve Boost Close On	S-IVB	77	TB7 +4,503.0
	LH2 Tank Vent and Latching Relief Valve Boost Close Off	S-IVB	78	TB7 +4,505.0
	Begin Maneuver to Communications and Slingshot Attitude	–	–	TB7 +6,540.0
	LH2 Tank Continuous Vent Orifice Shutoff Valve Open On	S-IVB	111	TB7 +7,200.2
	LH2 Tank Continuous Vent Relief Override Shutoff Valve Open On	S-IVB	107	TB7 +7,200.3
	S-IVB Engine EDS Cutoff No. 2 Disable	S-IVB	19	TB7 +7,200.5
	LH2 Tank Continuous Vent Orifice Shutoff Valve Open Off	S-IVB	112	TB7 +7,202.2
	LH2 Tank Continuous Vent Relief Override Shutoff Valve Open Off	S-IVB	108	TB7 +7,202.3
	Aux Hydraulic Pump Flight Mode On	S-IVB	28	TB7 +7,890.0
	Passivation Enable	S-IVB	1	TB7 +7,910.0
	Engine Mainstage Control Valve Open On	S-IVB	14	TB7 +7,920.0
	Engine He Control Valve Open On	S-IVB	109	TB7 +7,920.2
	Start Bottle Vent Control Valve Open On	S-IVB	30	TB7 +7,950.0
	Start Bottle Vent Control Valve Open Off	S-IVB	31	TB7 +8,100.0
↓	Engine Pump Purge Control Valve Enable On	S-IVB	24	TB7 +8,190.0
Variable	Engine Mainstage Control Valve Open Off	S-IVB	15	TB7 +8,220.2

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	Engine He Control Valve Open Off	S-IVB	110	TB7 +8,220.4
	Aux Hydraulic Pump Flight Mode Off	S-IVB	29	TB7 +8,223.0
	LOX Tank NPV Valve Open On	S-IVB	105	TB7 +8,223.2
	LH2 Tank Latching Relief Valve Open On	S-IVB	99	TB7 +8,223.4
	LOX Tank NPV Valve Latch Open On	S-IVB	44	TB7 +8,225.2
	LH2 Tank Latching Relief Valve Latch On	S-IVB	64	TB7 +8,225.4
	LOX Tank NPV Valve Open Off	S-IVB	106	TB7 +8,226.2
	LH2 Tank Latching Relief Valve Open Off	S-IVB	100	TB7 +8,226.4
	LOX Tank NPV Valve Latch Open Off	S-IVB	45	TB7 +8,227.2
	LH2 Tank Latching Relief Valve Latch Off	S-IVB	65	TB7 +8,227.4
	Repressurization System Mode Select Off (Amb)	S-IVB	37	TB7 +8,227.6
	LH2 Tank Repressurization Control Valve Open On	S-IVB	39	TB7 +8,227.8
	CCS Coax Switch High Gain Antenna	IU	63	TB7 +9,080.0
	PCM Coax Switch High Gain Antenna	IU	62	TB7 +9,080.2
	Repressurization System Mode Select On (Amb)	S-IVB	36	TB7 +11,227.8
	LH2 Tank Repressurization Control Valve Open Off	S-IVB	81	TB7 +11,427.8
	Engine He Control Valve Open On	S-IVB	109	TB7 +11,428.0
	Engine Pump Purge Control Valve Enable Off	S-IVB	25	TB7 +11,710.0
	Engine He Control Valve Open Off	S-IVB	110	TB7 +11,728.0
Variable	Passivation Disable	S-IVB	2	TB7 +11,729.0

TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 19 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	Alternate Sequence - Start of Time Base 4a (TB4a)			TB4a +0.0
↑	S-II Engines Cutoff	S-II	18	TB4a +0.1
	Charge Ullage Ignition On	S-IVB	54	TB4a +0.2
	S-II/S-IVB Separation Ordnance Arm	S-II	8	TB4a +0.3
	S-IVB Engine Cutoff Off	S-IVB	13	TB4a +0.4
	Engine Ready Bypass	S-IVB	10	TB4a +0.5
	Start Data Recorder	S-II	71	TB4a +0.6
	Tape Recorder Record On	IU	39	TB4a +0.7
	Start Recorder Timers	S-II	66	TB4a +1.1
	Prevalves Open	S-IVB	83	TB4a +1.4
	Fire Ullage Ignition On	S-IVB	56	TB4a +1.6
	S-II/S-IVB Separation	S-II	5	TB4a +1.7
	LOX Tank Flight Pressure System On	S-IVB	103	TB4a +5.0
	LOX Chilldown Pump Off	S-IVB	23	TB4a +5.2
	S-IVB Engine Start On	S-IVB	9	TB4a +5.7
	Flight Control Computer S-IVB Burn Mode On "A"	IU	31	TB4a +5.9
	Flight Control Computer S-IVB Burn Mode On "B"	IU	74	TB4a +6.1
	S-IVB Engine Out Indication "A" Enable	IU	9	TB4a +6.5
	S-IVB Engine Out Indication "B" Enable	IU	11	TB4a +6.7
↓	Fuel Chilldown Pump Off	S-IVB	59	TB4a +6.9
	Fuel Injection Temperature OK Bypass	S-IVB	11	TB4a +8.7
Variable	S-IVB Engine Start Off	S-IVB	27	TB4a +10.3

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	First Burn Relay On	S-IVB	68	TB4a +10.5
	Charge Ullage Jettison On	S-IVB	55	TB4a +10.7
	Fire Ullage Jettison On	S-IVB	57	TB4a +13.9
	Ullage Charging Reset	S-IVB	88	TB4a +17.1
	Ullage Firing Reset	S-IVB	73	TB4a +17.3
	Fuel Injector Temperature OK Bypass Reset	S-IVB	16	TB4a +18.7
	Tape Recorder Record Off	IU	17	TB4a +22.0
	In-Flight Calibration Mode On	S-IVB	48	TB4a +22.9
	Telemetry Calibrator In-Flight Calibrate On	IU	23	TB4a +23.2
	TM Calibrate On	S-IVB	62	TB4a +23.4
	Water Coolant Valve Open	IU	107	TB4a +28.0
	Telemetry Calibrator In-Flight Calibrate Off	IU	24	TB4a +28.2
	TM Calibrate Off	S-IVB	63	TB4a +28.4
	Heat-Exchanger Bypass Valve Control Enable	S-IVB	50	TB4a +28.7
	In-Flight Calibration Mode Off	S-IVB	47	TB4a +28.9
	In-Flight Calibration Mode On	S-IVB	48	TB4a +199.7
	Telemetry Calibrator In-Flight Calibrate On	IU	23	TB4a +200.0
	TM Calibrate On	S-IVB	62	TB4a +200.2
	Telemetry Calibrator In-Flight Calibrate Off	IU	24	TB4a +205.0
	TM Calibrate Off	S-IVB	63	TB4a +205.2
	In-Flight Calibration Mode Off	S-IVB	47	TB4a +205.7
Variable	First Burn Relay Off	S-IVB	69	TB4a +305.7

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	Flight Control Computer Switch Point No. 6	IU	5	TB4a +408.7
Variable	Point Level Sensor Arming	S-IVB	97	TB4a +467.7
Variable	Engine Pump Purge Control Valve Enable On	S-IVB	24	C.O. -7.0
Variable	Return to Primary Time Base 5 - Cutoff S-IVB Engine	S-IVB	12	TB5 +0.0

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	Alternate Sequence - Start of Time Base 5a (TB5a)			TB5a +0.0
↕	Flight Control Computer Switch Point No. 5	IU	44	TB5a +0.2
	S-IVB Engine EDS Cutoff No. 1 Disable	IU	29	TB5a +0.4
	S-IVB Engine EDS Cutoff No. 2 Disable	S-IVB	19	TB5a +0.6
	IU Command System Enable	IU	82	TB5a +0.8
	Burner LH2 Propellant Valve Close Off	S-IVB	61	TB5a +1.0
Variable	Burner LOX Shutdown Valve Close Off	S-IVB	75	TB5a +1.2

TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 23 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	O_2-H_2 Burner Malfunction – Start of Time Base 6a (TB6a)			TB6a +0.0
Variable	LH2 Tank Continuous Vent Orifice Shutoff Valve Open On	S-IVB	111	TB6a +0.2
Variable	LH2 Tank Continuous Vent Relief Override Shutoff Valve Open On	S-IVB	107	TB6a +0.4
Variable	LH2 Tank Continuous Vent Orifice Shutoff Valve Open Off	S-IVB	112	TB6a +2.2
Variable	LH2 Tank Continuous Vent Relief Override Shutoff Valve Open Off	S-IVB	108	TB6a +2.4

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	O_2-H_2 Burner Malfunction - Start of Time Base 6b (TB6b)			TB6b +0.0
Variable	S-IVB Ullage Engine No. 1 On	S-IVB	42	TB6b +0.2
Variable	S-IVB Ullage Engine No. 2 On	S-IVB	101	TB6b +0.3
Variable	S-IVB Ullage Thrust Persent Indication On	IU	43	TB6b +0.5

TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 25 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	Translunar Injection Inhibit - Start of Time Base 6c (TB6c)			TB6c +0.0
↑	LOX Tank Repressurization Control Valve Open Off	S-IVB	4	TB6c +0.1
	LH2 Tank Repressurization Control Valve Open Off	S-IVB	81	TB6c +0.2
	LH2 Tank Continuous Vent Valve Close Off	S-IVB	87	TB6c +0.6
	LH2 Tank Continuous Vent Orifice Shutoff Valve Open On	S-IVB	111	TB6c +1.0
	LH2 Tank Continuous Vent Relief Override Shutoff Valve Open On	S-IVB	107	TB6c +1.1
	S-IVB Ullage Engine No. 1 Off	S-IVB	43	TB6c +1.2
	S-IVB Ullage Engine No. 2 Off	S-IVB	102	TB6c +1.3
	Fuel Chilldown Pump Off	S-IVB	59	TB6c +1.4
	S-IVB Ullage Thrust Present Indication Off	IU	46	TB6c +1.5
	LOX Chilldown Pump Off	S-IVB	23	TB6c +1.6
	Prevalves Close Off	S-IVB	83	TB6c +1.8
	Aux Hydraulic Pump Flight Mode Off	S-IVB	29	TB6c +2.0
	Burner LH2 Propellant Valve Close On	S-IVB	60	TB6c +2.2
	Burner Automatic Cutoff System Disarm	S-IVB	86	TB6c +2.4
	LH2 Tank Continuous Vent Orifice Shutoff Valve Open Off	S-IVB	112	TB6c +3.0
	LH2 Tank Continuous Vent Relief Override Shutoff Valve Open Off	S-IVB	108	TB6c +3.1
	Burner LH2 Propellant Valve Close Off	S-IVB	61	TB6c +5.2
	Burner LOX Shutdown Valve Close On	S-IVB	74	TB6c +6.7
	Burner LOX Shutdown Valve Close Off	S-IVB	75	TB6c +9.7
Variable	S/C Control of Saturn Enable	IU	68	TB6c +9.9

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
Variable	Special Sequence for S-II PU System Mixture Ratio Shift			
↑	High (5.5) Engine MR Ratio Off	S-II	58	Variable
	Low (4.5) Engine MR Ratio On	S-II	56	Variable
	Water Coolant Valve Switching			
↓	Water Coolant Valve Open	IU	107	Variable
Variable	Water Coolant Valve Closed	IU	108	Variable

TABLE AP 1-2 SEQUENCE OF EVENTS (Sheet 27 of 27)

NOMINAL FLT TIME (hr:min:sec)	COMMAND	SWITCH SELECTOR		TIME FROM BASE (sec)
		STAGE	CHAN	
	Special Sequence for Vehicle Telemetry Calibration			
Variable	Inflight Calibration Mode On	S-IVB	48	Acq +60.0
↑	Telemetry Calibrator Inflight Calibrate On	IU	23	Acq +60.2
	TM Calibrate On	S-IVB	62	Acq +60.4
	Telemetry Calibrator Inflight Calibrate Off	IU	24	Acq +65.2
↓	TM Calibrate Off	S-IVB	63	Acq +65.4
Variable	Inflight Calibration Mode Off	S-IVB	49	Acq +66.0

APPENDIX 2

MASS CHARACTERISTICS DATA (WS11)

2. MASS CHARACTERISTICS DATA (WS11)

This appendix presents two types of digital printouts for the S-IVB-503 stage as computed by the WS11 Computer Program as follows:

a. The predicted mass breakdown (table AP 2-1) is an itemized listing of major components (including all propellants, gases, etc.) listing mass, centers of gravity, and moments of inertia, and includes a summation for the indicated time. A summary of items jettisoned is also presented where applicable.

b. The mass characteristics summary (table AP 2-2) is a chronological listing of the S-IVB-503N flight stage mass characteristics. These data were generated using a flight sequence of events which is presented in appendix 1 of this document. All mass characteristics parameters are time referenced from AS-503 vehicle liftoff and progress chronologically from liftoff to 6 hr 11 min 23 sec (22,283 sec) of flight time.

c. Supplementary information is contained in table AP 2-3 (definitions for mass characteristics terms and abbreviations) and figure AP 2-1, S-IVB-503N stage section numbers.

d. Tables AP 2-4 and AP 2-5 present the predicted mass breakdown and mass characteristics summaries, respectively, for the second TLI opportunity, second burn.

e. Figures AP 2-2 through AP 2-5 present the predicted three sigma mass characteristics dispersions for the Saturn V AS-503 third flight stage during both S-IVB burns. The mass characteristics dispersions are referenced relative to time from Saturn IC liftoff rather than event. It is assumed that the lower stages will perform nominally.

f. The sources of the mass characteristics data presented in the WS11 Computer Program are as follows:

(1) S-IVB-503N stage dry mass is based on the stage weight measured at MDC/STC on December 21, 1967.

(2) S-IVB-503N propellant loading is as presented in appendix 6 of this document.

(3) Propellant mass flows are based on those found in appendix 5 of this document.

(4) The vehicle coordinate system used conforms to standard coordinate system 9, mass properties, as presented in document SE008-001-1, Project Apollo Coordinate System Standards (reference 12, appendix 11).

S-IC LIFTOFF					TIME 0.000 SEC		ITEMS REMAINING
SEQ ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
1 LAUNCH ESCAPE	8875.00	1507.70	.0	-.8	.36572937+07	.12546774+09	.12546774+09
2 SEPARATION PKG	52.50	200.69	.0	.0	.88315971+06	.62443938+06	.62443938+06
3 FROST	300.00	420.40	.0	.0	.50778028+07	.43416269+07	.43416269+07
8 ULLAGE ROCKETS	252.00	223.50	.0	.0	.49392000+07	.51098062+06	.44315237+07
70 COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71 SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72 SM PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11077873+09
73 ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
80 ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81 LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82 INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83 S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84 LOX IN TANK	192557.00	241.61	.0	.0	.00000000	.00000000	.00000000
85 LOX ULLAGE GAS	40.00	317.84	.0	.0	.00000000	.00000000	.00000000
86 LOX BELOW TANK	367.00	118.43	3.4	7.0	.17649943+06	.42450159+06	.42850512+06
87 LH2 IN TANK	43532.00	460.26	.0	.0	.00000000	.24678246+09	.24678246+09
88 LH2 ULLAGE GAS	58.00	654.62	.0	.0	.00000000	.00000000	.00000000
89 LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287802+06	.18804039+06
90 COLD HELIUM	369.00	486.83	101.6	-22.5	.90158688+06	.12932122+07	.52919651+06
91 APS PROP + HE	622.00	246.20	.0	.0	.12459120+08	.12408115+08	.22548843+06
92 HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93 GH2 IN STARTNK	5.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94 SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
TOTAL REMAINING	365470.25	504.25	1.3	.8	.71287516+09	.53848531+11	.53840658+11
					(SLUG-FT2) .15387134+06	(SLUG-FT2) .11622671+08	(SLUG-FT2) .11620972+08

S-II/S-IVB SEPARATION					TIME 521.000 SEC		ITEMS JETTISONED
SEQ ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
2 SEPARATION PKG	52.50	200.69	.0	.0	.88315971+06	.62443938+06	.62443938+06
3 FROST	.00	420.40	.0	.0	.00000000	.00000000	.00000000
TOTAL JETTISONED	52.50	200.69	.0	.0	.88315971+06	.62443941+06	.62443941+06
					(SLUG-FT2) .19062125+03	(SLUG-FT2) .13477904+03	(SLUG-FT2) .13477904+03

S-II/S-IVB SEPARATION					TIME 521 000 SEC		ITEMS REMAINING
SEQ ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
8 ULLAGE ROCKETS	248.95	223.50	.0	.0	.48794209+07	.50479622+06	.43778890+07
70 COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71 SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72 SM PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73 ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
80 ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81 LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82 INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83 S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84 LOX IN TANK	192557.00	241.70	.0	.0	.00000000	.00000000	.00000000
85 LOX ULLAGE GAS	40.00	318.07	.0	.0	.00000000	.00000000	.00000000
86 LOX BELOW TANK	367.00	118.43	3.4	7.0	.17649943+06	.42450159+06	.42850512+06
87 LH2 IN TANK	43532.00	460.67	.0	.0	.00000000	.24886043+09	.24886043+09
88 LH2 ULLAGE GAS	58.00	655.57	.0	.0	.00000000	.00000000	.00000000
89 LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287802+06	.18804039+06
90 COLD HELIUM	369.00	486.83	101.6	-22.5	.90158688+06	.12932122+07	.52919651+06
91 APS PROP + HE	622.00	246.20	.0	.0	.12459120+08	.12408115+08	.22548843+06
92 HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93 GH2 IN STARTNK	5.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94 SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
TOTAL REMAINING	356239.69	479.47	1.4	.9	.70317568+09	.44546599+11	.44538686+11
					(SLUG-FT2) .15177349+06	(SLUG-FT2) .96149410+07	(SLUG-FT2) .96132332+07

	1ST S-IVB ENGINE START COMMAND				TIME 521.200 SEC		ITEMS REMAINING
SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
8	ULLAGE ROCKETS	242.85	223.50	.0	.0	.47598627+07	.49242745+06	.42706196+07
70	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72	SM PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
80	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	192557.00	241.70	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	40.00	318.07	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	367.00	118.43	3.4	7.0	.17649943+06	.42450159+06	.42850512+06
87	LH2 IN TANK	43532.00	460.67	.0	.0	.00000000	.24886294+09	.24886294+09
88	LH2 ULLAGE GAS	58.00	655.57	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287802+06	.18804039+06
90	COLD HELIUM	369.00	486.83	101.6	-22.5	.90158688+06	.12932122+07	.52919651+06
91	APS PROP + HE	622.00	246.20	.0	.0	.12459096+08	.12408090+08	.22548798+06
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	5.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	356233.59	479.48	1.4	.9	.70305607+09	.44546183+11	.44538176+11
						(SLUG-FT2) .15174767+06	(SLUG-FT2) .96148513+07	(SLUG-FT2) .96131229+07

	90% THRUST				TIME 526 700 SEC		ITEMS REMAINING
SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
8	ULLAGE ROCKETS	130.00	223.50	.0	.0	.25480000+07	.26360111+06	.22861035+07
70	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72	SM PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
80	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	192261.00	241.60	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	41.60	317.82	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	397.00	118.43	3.4	7.0	.19092719+06	.45920199+06	.46353278+06
87	LH2 IN TANK	43421.00	460.23	.0	.0	.00000000	.24600195+09	.24600195+09
88	LH2 ULLAGE GAS	58.00	654.56	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	58.00	163.80	-47.4	-51.3	.14343823+06	.23306094+06	.22721547+06
90	COLD HELIUM	368.26	486.83	101.6	-22.5	.89977775+06	.12906172+07	.52813462+06
91	APS PROP + HE	621.96	246.20	.0	.0	.12458410+08	.12407407+08	.22547559+06
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	1.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	355750.56	479.62	1.4	.9	.70092097+09	.44533665+11	.44523889+11
						(SLUG-FT2) .15128683+06	(SLUG-FT2) .96121494+07	(SLUG-FT2) .96100392+07

1ST S-IVB ENGINE CUTOFF COMMAND   TIME 681.490 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
70	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72	SM PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
80	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	131034.00	222.45	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	145.00	286.53	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	397.00	118.43	3.4	7.0	.19092719+06	.45920199+06	.46353278+06
87	LH2 IN TANK	31008.00	411.88	.0	.0	.00000000	.12971433+09	.12971433+09
88	LH2 ULLAGE GAS	154.00	590.95	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	58.00	163.80	-47.4	-51.3	.14343823+06	.23306094+06	.22721547+06
90	COLD HELIUM	322.41	486.83	101.6	-22.5	.78776372+06	.11299472+07	.46238674+06
91	APS PROP + HE	621.00	246.20	.0	.0	.12439127+08	.12388203+08	.22512659+06
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	7.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	282139.15	517.97	1.7	1.1	.69751768+09	.41898636+11	.41886419+11
						(SLUG-FT2) .15055227+06	(SLUG-FT2) .90434045+07	(SLUG-FT2) .90407675+07

END THRUST DECAY   TIME 682.890 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
70	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72	SM PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465521+06
80	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	130896.00	222.41	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	146.00	286.48	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	367.00	118.43	3.4	7.0	.17649943+06	.42450159+06	.42850512+06
87	LH2 IN TANK	30980.00	411.77	.0	.0	.00000000	.12956389+09	.12956389+09
88	LH2 ULLAGE GAS	155.00	590.84	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287802+06	.18804039+06
90	COLD HELIUM	322.00	486.83	101.6	-22.5	.78675061+06	.11284941+07	.46179208+06
91	APS PROP + HE	620.19	246.20	.0	.0	.12422937+08	.12372079+08	.22483358+06
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	7.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	281933.93	518.15	1.7	1.1	.69740357+09	.41883782+11	.41871581+11
						(SLUG-FT2) .15052763+06	(SLUG-FT2) .90401983+07	(SLUG-FT2) .90375650+07

BEGIN RESTART PREPARATION   TIME 9,660 000 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
70	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72	SM PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
80	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG.	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	130707.99	222.39	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	272.00	286.45	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	367.00	118.43	3.4	7.0	.17649943+06	.42450159+06	.42850512+06
87	LH2 IN TANK	28430.98	402.15	.0	.0	.00000000	.11773247+09	.11773247+09
88	LH2 ULLAGE GAS	318.61	580.96	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287802+06	.18804039+06
90	COLD HELIUM	322.00	486.83	101.6	-22.5	.78675061+06	.11284941+07	.46179208+06
91	APS PROP + HE	531.12	246.20	.0	.0	.10638711+08	.10595157+08	.19254218+06
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK.	7.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	279397.43	518.35	1.7	1.1	.69560866+09	.41887818+11	.41877359+11
						(SLUG-FT2) .15014023+06	(SLUG-FT2) .90410696+07	(SLUG-FT2) .90388121+07

2ND S-IVB ENGINE START COMMAND   TIME 10,230.000 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
70	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72	SM PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
80	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG.	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	130706.00	222.40	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	280.00	286.47	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	367.00	118.43	3.4	7.0	.17649943+06	.42430159+06	.42850512+06
87	LH2 IN TANK	28404.00	402.21	.0	.0	.00000000	.11761895+09	.11761895+09
88	LH2 ULLAGE GAS	329.00	581.01	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287802+06	.18804039+06
90	COLD HELIUM	279.00	486.83	101.6	-22.5	.68168764+06	.97779456+06	.40012419+06
91	APS PROP + HE	394.80	246.20	.0	.0	.79081415+07	.78757667+07	.14312362+06
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	7.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	279207.53	518.51	1.7	1.1	.69231947+09	.41873096+11	.41864990+11
						(SLUG-FT2) .14943028+06	(SLUG-FT2) .90378920+07	(SLUG-FT2) .90361422+07

90% THRUST   TIME 10,240.500 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
70	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72	S-M PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
80	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	130418.00	222.32	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	285.24	286.37	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	397.00	118.43	3.4	7.0	.19092719+06	.45920199+06	.46353278+06
87	LH2 IN TANK	28277.00	401.71	.0	.0	.00000000	.11711148+09	.11711148+09
88	LH2 ULLAGE GAS	335.73	580.52	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	58.00	163.80	-47.4	-51.3	.14343823+06	.23306094+06	.22721547+06
90	COLD HELIUM	278.11	486.83	101.6	-22.5	.67951529+06	.97467860+06	.39884911+06
91	APS PROP + HE	392.88	246.20	.0	.0	.78697427+07	.78375250+07	.14242867+06
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	1.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	278835.71	518.73	1.7	1.1	.69235525+09	.41860589+11	.41852506+11
						(SLUG-FT2) .14943801+06	(SLUG-FT2) .90351925+07	(SLUG-FT2) .90334479+07

2ND S-IVB ENGINE CUTOFF COMMAND   TIME 10,554.240 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
70	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72	S-M PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
80	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	6795.00	170.37	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	441.90	247.07	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	397.00	118.43	3.4	7.0	.19092719+06	.45920199+06	.46353278+06
87	LH2 IN TANK	3074.00	293.79	.0	.0	.00000000	.24053711+08	.24053711+08
88	LH2 ULLAGE GAS	536.87	492.10	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	58.00	163.80	-47.4	-51.3	.14343823+06	.23306094+06	.22721547+06
90	COLD HELIUM	166.53	486.83	101.6	-22.5	.40689534+06	.58363982+06	.23883178+06
91	APS PROP + HE	388.00	246.20	.0	.0	.77719273+07	.77401100+07	.14065838+06
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	7.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	130257.04	816.72	3.6	2.4	.68951182+09	.19351631+11	.19342341+11
						(SLUG-FT2) .14882428+06	(SLUG-FT2) .41768575+07	(SLUG-FT2) .41748521+07

END THRUST DECAY — TIME 10,555.740 SEC — ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
70	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72	S.M PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
80	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67336535+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	6659.00	170.24	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	441.62	247.02	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	367.00	118.43	3.4	7.0	.17649943+06	.42450159+06	.42850512+06
87	LH2 IN TANK	3047.00	293.60	.0	.0	.00000000	.23832073+08	.23832073+08
88	LH2 ULLAGE GAS	536.95	482.00	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287802+06	.18804039+06
90	COLD HELIUM	166.00	486.83	101.6	-22.5	.40559193+06	.58177025+06	.23806673+06
91	APS PROP + HE	386.90	246.20	.0	.0	.77499326+07	.77182055+07	.14026032+06
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	7.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	130052.21	817.71	3.6	2.4	.68938534+09	.19269289+11	.19260018+11
						(SLUG-FT2) .14879698+06	(SLUG-FT2) .41590846+07	(SLUG-FT2) .41570837+07

SPACECRAFT SEPARATION — TIME 11,754.240 SEC — ITEMS JETTISONED

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
70	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
71	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.56731325+08	.54268389+08
72	SM PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
73	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
	TOTAL JETTISONED	63741.00	1144.93	3.9	6.7	.15849859+09	.36833253+09	.37783251+09
						(SLUG-FT2) .34210347+05	(SLUG-FT2) .79500920+05	(SLUG-FT2) .81551395+05

SPACECRAFT SEPARATION — TIME 11,754.240 SEC — ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
80	ADAPTER	1412.00	759.70	2.2	.7	.20673092+08	.11744226+08	.11744226+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	6629.62	170.22	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	420.38	247.01	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	367.00	118.43	3.4	7.0	.17649943+06	.42450159+06	.42850512+06
87	LH2 IN TANK	2830.33	292.04	.0	.0	.00000000	.22062617+08	.22062617+08
88	LH2 ULLAGE GAS	516.67	481.14	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287802+06	.18804039+06
90	COLD HELIUM	166.00	486.83	101.6	-22.5	.40559193+06	.58177023+06	.23806673+06
91	APS PROP + HE	310.37	246.20	.0	.0	.62168659+07	.61914148+07	.11251447+06
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	7.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	63300.11	488.01	3.3	-1.8	.49678061+09	.50260464+10	.50191409+10
						(SLUG-FT2) .10722516+06	(SLUG-FT2) .10848223+07	(SLUG-FT2) .10833331+07

START LOX DUMP   TIME 18,474.400 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
80	ADAPTER	1412.00	759.70	2.2	.7	.20673092+08	.11744226+08	.11744226+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	6500.00	170.10	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	350.00	246.96	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	367.00	118.43	3.4	7.0	.17649943+06	.42450159+06	.42850512+06
87	LH2 IN TANK	2408.15	288.58	.0	.0	.00000000	.18658405+08	.18658405+08
88	LH2 ULLAGE GAS	26.35	479.47	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287802+06	.18804039+06
90	COLD HELIUM	166.00	486.83	101.6	-22.5	.40552193+06	.58177023+06	.23806673+06
91	APS PROP + HE	239.92	246.20	.0	.0	.48053377+07	.47861633+07	.86977312+05
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	7.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	62317.17	489.68	3.4	-1.9	.49535507+09	.49989334+10	.49934000+10
						(SLUG-FT2) .10691747+06	(SLUG-FT2) .10789701+07	(SLUG-FT2) .10777758+07

END PASSIVATION   TIME 22,283.000 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
80	ADAPTER	1412.00	759.70	2.2	.7	.20673092+08	.11744226+08	.11744226+08
81	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
82	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36936720+08
83	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
84	LOX IN TANK	.00	164.83	.0	.0	.00000000	.00000000	.00000000
85	LOX ULLAGE GAS	.00	249.55	.0	.0	.00000000	.00000000	.00000000
86	LOX BELOW TANK	.00	118.43	3.4	7.0	.00000000	.00000000	.00000000
87	LH2 IN TANK	.00	251.77	.0	.0	.00000000	.23236877-00	.23236877-00
88	LH2 ULLAGE GAS	.00	470.37	.0	.0	.00000000	.00000000	.00000000
89	LH2 BELOW TANK	.00	163.80	-47.4	-51.3	.00000000	.00000000	.00000000
90	COLD HELIUM	.00	486.83	101.6	-22.5	.00000000	.00000000	.00000000
91	APS PROP + HE	203.16	246.20	.0	.0	.40693489+07	.40526896+07	.73648145+05
92	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
93	GH2 IN STARTNK	.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
94	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	52207.89	544.45	3.8	-2.2	.49181584+09	.39688465+10	.39627881+10
						(SLUG-FT2) .10615357+06	(SLUG-FT2) .85663611+06	(SLUG-FT2) .85532848+06

TIME (SEC)	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (SLUG-FT2)	IYY (SLUG-FT2)	IZZ (SLUG-FT2)
0.000	365470.25	504.25	1.3	.8	.15387134+06	.11622671+08	.11620972+08
60.000	365470.25	504.26	1.3	.8	.15387134+06	.11622440+08	.11620740+08
80.000	365170.24	504.34	1.3	.8	.15277519+06	.11620971+08	.11619271+08
186.900	365170.24	504.36	1.3	.8	.15277519+06	.11620560+08	.11618861+08
186.900	356295.24	479.36	1.4	.9	.15197705+06	.96170308+07	.96153331+07
520.900	356295.24	479.43	1.4	.9	.15197703+06	.96160014+07	.96143039+07
521.000	356292.19	479.43	1.4	.9	.15196414+06	.96159565+07	.96142485+07
521.000	356239.69	479.47	1.4	.9	.15177349+06	.96149410+07	.96132332+07
521.200	356233.59	479.48	1.4	.9	.15174767+06	.96148513+07	.96131229+07
524.200	356137.52	479.54	1.4	.9	.15136936+06	.96135934+07	.96115573+07
524.900	356013.79	479.57	1.4	.9	.15128122+06	.96129641+07	.96108556+07
526.700	355750.56	479.62	1.4	.9	.15128683+06	.96121494+07	.96100392+07
530.000	354184.26	480.13	1.4	.9	.15128315+06	.96042237+07	.96021120+07
530.900	353757.08	480.27	1.4	.9	.15128215+06	.96020319+07	.95999194+07
530.900	353627.09	480.36	1.4	.9	.15073212+06	.96001240+07	.95975748+07
540.000	349307.90	481.84	1.4	.9	.15072194+06	.95771995+07	.95746454+07
550.000	344561.54	483.57	1.4	.9	.15071069+06	.95504445+07	.95478848+07
560.000	339815.18	485.42	1.4	.9	.15069935+06	.95220235+07	.95194583+07
570.000	335068.84	487.38	1.5	.9	.15068799+06	.94919002+07	.94893295+07
576.700	331888.78	488.77	1.5	.9	.15068020+06	.94707458+07	.94681712+07
580.000	330322.09	489.47	1.5	.9	.15067639+06	.94600224+07	.94574460+07
590.000	325574.53	491.67	1.5	1.0	.15066463+06	.94263255+07	.94237429+07
600.000	320826.98	494.00	1.5	1.0	.15065277+06	.93907806+07	.93881924+07
610.000	316079.42	496.45	1.5	1.0	.15064082+06	.93533246+07	.93507307+07
620.000	311331.87	499.03	1.6	1.0	.15062878+06	.93138885+07	.93112886+07
630.000	306584.31	501.74	1.6	1.0	.15061663+06	.92723937+07	.92697883+07
640.000	301836.75	504.59	1.6	1.0	.15060437+06	.92287546+07	.92261426+07
650.000	297089.20	507.58	1.6	1.1	.15059201+06	.91997706+07	.91971527+07
660.000	292341.65	510.70	1.7	1.1	.15057952+06	.91526347+07	.91500107+07
670.000	287594.09	513.99	1.7	1.1	.15056691+06	.91031971+07	.91005669+07
680.000	282846.53	517.44	1.7	1.1	.15055418+06	.90513444+07	.90487082+07
681.490	282139.15	517.97	1.7	1.1	.15055227+06	.90434045+07	.90407675+07
681.790	282095.34	518.01	1.7	1.1	.15054774+06	.90427206+07	.90400834+07
682.890	281933.93	518.15	1.7	1.1	.15052763+06	.90401983+07	.90375650+07

TIME (SEC)	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (SLUG-FT2)	IYY (SLUG-FT2)	IZZ (SLUG-FT2)
765.000	281851.35	518.21	1.7	1.1	.15026732+06	.90388524+07	.90364735+07
9660.000	279397.43	518.35	1.7	1.1	.15014023+06	.90410696+07	.90388121+07
9755.000	279371.22	518.35	1.7	1.1	.15013886+06	.90410192+07	.90387630+07
10004.700	279335.52	518.37	1.7	1.1	.15001507+06	.90407876+07	.90384665+07
10005.000	279335.30	518.37	1.7	1.1	.15001415+06	.90407840+07	.90384636+07
10230.000	279207.53	518.51	1.7	1.1	.14943028+06	.90378920+07	.90361422+07
10233.000	279201.89	518.50	1.7	1.1	.14942720+06	.90379713+07	.90362291+07
10238.000	279195.40	518.50	1.7	1.1	.14943470+06	.90381626+07	.90364204+07
10240.500	278835.71	518.73	1.7	1.1	.14943801+06	.90351925+07	.90334479+07
10250.000	274337.72	522.28	1.7	1.1	.14942393+06	.89829125+07	.89811615+07
10260.000	269603.01	526.19	1.8	1.2	.14940898+06	.89251173+07	.89233596+07
10270.000	264868.28	530.29	1.8	1.2	.14939388+06	.88643360+07	.88625716+07
10280.000	260133.57	534.59	1.8	1.2	.14937861+06	.88004030+07	.87986316+07
10290.000	255398.85	539.10	1.9	1.2	.14936317+06	.87331370+07	.87313591+07
10290.500	255162.12	539.33	1.9	1.2	.14936239+06	.87296829+07	.87279045+07
10300.000	250663.00	543.83	1.9	1.3	.14934737+06	.86622911+07	.86605062+07
10310.000	245927.08	548.79	1.9	1.3	.14933137+06	.85876957+07	.85859033+07
10320.000	241191.16	554.04	2.0	1.3	.14931516+06	.85078742+07	.85060750+07
10330.000	236455.25	559.53	2.0	1.3	.14929874+06	.84242135+07	.84224071+07
10340.000	231719.33	565.30	2.1	1.4	.14928210+06	.83358657+07	.83340520+07
10350.000	226983.41	571.37	2.1	1.4	.14926521+06	.82424758+07	.82406547+07
10360.000	222247.49	577.76	2.1	1.4	.14924806+06	.81436680+07	.81418392+07
10370.000	217511.58	584.50	2.2	1.4	.14923064+06	.80390392+07	.80372031+07
10380.000	212775.66	591.59	2.2	1.5	.14921293+06	.79281563+07	.79263124+07
10390.000	208039.74	599.07	2.3	1.5	.14919490+06	.78105477+07	.78086960+07
10400.000	203303.82	606.97	2.3	1.5	.14917655+06	.76857021+07	.76838425+07
10410.000	198567.91	615.32	2.4	1.6	.14915783+06	.75530540+07	.75511864+07
10420.000	193831.99	624.14	2.4	1.6	.14913873+06	.74119814+07	.74101058+07
10430.000	189096.07	633.48	2.5	1.7	.14911922+06	.72617944+07	.72599103+07
10440.000	184360.15	643.39	2.6	1.7	.14909926+06	.71017198+07	.70998272+07
10450.000	179624.24	653.89	2.6	1.8	.14907882+06	.69308958+07	.69289946+07
10460.000	174888.32	665.05	2.7	1.8	.14905787+06	.67483502+07	.67464404+07
10470.000	170152.40	676.93	2.8	1.9	.14903633+06	.65529820+07	.65510630+07
10480.000	165416.49	689.58	2.8	1.9	.14901422+06	.63435493+07	.63416210+07

TIME (SEC)	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (SLUG-FT2)	IYY (SLUG-FT2)	IZZ (SLUG-FT2)
10490.000	160680.57	703.08	2.9	2.0	.14899142+06	.61186317+07	.61166941+07
10500.000	155944.65	717.48	3.0	2.0	.14896790+06	.58780260+07	.58760788+07
10510.000	151208.74	732.99	3.1	2.1	.14894359+06	.56155838+07	.56136263+07
10520.000	146472.82	749.59	3.2	2.2	.14891841+06	.53336152+07	.53316477+07
10530.000	141736.89	767.39	3.3	2.2	.14889226+06	.50322198+07	.50302416+07
10540.000	137000.99	786.57	3.4	2.3	.14886507+06	.47021779+07	.47001890+07
10550.000	132265.07	807.37	3.5	2.4	.14883669+06	.43403703+07	.43383697+07
10554.000	130370.70	816.18	3.6	2.4	.14882499+06	.41862727+07	.41842673+07
10554.240	130257.04	816.72	3.6	2.4	.14882428+06	.41768575+07	.41748521+07
10554.440	130229.99	816.85	3.6	2.4	.14882065+06	.41745038+07	.41724989+07
10555.740	130052.21	817.71	3.6	2.4	.14879698+06	.41590846+07	.41570837+07
10644.400	129932.17	818.22	3.6	2.4	.14851589+06	.41506948+07	.41489680+07
10697.900	129898.34	818.36	3.6	2.4	.14851333+06	.41485190+07	.41467946+07
11447.200	129691.32	819.14	3.6	2.4	.14847852+06	.41374240+07	.41357324+07
11754.140	129688.10	819.18	3.6	2.4	.14846460+06	.41365397+07	.41348618+07
11754.240	127041.10	817.61	3.6	2.4	.14193661+06	.41231067+07	.41231700+07
11754.240	63300.11	488.01	3.3	-1.8	.10722516+06	.10848223+07	.10833318+07
14154.600	63274.94	488.50	3.3	-1.8	.10711630+06	.10829254+07	.10815413+07
15057.200	62918.48	489.13	3.4	-1.8	.10707427+06	.10809374+07	.10795926+07
18474.400	62317.17	489.68	3.4	-1.9	.10691747+06	.10789701+07	.10777758+07
18504.200	61633.72	493.19	3.4	-1.9	.10690960+06	.10639929+07	.10627992+07
18654.200	58186.58	512.30	3.6	-2.0	.10686773+06	.98173625+06	.98054538+06
18774.400	55429.88	529.69	3.8	-2.1	.10683422+06	.90522687+06	.90403819+06
18777.600	55429.24	529.69	3.8	-2.1	.10683408+06	.90521631+06	.90402785+06
18782.000	55425.40	529.71	3.8	-2.1	.10683376+06	.90516520+06	.90397689+06
21782.000	52641.87	542.10	3.7	-2.1	.10617545+06	.86478359+06	.86346810+06
21982.000	52467.36	543.03	3.7	-2.1	.10616127+06	.86161256+06	.86030553+06
22283.000	52207.89	544.45	3.8	-2.2	.10615357+06	.85663611+06	.85532848+06

TERM	DEFINITION	UNITS
Items Jettisoned	A listing of all the items being considered at the current computing .time that will not be considered at the next computing time.	None
Items Remaining	A listing of all the times being considered at the current computing time that will be considered at the next computing time.	None
IXX	Moment of inertia of any item or total about an axis through its own center of gravity and parallel to the X axis.	$LB-IN^2$
IYY	Moment of inertia of any item or total about an axis through its own center of gravity and parallel to the Y axis.	$LB-IN^2$
IZZ	Moment of inertia of any item or total about an axis through its own center of gravity and parallel to the Z axis.	$LB-IN^2$
$LB-IN^2$	Pounds inches squared	
MDAC-WD	Distance along the H axis from an arbitrary S-IVB-503N stage reference zero. The station is located so that the S-IVB-503N stage engine gimbal point is station 100.0. Positive values increase in the forward direction and negative values are aft of station zero.	In.
$SLUG-FT^2$	Slug feet squared	
Time	Time is referenced to range time. All computing was done in the pounds, inches, and pound inches squared system of units. (Items below the TOTAL REMAINING line were converted to other unit systems.) Pound mass is defined as 1/32.174 slugs.	Sec
TLI	Translunar Injection	
Total Jettisoned	A summation of all the times being jettisoned at the current computing time.	None
Total Remaining	A summation of the items remaining	None

TABLE AP 2-3 (Sheet 2 of 2)
DEFINITIONS FOR MASS CHARACTERISTICS
COMPUTER PROGRAM WS11 PRINTOUTS

TERM	DEFINITION	UNITS
X Arm	Distance along the centerline of the stage from the center of gravity of the item under consideration to MDAC-WD station zero.	In.
Y Arm	Distance from the center of gravity of the item under consideration to the centerline of the stage along an axis perpendicular to the X and Z axes and coinciding with positions II and IV. Position II is positive and Position IV is negative.	In.
Z Arm	Distance from the center of gravity of the item under consideration to the centerline of the stage along an axis perpendicular to the X and Y axes and coinciding with Positions I and III. Position I is negative and Position III is positive.	

S-IVB-503N PREDICTED MASS BREAKDOWN SUMMARY, SECOND TLI OPPORTUNITY, SECOND BURN

BEGIN RESTART PREPARATIONS   TIME 14,952.000 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
22	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.25909971+08	.24209506+08	.21359488+08
23	SERVICE MODULE	10575.00	1129.40	-5.7	11.2	.33956748+08	.55731325+08	.54258389+08
24	SM PROPELLANT	40583.00	1115.30	7.7	5.8	.95058109+08	.10597073+09	.11877873+09
25	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.25931259+06	.25405531+06
29	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67335535+08
30	LEM TEST ARTCL	19900.00	792.00	.0	.0	.13373552+09	.75255775+08	.75255775+08
31	INSTRUM. UNIT	4380.00	699.60	-2.8	-9.8	.73709519+08	.42479862+08	.35935720+08
32	S4B503 DRY STW	25580.00	315.30	3.0	-2.6	.28756136+09	.10505458+10	.10534565+10
33	LOX IN TANK	130706.00	222.39	.0	.0	.00000000	.00000000	.00000000
34	LOX ULLAGE GAS	276.00	285.45	.0	.0	.00000000	.00000000	.00000000
35	LOX BELOW TANK	357.00	119.43	3.4	7.0	.17649943+06	.42450159+06	.42850512+06
36	LH2 IN TANK	27521.00	393.59	.0	.0	.00000000	.11424967+09	.11424967+09
37	LH2 ULLAGE GAS	305.00	577.40	.0	.0	.00000000	.00000000	.00000000
38	LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287802+05	.18804039+06
39	COLD HELIUM	322.00	435.63	101.6	-22.5	.78675061+06	.11284941+07	.46179208+06
40	APS PROP + HE	531.00	245.20	.0	.0	.10635323+08	.10592750+08	.19249897+06
41	HELIUM-REPRESS	72.00	153.50	.0	.0	.13000000+06	.88200001+05	.89200001+05
42	GH2 IN STARTNK	7.00	83.40	-22.0	14.6	.00000000	.00000000	.00000000
43	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	278476.74	513.37	1.7	1.1	.69560234+09	.41895024+11	.41984565+11
						(SLUG-FT2) .15013896+06	(SLUG-FT2) .90426248+07	(SLUG-FT2) .90403675+07

2ND S-IVB ENGINE START COMMAND   TIME 15,522.000 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
22	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.25909971+08	.24209506+08	.21359488+08
23	SERVICE MODULE	10575.00	1129.40	-5.7	11.2	.33956748+08	.55731325+08	.54258389+08
24	SM PROPELLANT	40583.00	1115.30	7.7	5.8	.95058109+08	.10597073+09	.11877873+09
25	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.25931259+06	.25405531+06
29	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67335535+08
30	LEM TEST ARTCL	19900.00	792.00	.0	.0	.13373552+09	.75255775+08	.75255775+08
31	INSTRUM. UNIT	4380.00	699.60	-2.8	-9.8	.73709519+08	.42479862+08	.35935720+08
32	S4B503 DRY STW	25580.00	315.30	3.0	-2.6	.28756136+09	.10505458+10	.10534565+10
33	LOX IN TANK	130706.00	222.40	.0	.0	.00000000	.00000000	.00000000
34	LOX ULLAGE GAS	280.00	285.47	.0	.0	.00000000	.00000000	.00000000
35	LOX BELOW TANK	357.00	119.43	3.4	7.0	.17649943+06	.42450159+06	.42850512+06
36	LH2 IN TANK	27521.00	393.75	.0	.0	.00000000	.11422960+09	.11422960+09
37	LH2 ULLAGE GAS	347.00	577.56	.0	.0	.00000000	.00000000	.00000000
38	LH2 BELOW TANK	48.00	163.80	-47.4	-51.3	.11870750+06	.19287852+05	.18804039+06
39	COLD HELIUM	279.00	485.63	101.6	-22.5	.63168764+06	.97779455+06	.40012419+06
40	APS PROP + HE	394.30	245.20	.0	.0	.79081418+07	.73757558+07	.14312363+06
41	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
42	GH2 IN STARTNK	7.00	89.40	-22.0	14.6	.00000000	.00000000	.00000000
43	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	278342.54	513.53	1.7	1.1	.69231582+09	.41880123+11	.41872015+11
						(SLUG-FT2) .14942949+06	(SLUG-FT2) .90394085+07	(SLUG-FT2) .90375585+07

S-IVB-503N PREDICTED MASS BREAKDOWN SUMMARY, SECOND TLI OPPORTUNITY, SECOND BURN

90% THRUST   TIME 15,532.500 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
22	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21959488+08
23	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.55731325+08	.54268389+08
24	S-M PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
25	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
29	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67335535+08
30	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
31	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479864+08	.36936720+08
32	S4B503 DRY STG	25590.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
33	LOX IN TANK	130418.00	222.32	.0	.0	.00000000	.00000000	.00000000
34	LOX ULLAGE GAS	285.27	285.37	.0	.0	.00000000	.00000000	.00000000
35	LOX BELOW TANK	397.00	118.43	3.4	7.0	.19092719+06	.45920199+06	.46353278+06
36	LH2 IN TANK	27334.00	399.26	.0	.0	.00000000	.11376565+09	.11376565+09
37	LH2 ULLAGE GAS	353.18	577.07	.0	.0	.00000000	.00000000	.00000000
38	LH2 BELOW TANK	58.00	163.80	-47.4	-51.3	.14343823+06	.23306094+06	.22721547+06
39	COLD HELIUM	278.10	485.63	101.6	-22.5	.67749425+06	.97464842+06	.39983676+06
40	APS PROP + HE	392.91	245.20	.0	.0	.73702013+07	.78379818+07	.14243697+05
41	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
42	G-H2 IN STARTNK	1.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
43	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	277970.19	513.76	1.7	1.1	.69235194+09	.41867545+11	.41859462+11
						(SLUG-FT2) .14943729+06	(SLUG-FT2) .90356941+07	(SLUG-FT2) .90349491+07

2ND S-IVB ENGINE CUTOFF COMMAND   TIME 15,844.690 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
22	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21959488+08
23	SERVICE MODULE	10675.00	1129.40	-5.7	11.2	.33956748+08	.55731325+08	.54268389+08
24	S-M PROPELLANT	40583.00	1116.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
25	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.26831259+06	.25465531+06
29	ADAPTER	4059.00	847.50	2.5	1.5	.50916096+08	.75406842+08	.67335535+08
30	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75266775+08	.75266775+08
31	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479864+08	.36936720+08
32	S4B503 DRY STG	25590.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
33	LOX IN TANK	7386.00	170.89	.0	.0	.00000000	.00000000	.00000000
34	LOX ULLAGE GAS	441.90	247.28	.0	.0	.00000000	.00000000	.00000000
35	LOX BELOW TANK	397.00	118.43	3.4	7.0	.19092719+06	.45920199+06	.46353278+06
36	LH2 IN TANK	2311.00	287.54	.0	.0	.00000000	.17880991+08	.17880991+08
37	LH2 ULLAGE GAS	536.88	479.06	.0	.0	.00000000	.00000000	.00000000
38	LH2 BELOW TANK	58.00	163.80	-47.4	-51.3	.14343823+06	.23306094+06	.22721547+06
39	COLD HELIUM	166.00	485.63	101.5	-22.5	.40559193+06	.58177025+06	.23806573+06
40	APS PROP + HE	389.36	245.20	.0	.0	.77919580+07	.77500567+07	.14102090+05
41	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
42	G-H2 IN STARTNK	7.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
43	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49266904+06	.44506066+07	.44538954+07
	TOTAL REMAINING	130085.52	815.76	3.6	2.4	.68952188+09	.19394981+11	.19385664+11
						(SLUG-FT2) .14882645+06	(SLUG-FT2) .41862141+07	(SLUG-FT2) .41842031+07

END THRUST DECAY **TIME 15,846.190 SEC** **ITEMS REMAINING**

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
22	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209506+08	.21859488+08
23	SERVICE MODULE	10575.00	1129.40	-5.7	11.2	.33956748+08	.55731325+08	.54258389+08
24	SM PROPELLANT	40583.00	1115.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
25	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.25831259+06	.25465531+06
29	ADAPTER	4059.00	847.50	7.5	1.5	.50916096+08	.75406842+08	.67335535+08
30	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75256775+08	.75256775+08
31	INSTRUM. UNIT	4380.00	698.50	-2.6	-9.8	.73709519+08	.42479862+08	.36935720+08
32	S4B503 DRY STG	25680.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
33	LOX IN TANK	7250.00	175.77	.0	.0	.00000000	.00000000	.00000000
34	LOX ULLAGE GAS	441.62	247.23	.0	.0	.00000000	.00000000	.00000000
35	LOX RELIN TANK	357.00	119.43	3.4	7.0	.17649943+06	.42450159+06	.42950512+05
36	LH2 IN TANK	2254.00	287.39	.0	.0	.00000000	.17565808+08	.17565808+08
37	LH2 ULLAGE GAS	536.95	478.95	.0	.0	.00000000	.00000000	.00000000
38	LH2 BELIN TANK	48.00	163.80	-47.4	-51.3	.11875759+06	.19287864+05	.16904037+06
39	COLD HELIUM	156.00	464.63	101.6	-22.5	.40559193+06	.58177023+06	.23806673+06
40	APS PROP + HE	337.89	245.20	.0	.0	.77696300+07	.77378222+07	.14051580+06
41	HELIUM REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
42	G-H2 IN STARTNK	7.00	88.40	-22.0	14.6	.00000000	.00000000	.00000000
43	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44305066+07	.44533954+07
	TOTAL REMAINING	129881.15	817.75	3.6	2.4	.68940180+09	.19312547+11	.19303356+11
						(SLUG-FT2) .14880054+06	(SLUG-FT2) .41584431+07	(SLUG-FT2) .41554378+07

SPACECRAFT SEPARATION **TIME 17,044.700 SEC** **ITEMS JETTISONED**

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
22	COMMAND MODULE	12392.00	1252.80	-.2	5.8	.26909971+08	.24209500+08	.21859488+08
23	SERVICE MODULE	10575.00	1129.40	-5.7	11.2	.33956748+08	.55731325+08	.54258389+08
24	SM PROPELLANT	40583.00	1115.30	7.7	5.8	.95068109+08	.10597073+09	.11877873+09
25	ADAPTER RING	91.00	1047.80	-.3	1.9	.52285323+06	.25831259+06	.25465531+06
	TOTAL JETTISONED	53741.00	1144.93	3.7	5.7	.15849859+09	.35833253+09	.37783251+09
						(SLUG-FT2) .34210347+05	(SLUG-FT2) .79500920+05	(SLUG-FT2) .81551395+05

SPACECRAFT SEPARATION   TIME 17,044.700 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
29	ADAPTER	1412.00	759.70	2.2	.7	.20673092+08	.11744226+08	.11744226+08
30	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75256775+08	.75256775+08
31	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36935720+08
32	S4B503 DRY STG	25580.00	315.30	8.0	-2.6	.26756136+09	.10505458+10	.10534565+10
33	LOX IN TANK	7219.63	170.75	.0	.0	.00000000	.00000000	.00000000
34	LOX ULLAGE GAS	420.37	247.22	.0	.0	.00000000	.00000000	.00000000
35	LOX BELOW TANK	367.00	118.43	3.4	7.0	.17649943+06	.42450159+05	.42850512+06
36	LH2 IN TANK	2057.34	285.32	.0	.0	.00000000	.15946554+08	.15946554+08
37	LH2 ULLAGE GAS	516.66	478.07	.0	.0	.00000000	.00000000	.00000000
38	LH2 BELOW TANK	48.00	163.90	-47.4	-51.3	.11870750+06	.19287802+06	.18804039+06
39	COLD HELIUM	166.00	485.63	101.6	-22.5	.40559193+06	.58177023+05	.23305573+05
40	APS PROP + HE	310.37	245.20	.0	.0	.62158348+07	.61914437+07	.11251550+06
41	HELIUM-REPRESS	72.00	153.50	.0	.0	.18000000+06	.88200001+05	.88200001+05
42	GH2 IN STARTNK	7.00	83.40	-22.0	14.6	.00000000	.00000000	.00000000
43	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44505056+07	.44538954+07
	TOTAL REMAINING	63127.11	487.23	3.4	-1.8	.49677812+09	.50032551+10	.50463581+10
						(SLUG-FT2) .13722462+06	(SLUG-FT2) .13906971+07	(SLUG-FT2) .10892063+07

END PASSIVATION   TIME 27,575.000 SEC   ITEMS REMAINING

SEQ	ITEM	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (LB-IN2)	IYY (LB-IN2)	IZZ (LB-IN2)
29	ADAPTER	1412.00	759.70	2.2	.7	.20673092+08	.11744226+08	.11744226+08
30	LEM TEST ARTCL	19900.00	792.00	.0	.0	.10373552+09	.75256775+08	.75256775+08
31	INSTRUM. UNIT	4880.00	698.60	-2.8	-9.8	.73709519+08	.42479862+08	.36935720+08
32	S4B503 DRY STG	25580.00	315.30	8.0	-2.6	.28756136+09	.10505458+10	.10534565+10
33	LOX IN TANK	.00	168.29	.0	.0	.00000000	.00000000	.00000000
34	LOX ULLAGE GAS	.00	245.54	.0	.0	.00000000	.00000000	.00000000
35	LOX BELOW TANK	.00	118.43	3.4	7.0	.00000000	.00000000	.00000000
36	LH2 IN TANK	.00	251.77	.0	.0	.00000000	.11518438+00	.11518438+00
37	LH2 ULLAGE GAS	.00	477.09	.0	.0	.00000000	.00000000	.00000000
38	LH2 BELOW TANK	.00	163.80	-47.4	-51.3	.00000000	.00000000	.00000000
39	COLD HELIUM	.00	485.63	101.6	-22.5	.00000000	.00000000	.00000000
40	APS PROP + HE	200.00	245.20	.0	.0	.40061482+07	.39897475+07	.72504321+05
41	HELIUM-REPRESS	.00	153.50	.0	.0	.00000000	.00000000	.00000000
42	GH2 IN STARTNK	.00	83.40	-22.0	14.6	.00000000	.00000000	.00000000
43	SERVICE ITEMS	60.74	392.78	17.6	18.8	.49286904+06	.44505056+07	.44538954+07
	TOTAL REMAINING	52132.74	545.01	3.8	-2.2	.49157173+09	.39573941+10	.39513966+10
						(SLUG-FT2) .13610077+06	(SLUG-FT2) .85416421+05	(SLUG-FT2) .85285973+05

TIME (SEC)	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (SLUG-FT2)	IYY (SLUG-FT2)	IZZ (SLUG-FT2)
14952.000	278476.74	518.37	1.7	1.1	.15013886+06	.90425248+07	.90403575+07
15047.000	278476.46	518.37	1.7	1.1	.15013767+06	.90425391+07	.90402929+07
15296.700	278477.74	518.39	1.7	1.1	.15001430+06	.90423442+07	.90400229+07
15297.000	278477.56	518.39	1.7	1.1	.15001335+06	.90423407+07	.90400203+07
15522.000	278342.54	518.53	1.7	1.1	.14942949+06	.90394086+07	.90376585+07
15525.000	278336.74	518.53	1.7	1.1	.14942641+06	.90394869+07	.90377441+07
15530.000	278330.01	518.52	1.7	1.1	.14943398+06	.90395769+07	.90379340+07
15532.500	277570.19	518.75	1.7	1.1	.14943729+06	.90366941+07	.90349491+07
15540.000	274418.18	521.57	1.7	1.1	.14942620+06	.89955328+07	.89937925+07
15550.000	264946.19	529.59	1.8	1.2	.14939621+06	.88777935+07	.88759398+07
15580.000	255474.19	538.38	1.9	1.2	.14936559+06	.87472539+07	.87455050+07
15582.500	254290.19	539.54	1.9	1.2	.14936170+06	.87300101+07	.87282302+07
15600.000	246000.10	548.07	1.9	1.3	.14933389+06	.85025241+07	.85007316+07
15620.000	236525.69	558.80	2.0	1.3	.14930134+06	.84398494+07	.84380423+07
15640.000	227051.30	570.64	2.1	1.4	.14926787+06	.82587974+07	.82569748+07
15660.000	217576.89	583.75	2.2	1.4	.14923339+06	.80560548+07	.80542270+07
15680.000	208102.49	598.32	2.3	1.5	.14919773+06	.78282997+07	.78264463+07
15700.000	198628.09	614.55	2.4	1.6	.14916073+06	.75715640+07	.75696944+07
15720.000	189153.69	632.70	2.5	1.7	.14912219+06	.72811069+07	.72792204+07
15740.000	179579.29	653.09	2.6	1.8	.14908188+06	.69510724+07	.69491582+07
15760.000	170204.89	675.11	2.8	1.9	.14903948+06	.65741037+07	.65721815+07
15780.000	160730.50	702.24	2.9	2.0	.14899454+06	.61408034+07	.61388621+07
15800.000	151256.09	732.11	3.1	2.1	.14894689+06	.56391842+07	.56372230+07
15820.000	141781.70	766.47	3.3	2.2	.14889565+06	.50568098+07	.50548273+07
15840.000	132307.30	806.42	3.5	2.4	.14884017+06	.43667584+07	.43647531+07
15844.690	130085.52	815.75	3.6	2.4	.14882545+06	.41862141+07	.41842031+07
15844.890	130058.53	815.89	3.6	2.4	.14882300+06	.41838598+07	.41818495+07
15846.190	129881.19	817.75	3.6	2.4	.14880054+06	.41584431+07	.41564378+07
15034.850	129759.54	818.27	3.6	2.4	.14851519+06	.41598794+07	.41581723+07
15988.350	129725.34	818.41	3.6	2.4	.14851262+06	.41575751+07	.41559503+07
16737.650	129518.32	819.20	3.6	2.4	.14847782+06	.41463157+07	.41446251+07
17044.600	129515.11	819.24	3.6	2.4	.14846390+06	.41454130+07	.41437349+07

TIME (SEC)	MASS (LBM)	X ARM (STA-IN)	Y ARM (STA-IN)	Z ARM (STA-IN)	IXX (SLUG-FT2)	IYY (SLUG-FT2)	IZZ (SLUG-FT2)
17044.700	126558.10	817.67	3.6	2.5	.14193590+06	.41319849+07	.41320479+07
17044.700	63127.11	487.23	3.4	-1.8	.10722462+06	.10906971+07	.10892053+07
19446.500	63101.93	487.73	3.4	-1.8	.10711571+06	.10887329+07	.10873485+07
20349.200	62745.47	488.39	3.4	-1.8	.10707367+06	.10865981+07	.10852531+07
23756.400	62581.35	488.93	3.4	-1.9	.10691766+06	.10845635+07	.10833693+07
23796.200	61633.14	492.74	3.4	-1.9	.10690958+06	.10583940+07	.10572005+07
23946.200	57859.99	513.62	3.6	-2.0	.10686651+06	.97809343+06	.97780193+06
24056.400	54942.05	532.83	3.8	-2.2	.10683177+06	.89489540+06	.89370652+06
24069.500	54941.25	532.84	3.8	-2.2	.10683162+06	.89488518+06	.89369645+06
24069.800	54941.12	532.84	3.8	-2.2	.10683161+06	.89488424+06	.89369452+06
24074.000	54936.16	532.85	3.8	-2.2	.10683131+06	.89484403+06	.89365450+06
27074.000	52557.83	542.65	3.7	-2.1	.10617512+06	.86277111+06	.86145541+06
27274.000	52344.98	543.91	3.7	-2.2	.10612192+06	.85796892+06	.85656153+06
27575.000	52132.74	545.01	3.8	-2.2	.10610077+06	.85416421+06	.85286973+06

POSITION III
(+Z, +V)

FORWARD
(+X, +H)

OXYGEN/HYDROGEN BURNER

AMBIENT HELIUM SPHERES

ULLAGE ROCKET
(2 REQD - 180° APART)

POSITION II
(+Y, +L)

POSITION IV
(-Y, -L)

10°

COLD HELIUM SPHERES

MAIN TUNNEL

AUX TUNNEL

AUXILIARY PROPULSION MODULE
(2 REQD-180° APART)

POSITION I
(-Z, -V)

LH2 FEED LINE FAIRING

A B   C   D   E   F   G   H I JK L M N   O P
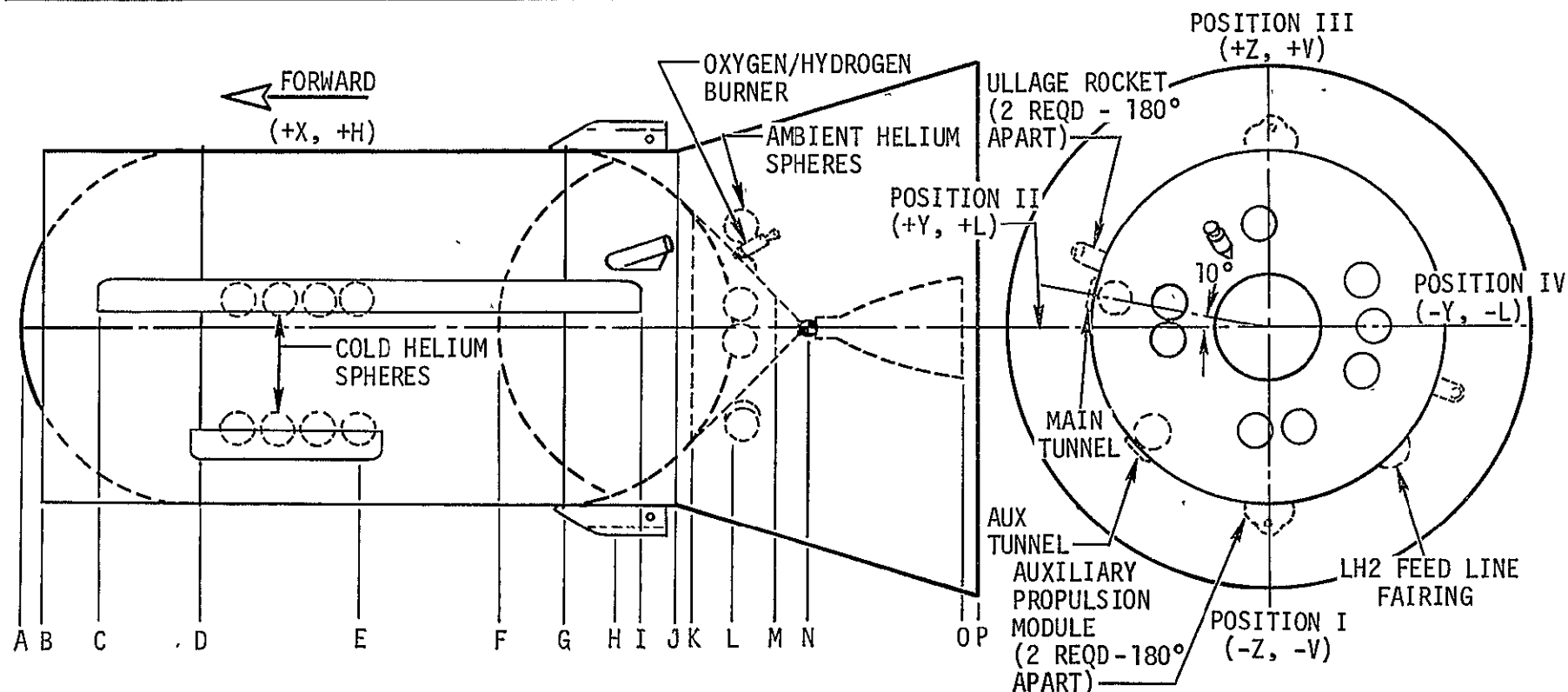
INSTALLATION	STATION		INSTALLATION	STATION
A. FWD BULKHEAD (FWD END)	684.6	I.	MAIN TUNNEL (AFT END)	220.9
B. FWD SKIRT (FWD END)	676.7		ULLAGE ROCKET FAIRING (AFT END)	204.6
C. MAIN TUNNEL (FWD END)	647.7		AUXILIARY PROPULSION MODULE (AFT END)	203.6
D. FWD SKIRT (AFT END)	554.7		LH2 FEED LINE FAIRING (AFT END)	202.7
FWD BULKHEAD (AFT END)	553.0	J.	AFT SKIRT (AFT END)	200.6
E. COLD HELIUM SPHERES (9 REQD - 26:9 ₡ TO ₡)	454.0		INTERSTAGE (FWD END)	200.6
F. COMMON BULKHEAD (FWD END)	335.2	K.	THRUST STRUCTURE/AFT BULKHEAD TANGENT POINT	186.9
AUXILIARY PROPULSION MODULE (FWD END)	298.4	L.	AFT BULKHEAD (AFT END)	156.3
AFT BULKHEAD (FWD END)	287.9		AMBIENT HELIUM SPHERES	153.5
G. AFT SKIRT (FWD END)	286.1	M.	THRUST STRUCTURE SKIN (AFT END)	121.4
LH2 FEED LINE FAIRING (FWD END)	286.1	N.	GIMBAL STATION	100.0
ULLAGE ROCKET (FWD END)	245.3	O.	ENGINE NOZZLE (AFT END)	-16.0
H. COMMON BULKHEAD (AFT END)	244.4	P.	INTERSTAGE (AFT END)	-26.9

Figure AP 2-1. S-IVB-503N Configuration Station List
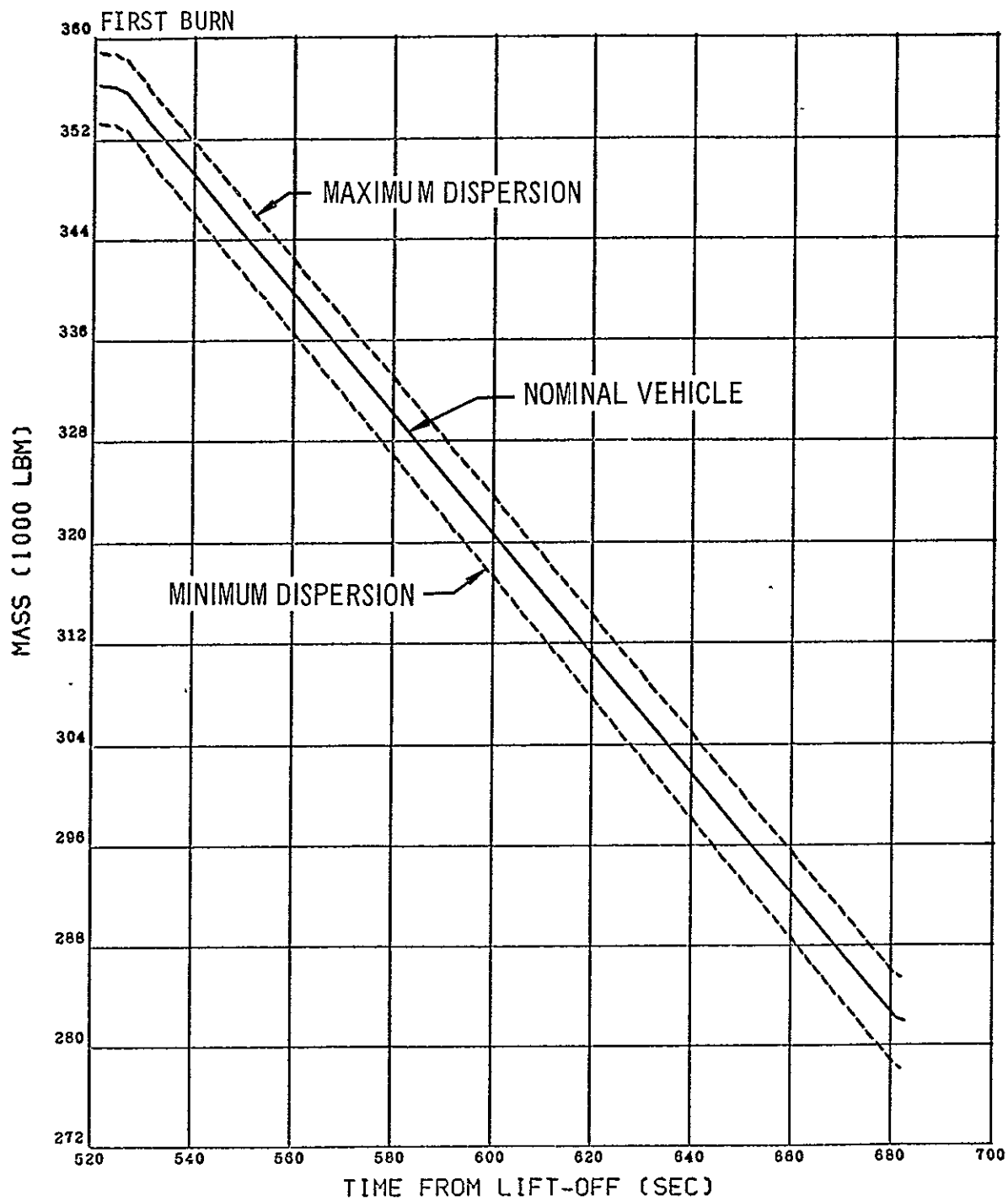
Figure AP 2-2.   Stage Mass (Sheet 1 of 2)
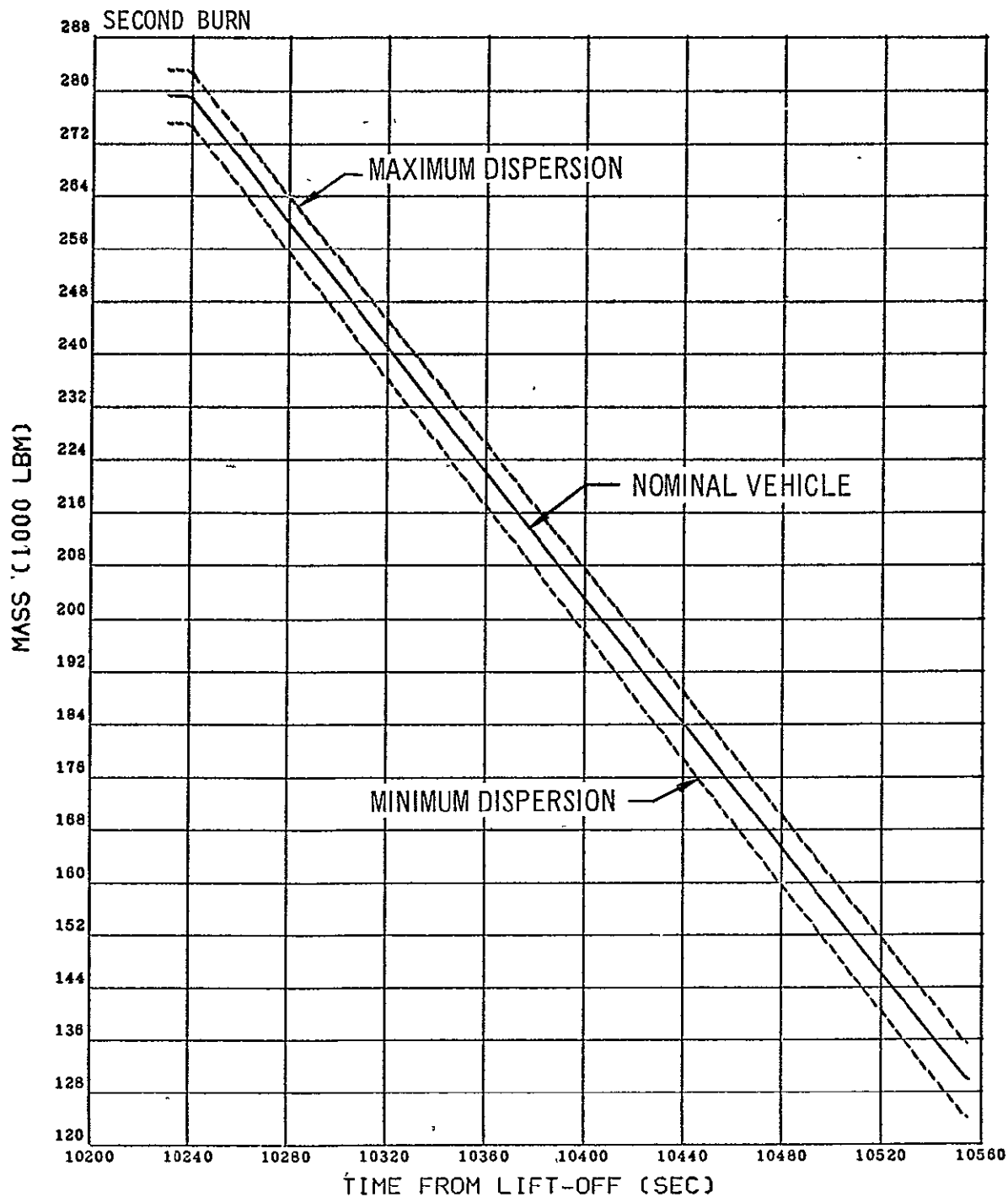
Figure AP 2-2. Stage Mass (Sheet 2 of 2)
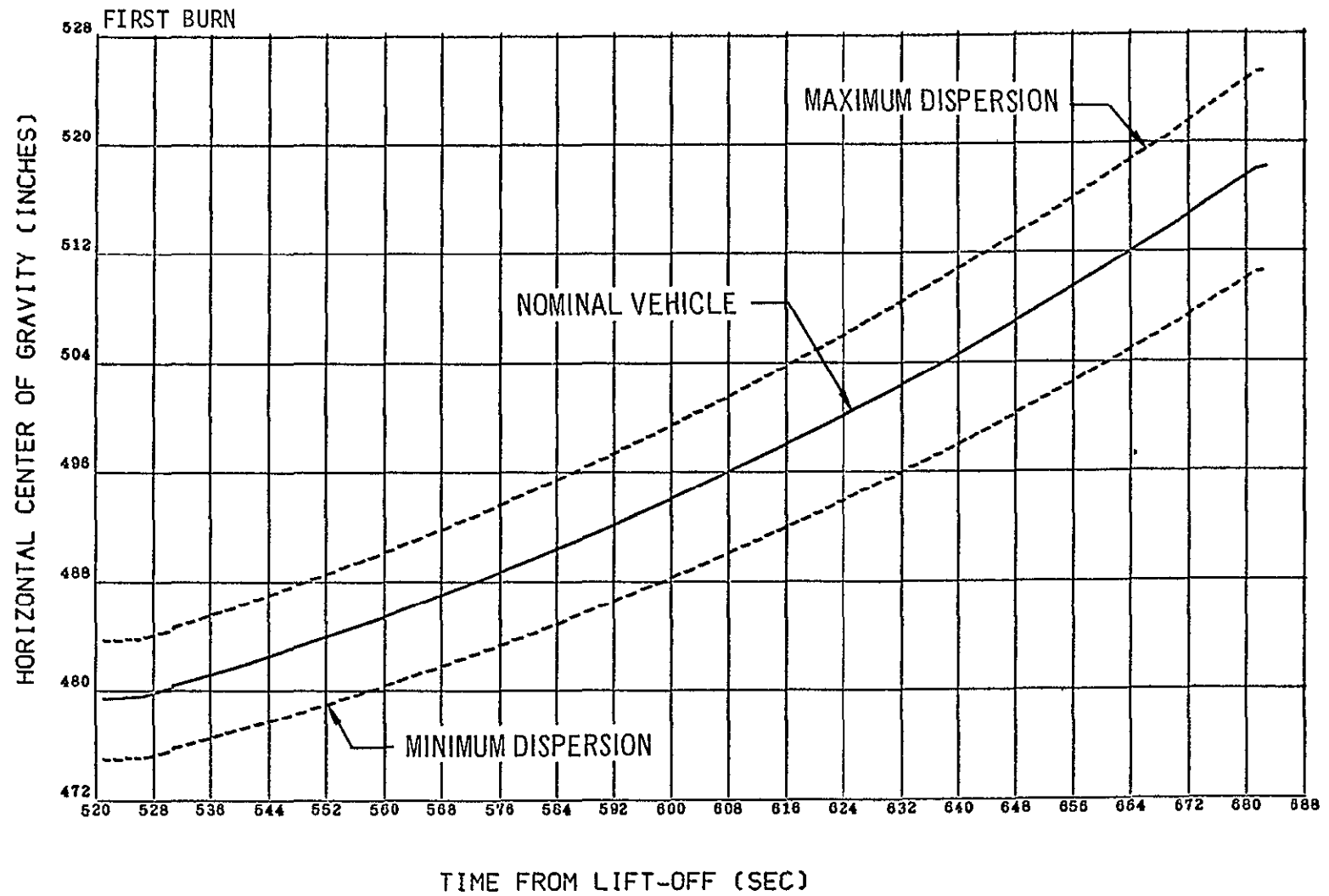
Figure AP 2-3. Stage Horizontal Center of Gravity (Sheet 1 of 2)
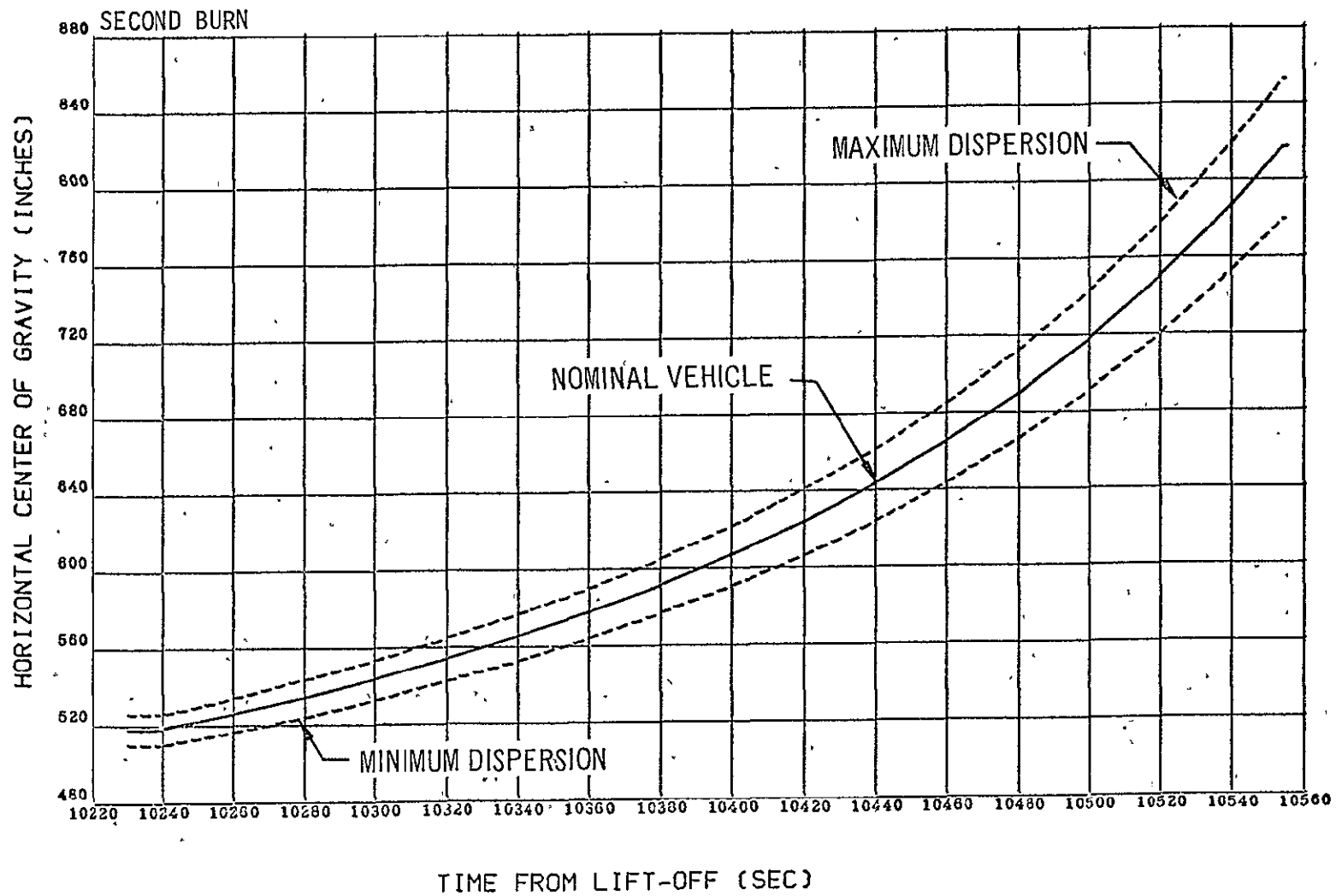
Figure AP 2-3   Stage Horizontal Center of Gravity (Sheet 2 of 2)

FIRST BURN

ROLL MOMENT OF INERTIA (100,000 SLUG FT^2)

TIME FROM LIFTOFF (SEC)

MAXIMUM DISPERSION

NOMINAL VEHICLE

MINIMUM DISPERSION
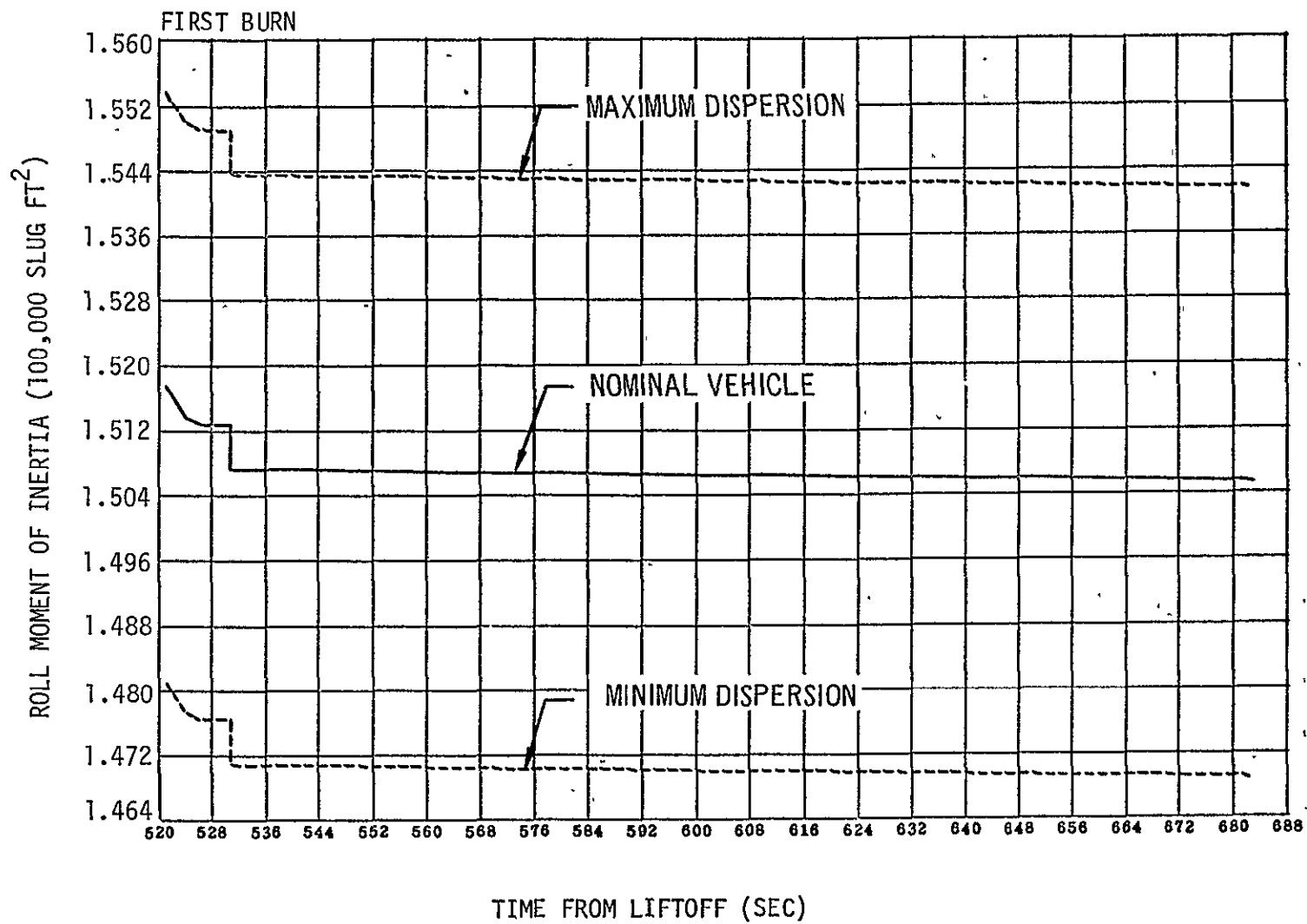
Figure AP 2-4. Third Flight Stage Vehicle Roll Moment of Inertia (Sheet 1 of 2)
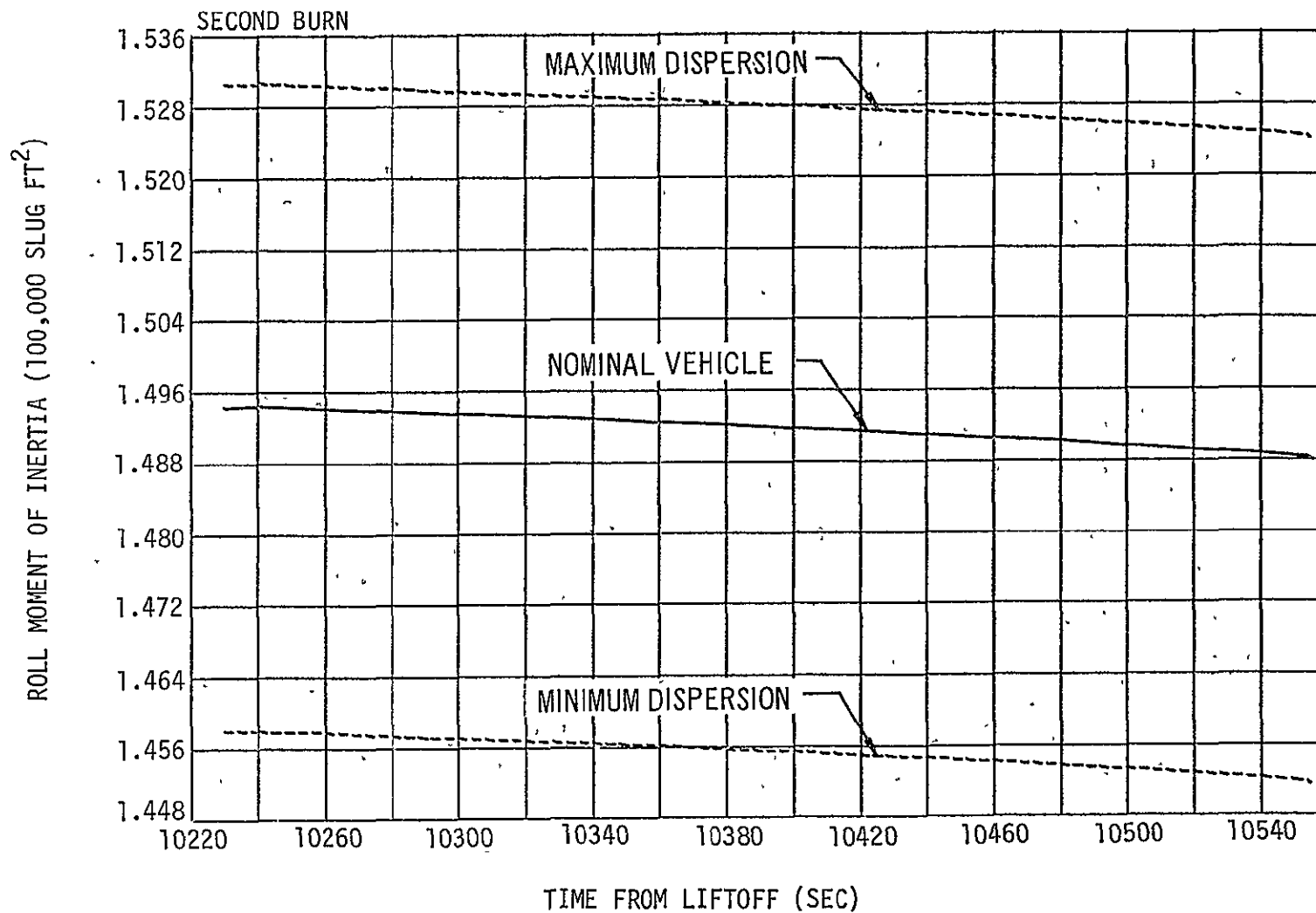
Figure AP 2-4. Third Flight Stage Vehicle Roll Moment of Inertia (Sheet 2 of 2)
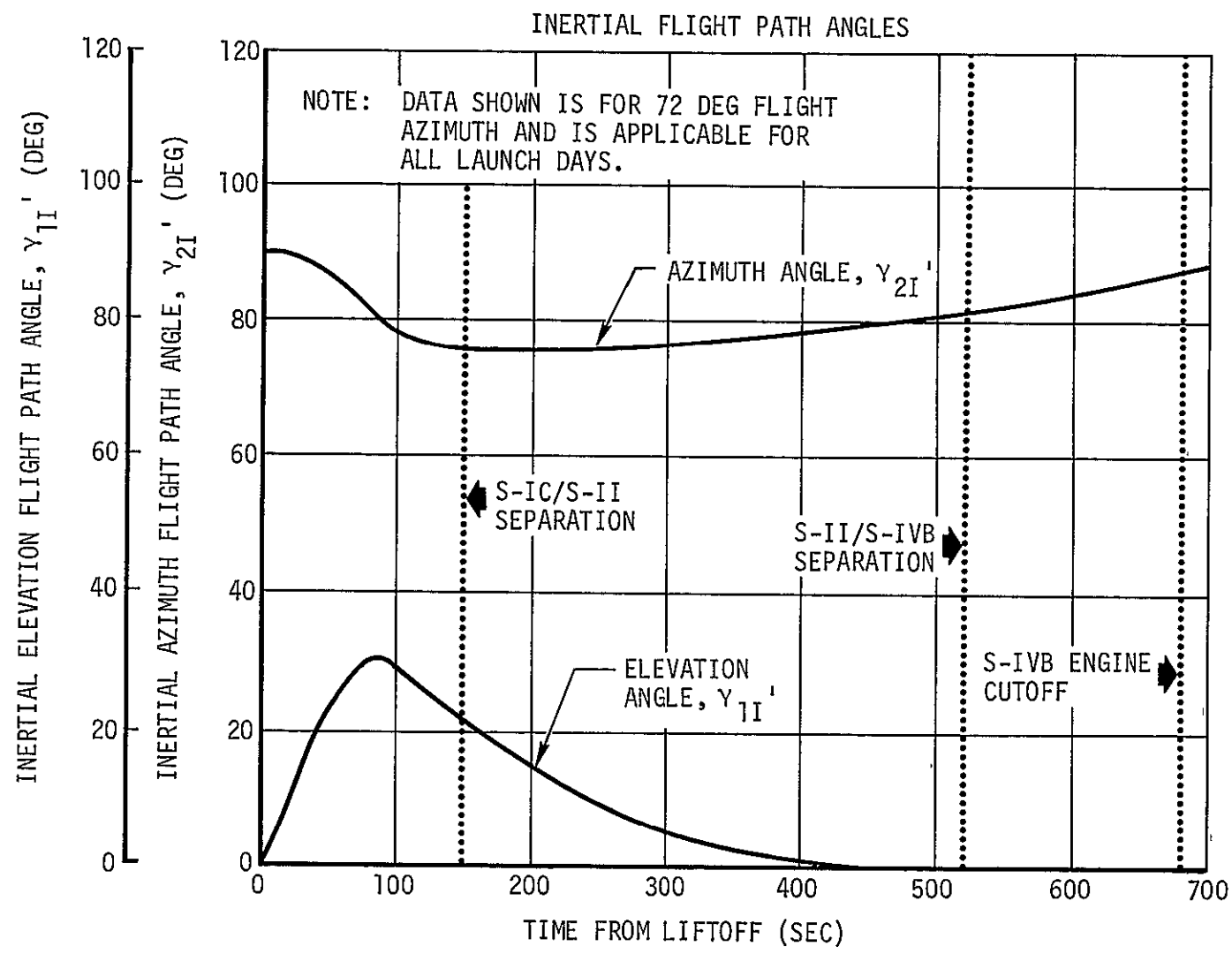
Figure AP 2-5. Third Flight Stage Vehicle Pitch Moment of Inertia (Sheet 1 of 2)

SECOND BURN

Figure AP 2-5.   Third Flight Stage Vehicle Pitch Moment of Inertia (Sheet 2 of 2)

INERTIAL FLIGHT PATH ANGLES

Figure 2-6. Typical Trajectory Profile Boost to Parking Orbit (Sheet 3 of 8)

3. PREDICTED FLIGHT TRAJECTORY

This appendix presents the predicted AS-503 C Prime trajectory for a
December 21, 1968 launch at a flight azimuth of 72 deg.

Trajectory predictions for the S-IC and S-II stages were transmitted to
MDAC-WD by MSFC and reformatted by Computer Program AB21 to be compatible
with MDAC-WD coordinate system conventions and symbology. The S-IVB
stage trajectory simulation was derived by MDAC-WD using predicted S-IVB
stage performance characteristics documented in this report. These
predictions are based on the predicted AS-503 C' Launch Vehicle Operational
Trajectory for December 1968 Launch Window (reference 13, appendix 11),
sequence of events (appendix 1), mass characteristics data (appendix 2),
and predicted propulsion system performance (appendix 5).

Table AP 3-1 presents the S-IC and S-II stage trajectory predictions;
table AP 3-2 presents the S-IVB boost to parking orbit and three revolu-
tions of parking orbit coast. S-IVB second burn predictions for each
restart opportunity are presented in tables AP 3-3 and 3-4; table AP 3-5
presents the predicted S-IVB translunar coast trajectory through termina-
tion of the LOX dump for a first opportunity restart. Symbol definitions
and coordinate subscript definitions are shown in tables AP 3-6 and
AP 3-7. Figures AP 3-1 and AP 3-2 show the coordinate systems applicable
to the trajectory simulation.

Trajectory parameters are graphically presented in section 2.

PREDICTED S-IC AND S-II STAGE TRAJECTORY

#					
1	TIME (SEC)	WEIGHT (LB)	F SB T (LB)	ALTITUDE (FT)	RANGE (FT)
2	V SB I (FT/SEC)	V SB E (FT/SEC)	R SB C (FT)	R SB L (FT)	RANGE ANGLE (RAD)
3	X SB E (FT)	X SB P (M) (M)	X SB S (FT)	X SB SFE (FT)	MU (DEG)
4	Y SB E (FT)	Y SB P (M) (M)	Y SB S (FT)	Y SB SFE (FT)	RHO (DEG)
5	Z SB E (FT)	Z SB P (M) (M)	Z SB S (FT)	Z SB SFE (FT)	RHO PRIME (DEG)
6	D-X SB E (FT/SEC)	D-X SB P (M) (M/SEC)	D-X SB S (FT/SEC)	D-X SB SFE (FT/SEC)	A SB XM (FT/SEC/SEC)
7	D-Y SB E (FT/SEC)	D-Y SB P (M) (M/SEC)	D-Y SB S (FT/SEC)	D-Y SB SFE (FT/SEC)	A SB YM (FT/SEC/SEC)
8	D-Z SB E (FT/SEC)	D-Z SB P (M) (M/SEC)	D-Z SB S (FT/SEC)	D-Z SB SFE (FT/SEC)	A SB ZM (FT/SEC/SEC)
9	F SB X (LB)	F SB TX (LB)	F SB AX (LB)	M SB X (LB-FT)	M SB AX (LB-FT)
10	F SB Y (LB)	F SB TY (LB)	F SB AY (LB)	M SB Y (LB-FT)	M SB AY (LB-FT)
11	F SB Z (LB)	F SB TZ (LB)	F SB AZ (LB)	M SB Z (LB-FT)	M SB AZ (LB-FT)
12	THETA M QRP (DEG)	D-THET M QPP (DEG/SEC)	V SB RM (FT/SEC)	I SB XX (SLUG/FT/FT)	EPS (THETA) (DEG)
13	PSI M QRP (DEG)	D-PSI M QRP (DEG/SEC)	V SB W (FT/SEC)	I SB YY (SLUG/FT/FT)	EPS (PSI) (DEG)
14	PHI M QRP (DEG)	D-PHI M QRP (DEG/SEC)	E SB W (DEG)	I SB ZZ (SLUG/FT/FT)	EPS (PHI) (DEG)
15	CHI SB P (DEG)	D-CHI SB P (DEG/SEC)	ALPHA * (DEG)	P SB M (DEG/SEC)	X SB CG (IN)
16	CHI SB Y (DEG)	D-CHI SB Y (DEG/SEC)	ALPHA (DEG)	Q SB M (DEG/SEC)	Y SB CG (IN)
17	CHI SB R (DEG)	D-CHI SB R (DEG/SEC)	BETA (DEG)	R SB M (DEG/SEC)	Z SB CG (IN)
18	GAMMA SB 1 (DEG)	GAMMA SB 1I (DEG)	GAMMA 1I PR (DEG)	V SB S (FT/SEC)	F/M (FT/SEC/SEC)
19	GAMMA SB 2 (DEG)	GAMMA SB 2I (DEG)	GAMMA 2I PR (DEG)	I SB SP (SEC)	WEIGHT FLOW (LB/SEC)
20	DYN PRESS (LB/SQ FT)	MACH NO.	PRESSURE (LB/FT/FT)	ALPHA Q PROD (LB/DEG/F/F)	X SB CP (IN)
21	DENSITY SLUG/FT3	CHORD FORCE (LB)	NORMAL FORCE (LB)	N SB 1 (DEG)	N SB 2 (DEG)
22	DELTA D-X(V) (M/SEC)	DELTA D-Y(V) (M/SEC)	DELTA D-Z(V) (M/SEC)	K SB 1 (DEG)	K SB 3 (DEG)
23	T SB 1V (SEC)	T SB 1V2-4V (SEC)	T SB 3-5V (SEC)	K SB 2 (DEG/SEC)	K SB 4 (DEG/SEC)
24	T SB 1S SEC	T SB 2S (SEC)	R (PER) FT	V (PER) (FT/SEC)	ECCENTRICITY
25	R(AP) (FT)	V (AP) (FT/SEC)	INCLINATION DEG	PERIOD SEC	LAMBDA SB N DEG
26	TRUE ANOMALY (DEG)	T SB F (SEC)	S SB F (FT)	MU SB F (DEG)	RHO SB F (DEG)

FIRST MOTION

#	A	B	C	D	
1	.0000	6132673.8	7645892.6	197.2	.6
2	1340.67	.00	20909957.0	20909759.0	.0000
3	195.3	6373325.7	22192.0	3024447.3	-80.6041
4	.0	19257.2	-12.9	-18134578.0	28.4470
5	.0	1154.7	7139.9	9960311.2	28.4470
6	.00	-.45	1275.29	1322.40	-.08
7	.00	126.04	-1.49	220.53	35.56
8	.00	388.71	413.51	-.04	-11.57
9	7176550.0	7645891.8	-532419.6	40.7	-.0
10	.6	.0	.6	371469.1	-5806.7
11	-3253.7	-3255.5	1.8	90194.6	-6642.6
12	-.069	-.003	.39	2945907.90	.0685
13	.022	.001	-.39	658006930.00	-.0223
14	-18.000	.002	252.000	658006930.00	.0000
15	.000	.000	89.9315	.002	1182.8
16	.000	.000	89.9279	-.004	.2
17	-18.000	.000	89.7782	.000	-.1
18	.0000	.0000	.0000	1137.11	40.100
19	.0000	90.0000	90.0000	264.66	-29128.085
20	.00	.000	2109.53	.016	1438.67
21	.002	532419.64	1.91	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	27951.6	1002927.12	.99733
25	20909957.0	1340.67	28.4470	1793.853	9.4679
26	.000	3.5009	.6	-80.6041	28.6084

LIFTOFF - TB 1

	A	B	C	D	
1	.3850	6121459.5	7698116.5	197.5	.6
2	1340.68	1.75	20909958.0	20909759.0	.0000
3	195.7	6373325.7	22683.3	3024956.7	-80.6041
4	.5	19305.7	-12.9	-18134493.0	28.4470
5	-.2	1304.4	7299.0	9960311.7	28.4470
6	1.75	.07	1277.05	1324.00	-.07
7	.00	126.04	-1.52	221.09	36.39
8	.01	388.72	413.50	.43	-11.83
9	7329548.7	7698115.7	-432215.0	44.3	-.1
10	-430.1	-431.2	1.1	366431.6	-4807.2
11	-3162.9	-3174.3	3.4	52282.3	-5362.9
12	-.069	.003	1.80	2945897.70	.0686
13	.020	-.013	-.39	657697200.00	-.0200
14	-18.000	.001	252.000	657697200.00	-.0005
15	.000	.000	12.8079	.001	1182.8
16	.000	.000	12.2217	.007	.2
17	-18.000	.000	3.9493	-.011	-.1
18	89.6677	.0000	.0749	1137.11	40.448
19	57.9972	89.9772	89.9998	532.94	-14564.042
20	.00	.002	2109.51	.045	1623.16
21	.002	432214.98	3.57	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.215	144.000	.000	.000
24	.000	321.953	27952.0	1002920.63	.99733
25	20909958.0	1340.68	28.4470	1793.853	9.4700
26	.000	3.5587	.6	-80.6041	28.6084

START TOWER CLEARANCE YAW MANEUVER

	A	B	C	D	
1	1.3850	6092331.6	7720141.9	204.4	.5
2	1340.73	10.15	20909964.0	20909759.0	.0000
3	202.5	6373327.2	23965.5	3026285.3	-80.6041
4	.5	19431.8	-14.5	-18134271.0	28.4470
5	-.2	1693.1	7712.5	9960313.5	28.4470
6	10.15	2.60	1285.46	1331.66	.16
7	-.04	126.01	-1.64	223.73	38.81
8	.02	388.73	413.48	2.67	-12.64
9	7774399.0	7720113.8	-9608.5	117.4	-.3
10	-13545.9	-13554.0	8.0	-126292.2	-488.7
11	2342.6	2327.1	17.2	-1126591.7	57.3
12	-.057	.015	10.16	2945871.00	.0573
13	-.000	-.002	-.38	656892730.00	.2711
14	-18.000	-.000	252.000	656892730.00	-.0005
15	.000	.000	2.6565	-.000	1182.8
16	.271	.000	2.4794	.015	.2
17	-18.000	.000	.9278	.002	-.1
18	89.6413	-.0019	.4336	1137.08	40.758
19	19.2222	89.8679	89.9971	534.47	-14564.042
20	.14	.009	2109.01	.239	1456.51
21	.002	9608.51	19.06	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	27952.0	1002920.94	.99733
25	20909966.0	1340.68	28.4470	1793.854	9.4799
26	.001	3.8953	.8	-80.6041	28.6084

1	5.0000	5986758.2	7738267.2	298.8	.3
2	1341.42	43.20	20910059.0	20909759.0	.0000
3	297.0	6373354.2	28670.3	3031152.0	-80.6041
4	.2	19887.1	-21.1	-18133443.0	28.4470
5	-.2	3098.4	9207.0	9960338.8	28.4470
6	43.20	12.59	1318.56	1361.85	1.10
7	.40	126.10	-1.50	233.67	39.56
8	-.09	388.73	413.25	11.91	-12.88
9	7798017.9	7738257.9	-4367.3	-73.1	-.8
10	11343.5	11275.0	68.5	397919.0	-171.1
11	-4502.9	-3992.0	6.3	1130833.2	1296.8
12	-.008	.004	43.20	2945786.30	.0083
13	.971	.379	-.17	653987920.00	.2788
14	-17.999	.001	252.000	653987920.00	-.0006
15	.000	.000	.4453	.001	1182.8
16	1.250	.000	.0406	-.113	.2
17	-18.000	.000	.4434	.362	-.1
18	89.6105	.0157	1.8455	1136.66	41.573
19	172.3313	89.4429	90.0124	267.13	-29208.500
20	2.13	.038	2102.06	.086	1419.58
21	.002	4367.31	68.79	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	27953.8	1002887.96	.99733
25	20910088.0	1340.72	28.4470	1793.870	9.4627
26	.005	5.8571	2.0	-80.6041	28.6084

END TOWER CLEARANCE YAW MANEUVER

	A	B	C	D	
1	9.3850	5858753.4	7738656.4	583.8	11.6
2	1344.69	87.00	20910344.0	20909759.0	.0000
3	581.9	6373438.2	34547.9	3037212.3	-80.6041
4	11.6	20442.9	-18.6	-18132398.0	28.4469
5	-1.2	4802.9	11018.5	9960421.8	28.4469
6	86.86	25.78	1362.29	1402.27	1.76
7	4.86	127.41	2.58	243.46	40.41
8	-.35	388.70	412.87	26.05	-13.15
9	7796659.3	7738642.4	-6232.4	-20.2	11.7
10	6250.1	7451.4	-1201.3	426803.4	-2208.9
11	-3435.2	-3673.9	96.8	744160.7	-26670.5
12	-.014	-.002	87.00	2945686.00	.0136
13	1.361	-.104	.45	650482650.00	-.3815
14	-18.000	.000	252.000	650482650.00	-.0005
15	.000	.000	1.9143	.000	1183.3
16	.979	-.241	.1544	.030	.2
17	-18.000	.000	1.9081	-.099	-.1
18	86.9553	.2037	3.7042	1135.43	42.484
19	165.4212	88.9057	90.1914	267.44	-29176.500
20	8.58	.077	2081.25	1.335	1448.21
21	.002	6232.39	1205.21	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	28002.7	1002010.02	.99733
25	20910461.0	1341.87	28.4475	1793.925	9.1053
26	.010	9.2983	54.9	-80.6041	28.6083

START PITCH AND ROLL MANEUVERS

	A	B	C	D	
1	10.0000	5840809.9	7739277.3	637.9	14.7
2	1345.27	93.44	20910398.0	20909759.0	.0000
3	636.1	6373454.3	35386.4	3038075.3	-80.6041
4	14.6	20521.3	-17.0	-18132247.0	28.4469
5	-1.4	5041.9	11272.4	9960438.0	28.4469
6	93.28	27.72	1368.71	1408.20	1.40
7	5.48	127.59	3.15	244.92	40.53
8	-.39	388.69	412.82	28.11	-13.19
9	7796929.1	7739241.4	-6591.9	-111.0	15.0
10	20465.7	21993.8	-1528.1	861566.0	-2727.6
11	-8093.8	-8424.8	118.6	2049239.1	-34315.7
12	-.015	-.001	93.44	2945672.00	.0146
13	1.303	-.156	.57	649995760.00	-.7557
14	-17.999	.001	252.000	649995760.00	-.0005
15	.000	.000	2.1490	.001	1183.3
16	.547	-.625	.1664	.047	.2
17	-18.000	.000	2.1426	-.149	-.1
18	86.7874	.2298	3.9767	1135.19	42.618
19	165.3855	88.8292	90.2163	267.46	-29176.500
20	9.85	.082	2077.31	1.639	1452.13
21	.002	6591.92	1532.66	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	28009.6	1001887.28	.99732
25	20910534.0	1342.02	28.4477	1793.935	9.0556
26	.011	9.8325	66.2	-80.6041	28.6082
1	15.0000	5694878.0	7772783.3	1241.4	48.7
2	1351.25	149.27	20911001.0	20909759.0	.0001
3	1239.5	6373634.3	42367.2	3045242.6	-80.6041
4	48.5	21161.1	4.5	-18130986.0	28.4468
5	-3.7	6985.5	13336.3	9960618.8	28.4468
6	149.12	44.61	1424.63	1459.61	-.13
7	6.66	127.90	3.91	260.91	42.34
8	.19	388.95	413.30	43.24	-11.78
9	7826992.0	7772758.5	-10680.7	295.1	83.1
10	-25090.1	-19599.1	-5491.0	29693.9	33273.1
11	22.4	1251.0	-1428.0	-1752701.6	-128564.4
12	-1.039	-.352	149.28	2945560.70	-.4401
13	-.227	-.053	1.88	646037910.00	.2269
14	-14.525	.937	252.000	646037910.00	.6495
15	-1.479	-.306	3.2291	.939	1184.3
16	.000	.000	.8135	-.327	.2
17	-13.875	1.000	3.1253	-.139	-.1
18	87.5926	.2770	6.3368	1132.66	43.899
19	159.0501	88.2261	90.2498	268.39	-29202.496
20	24.73	.132	2033.82	20.119	1464.96
21	.002	10680.66	5673.62	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	28051.5	1001137.52	.99732
25	20911348.0	1342.97	28.4478	1794.045	9.0062
26	.017	14.5680	140.0	-80.6040	28.6081

PREDICTED S-IC AND S-II STAGE TRAJECTORY

	A	B	C		D
1	20.0000	5548773.3	7818355.1	2140.2	79.4
2	1365.72	211.67	20911900.0	20909759.0	.0001
3	2138.4	6373903.8	49643.7	3052685.9	-80.6040
4	78.5	21799.5	20.4	-18129639.0	28.4468
5	11.7	8934.9	15417.9	9960862.1	28.4468
6	211.48	63.48	1487.04	1519.03	-.05
7	5.55	127.52	2.37	278.33	44.22
8	7.08	391.14	420.12	53.73	-9.87
9	7867217.2	7818352.6	-16948.9	95.5	145.5
10	-8745.7	-2262.1	-6483.5	-302245.8	117277.4
11	566.3	5727.9	-5236.5	-190087.3	-145677.3
12	-2.801	-.428	211.57	2945452.70	-.6129
13	-.042	.019	3.84	642078210.00	.0419
14	-9.551	1.000	252.000	642078210.00	.6763
15	-3.414	-.492	2.3907	1.001	1185.8
16	.000	.000	1.5027	-.425	.2
17	-8.875	1.000	1.8603	-.052	-.1
18	87.6155	.2259	8.9082	1129.06	45.319
19	106.4505	87.8254	90.1059	269.70	-29233.488
20	48.43	.187	1970.42	72.778	1455.00
21	.002	16948.86	8334.04	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	28316.1	996443.13	.99730
25	20912597.0	1349.20	28.4470	1794.239	9.3293
26	.024	19.8490	254.1	-80.6035	28.6081

END ROLL MANEUVER

	A	B	C		D
1	29.0000	5285402.4	7916728.8	4608.3	246.4
2	1425.58	343.35	20914368.0	20909759.0	.0002
3	4606.4	6374645.9	63591.9	3066925.9	-80.6034
4	122.7	22945.1	34.7	-18127013.0	28.4469
5	213.4	12498.2	19339.7	9961378.1	28.4469
6	340.46	102.52	1616.05	1650.72	.60
7	4.15	127.01	.13	304.32	47.57
8	44.22	402.69	457.25	56.66	-6.75
9	7949800.7	7916724.0	-34928.8	460.4	297.0
10	-13334.9	-6109.4	-7225.4	973134.0	313710.0
11	-20715.6	-6144.4	-14587.9	-542282.0	-156092.9
12	-7.503	-.424	342.11	2945266.40	-.2678
13	-.092	-.007	10.66	634865860.00	.0920
14	-.548	1.000	252.000	634865860.00	.5484
15	-7.770	-.454	1.9004	1.000	1190.0
16	.000	.000	1.7031	-.424	.2
17	-.000	.000	.8437	-.012	-.2
18	82.5318	.1598	13.8160	1119.97	48.176
19	76.1578	87.8448	89.5581	272.65	-29285.516
20	117.87	.305	1804.60	200.742	1448.39
21	.002	34928.80	16279.20	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	29816.8	971007.85	.99715
25	20916174.0	1384.21	28.4500	1794.892	10.5175
26	.040	30.5414	1609.1	-80.5993	28.6092

	A	B	C		D
1	30.0000	5256116.0	7930325.6	4956.6	290.2
2	1435.27	359.75	20914716.0	20909759.0	.0002
3	4954.8	6374750.9	65215.8	3068585.2	-80.6032
4	126.7	23072.0	35.0	-18126708.0	28.4469
5	260.8	12901.9	19800.5	9961434.0	28.4469
6	356.15	107.27	1631.73	1667.44	.72
7	3.95	126.94	-.17	306.75	47.91
8	50.62	404.68	463.66	55.42	-6.74
9	7961102.2	7930322.9	-37521.1	396.4	290.7
10	-13160.3	-6054.7	-7105.6	594360.8	301260.6
11	-16361.2	-2119.1	-14247.9	-534460.3	-151006.4
12	-7.916	-.408	358.24	2945246.10	-.3107
13	-.098	-.005	11.80	634053480.00	.0984
14	.182	.283	252.000	634053480.00	-.1824
15	-8.227	-.477	1.7126	.283	1190.5
16	.000	.000	1.5327	-.408	.2
17	.000	.000	.7645	-.004	-.2
18	81.8484	.1507	14.3660	1118.76	48.528
19	75.3596	87.9081	89.4687	273.13	-29285.500
20	127.92	.320	1782.15	196.062	1444.67
21	.002	37521.07	15921.45	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	30080.0	966745.48	.99713
25	20916693.0	1390.26	28.4514	1794.992	10.7094
26	.042	31.5901	1877.2	-80.5984	28.6094

	A	B	C	D	
1	40.0000	4962921.8	8088352.4	9358.2	1180.1
2	1567.06	546.81	20919117.0	20909759.0	.0005
3	9356.4	6376077.8	82371.9	3086180.2	-80.6005
4	155.9	24337.8	23.4	-18123543.0	28.4476
5	1168.9	17072.9	24846.7	9961869.0	28.4476
6	528.69	159.47	1804.11	1858.40	2.54
7	1.97	126.24	-3.22	325.74	50.63
8	139.60	432.17	552.85	26.24	-11.68
9	8088602.6	8088350.5	-71526.6	392.3	307.1
10	-10954.2	-5297.0	-5657.0	492795.2	295425.1
11	-16418.9	-972.4	-15442.0	-392656.3	-109648.6
12	-13.133	-.595	540.61	2945053.10	-.5457
13	-.063	.003	26.29	625695110.00	.0633
14	.000	.000	252.000	625695110.00	-.0004
15	-13.679	-.591	.8881	.001	1198.0
16	.000	.000	.8339	-.595	.2
17	.000	.000	.3055	.003	-.2
18	75.1623	.0699	19.7130	1104.06	52.420
19	72.2260	89.0711	88.3396	278.11	-29341.000
20	254.80	.490	1518.05	212.483	1428.35
21	.002	71526.59	16445.63	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	33882.5	910801.28	.99677
25	20923475.0	1474.91	28.4920	1796.353	13.1211
26	.067	45.5319	7523.6	-80.5816	28.6143
1	50.0000	4669169.6	8275639.3	15620.2	3261.8
2	1774.54	782.77	20925377.0	20909759.0	.0008
3	15618.1	6377967.1	101383.6	3105917.9	-80.5943
4	167.6	25597.1	-13.4	-18120269.0	28.4494
5	3255.0	21607.3	31079.4	9961804.5	28.4494
6	727.67	219.61	2002.61	2096.09	5.94
7	.46	125.65	-6.04	328.42	53.09
8	288.48	478.05	702.20	-45.96	-17.54
9	8229591.9	8275637.9	-122012.3	427.3	349.0
10	-7646.8	-4554.9	-3091.7	372863.7	178302.1
11	-19140.2	-827.4	-18310.7	-234645.5	-32431.6
12	-19.097	-.583	766.27	2944870.90	-.4834
13	-.038	.001	47.76	616461730.00	.0377
14	.001	.000	252.000	616461730.00	-.0009
15	-19.580	-.575	.5613	.000	1208.6
16	.000	.000	.5535	-.583	.2
17	.000	.000	.0935	.001	-.2
18	68.3335	.0231	24.2015	1082.24	57.010
19	71.7083	91.3373	86.7875	284.10	-29396.751
20	420.89	.708	1199.29	232.948	1326.63
21	.001	122012.29	18569.89	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	40825.5	829609.77	.99611
25	20933644.0	1617.93	28.6151	1798.554	16.4063
26	.101	61.2001	20870.9	-80.5421	28.6258
1	60.0001	4374973.3	8465576.0	23993.2	7163.1
2	2060.00	1075.19	20933747.0	20909759.0	.0012
3	23990.2	6380493.8	122495.8	3128268.7	-80.5828
4	166.7	26851.0	-72.3	-18117077.0	28.4528
5	7163.8	26703.1	39147.7	9960766.6	28.4528
6	949.56	286.54	2223.58	2379.83	10.47
7	-.58	125.14	-8.73	310.92	54.77
8	504.33	544.49	918.80	-168.16	-23.00
9	8278278.6	8465574.6	-267622.4	258.0	215.7
10	-4547.2	-4348.3	-198.9	13429.5	7791.3
11	-10846.7	1310.0	-12157.5	-186254.2	-4876.5
12	-24.690	-.544	1040.50	2944616.80	-.4487
13	-.031	-.001	78.12	606513720.00	.0315
14	.000	.000	252.000	606513720.00	-.0004
15	-25.138	-.540	.2391	.000	1223.2
16	.000	.000	.2390	-.544	.2
17	.000	.000	.0039	-.001	-.2
18	61.9954	.0075	27.4402	1047.07	62.243
19	71.6547	94.4394	85.0140	290.40	-29427.750
20	594.87	.994	860.55	142.193	1234.87
21	.001	267622.43	12159.09	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	52156.7	733783.27	.99503
25	20947854.0	1827.00	28.8503	1801.840	20.1168
26	.149	78.4416	46579.5	-80.4658	28.6478

	A	B	C	D	
1	60.2500	4367616.6	8470111.9	24231.3	7289.8
2	2068.04	1083.18	20933985.0	20909759.0	.0012
3	24228.2	6380565.7	123052.2	3128864.6	-80.5824
4	166.5	26882.3	-74.1	-18117000.0	28.4529
5	7290.6	26839.5	39378.7	9960723.9	28.4529
6	955.30	288.27	2229.28	2387.41	10.59
7	-.60	125.13	-8.80	310.20	54.79
8	510.57	546.41	925.06	-171.87	-23.12
9	8276547.9	8470110.5	-273991.6	254.2	211.0
10	-4486.6	-4351.4	-135.1	20430.4	10057.1
11	-10678.5	1259.7	-11938.9	-186649.9	-4955.1
12	-24.826	-.544	1047.93	2944610.60	-.4476
13	-.032	-.000	78.97	606246690.00	.0316
14	.000	.000	252.000	606246690.00	-.0004
15	-25.273	-.540	.2334	.000	1223.6
16	.000	.000	.2334	-.544	.2
17	.000	.000	.0026	-.000	-.2
18	61.8465	.0074	27.5035	1045.96	62.382
19	71.6551	94.5243	84.9691	290.53	-29431.000
20	598.79	1.002	852.18	139.767	1237.88
21	.001	273991.64	11939.62	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	52506.4	731329.65	.99500
25	20948263.0	1833.06	28.8576	1801.938	20.2100
26	.150	78.8873	47419.2	-80.4633	28.6485
1	70.0001	4079956.1	8656364.8	34662.5	13558.7
2	2418.87	1425.90	20944411.0	20909759.0	.0018
3	34656.2	6383711.5	145885.4	3153652.0	-80.5638
4	157.3	28100.0	-151.4	-18114184.0	28.4583
5	13569.7	32567.2	49730.9	9958237.1	28.4583
6	1187.09	358.00	2459.62	2703.91	16.71
7	-1.21	124.67	-11.44	270.06	56.72
8	789.95	632.35	1205.42	-344.74	-28.80
9	8423376.0	8656363.3	-317564.7	456.1	337.3
10	-1705.6	-3832.0	2126.5	949716.6	510132.8
11	-23406.2	-3166.2	-20237.4	-70645.6	48311.1
12	-30.233	-.589	1363.85	2942492.10	-.4303
13	-.026	.002	117.36	595099080.00	.0263
14	.001	.000	252.000	595099080.00	-.0014
15	-30.663	-.515	.3822	.000	1242.5
16	.000	.000	.3801	-.589	.2
17	.000	.000	.0399	.002	-.2
18	56.3450	.0154	29.3856	995.18	68.252
19	71.7009	98.0672	83.2395	295.69	-29561.002
20	714.46	1.370	543.39	271.566	1547.93
21	.001	317564.69	20348.84	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	69445.7	635656.02	.99340
25	20966531.0	2105.43	29.1848	1806.471	23.7706
26	.215	96.8993	89715.4	-80.3377	28.6843

MAXIMUM DYNAMIC PRESSURE

	A	B	C	D	
1	76.0000	3902301.0	8763874.1	42249.7	18911.9
2	2678.42	1675.90	20951994.0	20909759.0	.0022
3	42239.4	6385997.8	161090.8	3170532.9	-80.5480
4	149.7	28847.3	-207.8	-18112699.0	28.4629
5	18934.9	36553.6	57613.2	9955753.5	28.4629
6	1341.91	404.48	2613.21	2925.52	21.78
7	-1.26	124.43	-13.02	232.03	58.11
8	1003.94	698.14	1420.19	-483.16	-32.63
9	8590811.1	8763873.2	-259955.7	373.8	298.5
10	-289.2	-3216.2	2927.1	952952.2	696793.5
11	-19251.7	-1128.6	-18121.4	65822.6	108270.2
12	-33.772	-.656	1600.84	2940473.30	-.5711
13	-.017	.001	129.91	585390130.00	.0168
14	.001	-.000	252.000	585390130.00	-.0012
15	-34.343	-.727	.3594	.000	1256.9
16	.000	.000	.3548	-.656	.2
17	.000	.000	.0573	.001	-.2
18	53.1997	.0317	30.0675	961.15	72.248
19	71.7496	100.4612	82.2048	298.70	-29631.000
20	738.80	1.666	380.38	262.112	1721.16
21	.001	259955.73	18356.32	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	84117.9	577364.32	.99201
25	20980337.0	2314.87	29.4247	1810.141	25.8680
26	.267	108.8365	127513.9	-80.2253	28.7160

	A	B	C	D	
1	80.0001	3783630.9	8827357.6	47836.7	23237.1
2	2871.65	1860.90	20957576.0	20909759.0	.0025
3	47822.0	6387680.2	171748.6	3182552.7	-80.5352
4	144.9	29344.7	-248.7	-18111854.0	28.4666
5	23271.8	39444.9	63633.6	9953598.2	28.4666
6	1449.25	436.64	2719.53	3084.73	26.11
7	-1.16	124.27	-14.08	199.59	58.53
8	1167.31	748.34	1584.13	-591.71	-35.16
9	8686568.4	8827356.6	-229049.1	301.4	203.0
10	-425.1	-3225.1	2800.2	900032.9	534306.7
11	-14712.4	-2230.1	-12483.4	96932.6	116127.3
12	-36.650	-.763	1791.68	2939131.50	-.6987
13	-.017	-.001	112.93	578910060.00	.0166
14	.001	.000	252.000	578910060.00	-.0012
15	-37.349	-.772	.2682	.000	1267.8
16	.000	.000	.2617	-.763	.2
17	.000	.000	.0587	-.001	-.2
18	51.1635	.0463	30.3162	944.08	75.056
19	71.7853	102.1458	81.5384	300.42	-29677.246
20	727.41	1.898	288.61	190.350	1785.09
21	.000	229049.11	12793.58	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	96312.3	539421.13	.99087
25	20990711.0	2475.04	29.5964	1813.050	27.2048
26	.309	117.1245	159027.7	-80.1315	28.7423
1	90.0001	3486838.6	8950692.5	63702.8	37235.5
2	3431.75	2392.26	20973431.0	20909759.0	.0035
3	63667.8	6392450.8	200252.9	3215524.0	-80.4937
4	135.7	30585.2	-363.8	-18110458.0	28.4786
5	37319.8	47657.7	81911.0	9946014.6	28.4786
6	1719.19	517.18	2986.12	3516.78	39.43
7	-.60	123.82	-17.04	83.90	58.26
8	1663.52	900.72	2081.97	-936.48	-40.71
9	8900766.7	8950691.0	-140743.2	252.7	117.4
10	-1948.7	-3747.9	1799.4	785703.7	312147.3
11	-10012.1	-3074.9	-6938.8	8097.6	78565.9
12	-44.161	-.673	2373.57	2938925.80	-.4999
13	-.028	-.001	26.82	562604030.00	.0278
14	.001	-.000	252.000	562604030.00	-.0009
15	-44.661	-.640	.1983	.000	1300.6
16	.000	.000	.1919	-.673	.3
17	.000	.000	.0498	-.001	-.2
18	45.9947	.0906	30.0930	950.49	82.586
19	71.8733	106.7757	79.9711	304.14	-29728.002
20	563.81	2.497	129.29	108.207	1844.85
21	.000	140743.25	7168.28	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	138658.0	449120.37	.98689
25	21020412.0	2962.56	30.0528	1822.350	30.3032
26	.442	138.3987	265450.4	-79.8142	28.8302
1	100.0001	3188793.4	9027831.7	82281.3	56794.5
2	4103.09	3030.21	20991991.0	20909759.0	.0048
3	82202.3	6398020.8	231389.9	3253037.6	-80.4357
4	134.7	31820.6	-499.5	-18110500.0	28.4952
5	56973.6	57591.3	105828.0	9934426.4	28.4952
6	1987.16	596.56	3249.42	3994.35	52.96
7	.51	123.25	-20.49	-83.45	58.06
8	2287.66	1092.24	2707.94	-1389.36	-44.68
9	9052479.7	9027826.3	-67627.2	584.2	288.7
10	-2942.6	-3953.9	1011.4	1940972.3	831021.2
11	-21737.8	-8954.7	-12783.0	-43677.0	64225.3
12	-49.933	-.468	3022.27	2938704.80	-.1493
13	-.031	.000	10.47	542303390.00	.0313
14	.002	-.000	252.000	542303390.00	-.0019
15	-50.082	-.450	.6343	.000	1343.0
16	.000	.000	.6324	-.468	.3
17	.000	.000	.0500	.000	-.2
18	41.0848	.1439	29.0345	979.67	91.086
19	71.9598	111.6669	78.6289	305.47	-29856.001
20	353.09	3.085	52.94	223.279	2124.39
21	.000	67627.22	12822.98	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	203388.7	370264.46	.98087
25	21055467.0	3576.63	30.5026	1835.257	32.9116
26	.622	160.3692	419652.8	-79.3534	28.9555

PREDICTED S-IC AND S-II STAGE TRAJECTORY

	A	B	C	D	
1	110.0001	2889554.1	9081748.4	103606.8	83137.9
2	4887.92	3784.45	21013294.0	20909759.0	.0063
3	103439.3	6404388.5	265153.6	3295563.6	-80.3576
4	148.6	33050.0	-659.7	-18112479.0	28.5175
5	83484.7	69628.5	136640.8	9917781.2	28.5175
6	2260.62	676.96	3516.72	4522.33	66.76
7	2.27	122.56	-24.47	-298.42	58.42
8	3035.07	1321.48	3457.45	-1944.57	-47.79
9	9142958.0	9081740.1	-31924.7	612.8	211.6
10	-4729.0	-4809.6	80.8	2226523.4	821466.9
11	-19126.1	-11136.8	-8002.0	-184583.1	7445.4
12	-54.558	-.440	3772.76	2938443.50	.1048
13	-.076	-.007	14.51	516469640.00	.0756
14	.002	-.000	252.000	516469640.00	-.0016
15	-54.453	-.409	.9245	.000	1398.3
16	.000	.000	.9245	-.440	.3
17	.000	.000	.0093	-.007	-.3
18	36.8579	.2041	27.6726	1006.84	101.121
19	72.0462	116.3517	77.5479	306.40	-29944.000
20	198.24	3.747	20.17	183.263	2631.22
21	.000	31924.74	8002.36	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	298053.2	305189.59	.97214
25	21096767.0	4311.69	30.9070	1852.891	34.9953
26	.865	183.7140	633207.1	-78.7130	29.1255

	A	B	C	D	
1	120.0001	2589001.9	9131153.5	127780.2	117506.9
2	5799.94	4669.93	21037438.0	20909759.0	.0083
3	127447.0	6411567.3	301588.6	3343628.9	-80.2556
4	180.3	34270.6	-852.3	-18116889.0	28.5465
5	118132.5	84161.0	175634.2	9895014.8	28.5465
6	2543.54	759.47	3791.72	5108.11	81.51
7	4.28	121.56	-29.58	-563.64	59.89
8	3916.46	1591.74	4341.23	-2610.33	-51.04
9	9210971.1	9131151.2	-13976.2	328.9	100.8
10	-4493.7	-4569.7	76.2	1068698.0	397926.5
11	-7344.6	-3920.9	-3422.7	-166209.9	8441.8
12	-58.095	-.332	4633.52	2938205.20	-.1480
13	-.075	.001	43.25	482781630.00	.0748
14	.001	.000	252.000	482781630.00	-.0006
15	-58.244	-.343	.9062	.000	1471.0
16	.000	.000	.9060	-.332	.4
17	.000	.000	.0202	.001	-.3
18	33.2738	.2650	26.2155	1045.33	113.474
19	72.1294	120.6948	76.6877	306.93	-30056.011
20	99.79	4.433	7.26	90.407	2867.31
21	.000	13976.20	3423.54	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	434367.7	252010.61	.95974
25	21145526.0	5176.76	31.2595	1876.985	36.6601
26	1.190	209.1598	923173.4	-77.8398	29.3504

S-IC CENTER-ENGINE CUTOFF - TB 2

	A	B	C	D	
1	125.5850	2420508.7	9162538.6	142594.2	140692.9
2	6373.38	5230.49	21052232.0	20909759.0	.0095
3	142117.0	6415943.7	323145.9	3373122.5	-80.1868
4	208.4	34947.8	-976.4	-18120601.0	28.5659
5	141541.1	93521.5	201491.3	9879213.6	28.5659
6	2709.79	807.67	3952.66	5466.70	91.30
7	5.80	120.93	-32.71	-735.34	60.70
8	4473.81	1762.60	4900.09	-3034.80	-52.78
9	9243628.2	9162535.1	-8079.8	408.7	91.3
10	-4827.1	-4807.8	-19.2	1290950.8	328099.5
11	-8962.7	-6102.4	-2866.5	-206956.7	-2457.9
12	-60.154	-.313	5184.95	2938079.10	.1062
13	-.107	-.003	53.04	459317980.00	.1069
14	.000	-.000	252.000	459317980.00	-.0005
15	-60.048	-.311	1.1582	.000	1521.7
16	.000	.000	1.1581	-.313	.4
17	.000	.000	.0078	-.003	-.3
18	31.5390	.3023	25.4218	1067.96	121.791
19	72.1807	122.9396	76.2911	306.69	-30183.084
20	66.43	4.855	4.03	76.940	2896.05
21	.000	8079.80	2866.61	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	534789.0	226598.01	.95074
25	21176931.0	5722.37	31.4333	1894.211	37.4385
26	1.420	224.8183	1127960.3	-77.2206	29.5050

PREDICTED S-IC AND S-II STAGE TRAJECTORY

#	A	B	C	D	
1	130.0001	2312589.4	7206673.7	154895.1	161079.1
2	6752.90	5600.00	21064515.0	20909759.0	.0106
3	154269.8	6419562.9	340713.5	3397717.2	-80.1262
4	236.7	35480.6	-1083.8	-18124209.0	28.5830
5	162144.4	101564.4	224041.1	9865099.7	28.5830
6	2791.16	830.56	4030.16	5681.97	77.01
7	7.06	120.43	-35.17	-862.15	48.11
8	4854.83	1879.41	5281.91	-3333.75	-42.37
9	7276585.5	7206672.2	-4139.6	239.9	60.9
10	-3925.3	-3955.7	30.5	665737.2	210568.9
11	-3966.3	-2105.5	-1852.1	-187332.1	3327.8
12	-61.342	-.252	5537.42	2937772.20	-.0438
13	-.084	.006	71.95	441882300.00	.0845
14	.000	-.000	252.000	441882300.00	-.0002
15	-61.385	-.282	1.0890	.000	1559.0
16	.000	.000	1.0888	-.252	.4
17	.000	.000	.0179	.006	-.3
18	30.2872	.3318	24.7230	1081.38	100.263
19	72.2235	124.4940	76.0730	309.13	-23552.028
20	46.13	5.121	2.51	50.223	2924.05
21	.000	4139.64	1852.37	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	610065.5	211794.06	.94405
25	21198554.0	6095.14	31.5361	1906.906	37.8870
26	1.574	234.5142	1277190.8	-76.7681	29.6155

#	A	B	C	D	
1	140.0001	2074220.3	7230981.4	184198.6	213537.7
2	7679.02	6506.26	21093774.0	20909759.0	.0134
3	183099.7	6428124.8	381705.8	3456971.4	-79.9703
4	326.5	36679.8	-1354.9	-18134577.0	28.6267
5	215246.9	121754.6	281584.9	9828043.2	28.6267
6	2976.96	882.32	4206.03	6195.50	90.24
7	11.09	119.39	-40.53	-1176.39	49.53
8	5785.24	2164.60	6214.26	-4067.08	-44.58
9	7306702.0	7230980.0	1393.4	197.2	25.1
10	-4055.3	-4070.9	15.7	475184.0	79291.2
11	-2059.4	-1361.3	-698.4	-206460.3	1829.2
12	-63.853	-.240	6417.83	2937566.50	-.1428
13	-.082	-.000	99.14	395862480.00	.0825
14	.000	-.000	252.000	395862480.00	-.0001
15	-63.996	-.241	.9317	.000	1657.6
16	.000	.000	.9314	-.240	.4
17	.000	.000	.0209	-.000	-.4
18	27.7648	.4056	23.2471	1056.20	112.163
19	72.3341	127.7732	75.6632	306.07	-23868.001
20	21.11	6.076	.82	19.666	3019.17
21	.000	-1393.44	698.62	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	817014.7	182161.41	.92596
25	21251791.0	7003.11	31.7423	1941.133	38.7648
26	1.983	258.0362	1672274.5	-75.5649	29.8988

BEGIN TILT ARREST

#	A	B	C	D	
1	147.0000	1906888.0	7246002.1	206011.6	255957.7
2	8410.34	7225.72	21115551.0	20909759.0	.0156
3	204431.9	6434437.7	411455.1	3501640.0	-79.8441
4	416.2	37512.7	-1568.6	-18143842.0	28.6619
5	258270.8	137681.3	327746.7	9797467.7	28.6619
6	3119.08	921.65	4339.89	6595.69	101.07
7	14.65	118.59	-44.51	-1425.42	50.90
8	6517.83	2389.12	6948.41	-4645.65	-46.41
9	7323722.5	7246000.8	3222.7	191.9	7.4
10	-3999.1	-4007.0	7.9	445715.8	22049.1
11	-1548.6	-1356.1	-192.1	-199740.2	1032.8
12	-65.476	-.228	7225.72	2937420.50	-.1431
13	-.082	.000	.00	355018650.00	.0818
14	-.000	.000	252.000	355018650.00	.0001
15	-65.619	-.000	.4766	.000	1744.3
16	.000	.000	.4762	-.228	.5
17	.000	.000	.0196	.000	-.4
18	26.2248	.4601	22.3122	1016.14	122.258
19	72.4191	129.9043	75.4257	305.99	-23924.001
20	11.79	7.111	.33	5.617	3115.06
21	.000	-3222.75	192.27	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1003964.0	163644.02	.90995
25	21294574.0	7715.24	31.8719	1971.521	39.3032
26	2.347	276.9831	2015502.1	-74.5137	30.1345

PREDICTED S-IC AND S-II STAGE TRAJECTORY

	A	B	C	D	
1	150.0001	1834698.2	7242970.3	215721.0	275712.5
2	8747.64	7558.41	21125243.0	20909759.0	.0166
3	213887.5	6437229.9	424490.6	3521661.8	-79.7853
4	462.8	37867.9	-1666.4	-18148370.0	28.6782
5	278330.6	145003.8	349159.3	9783078.5	28.6782
6	3184.02	939.58	4400.93	6779.37	105.67
7	16.40	118.23,	-46.26	-1540.30	52.12
8	6855.02	2492.44	7286.33	-4912.09	-47.61
9	7321167.1	7242968.4	3730.9	275.7	2.5
10	-3991.7	-3997.4	5.7	718552.3	7298.9
11	-3344.8	-3280.0	-64.6	-251012.2	793.2
12	-65.884	-.027	7558.41	2937361.00	.2651
13	-.082	.000	.00	334424580.00	.0818
14	.000	-.000	252.000	334424580.00	-.0003
15	-65.619	-.000	.2155	-.000	1787.6
16	.000	.000	.2146	-.027	.5
17	.000	.000	.0191	.000	-.4
18	25.6196	.4843	21.9385	996.68	127.016
19	72.4578	130.7755	75.3354	386.43	-18942.273
20	8.79	7.584	.22	1.887	3120.75
21	.000	-3730.91	64.81	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1097415.4	156198.05	.90207
25	21314716.0	8042.06	31.9241	1986.606	39.5171
26	2.529	285.9521	2183844.4	-73.9962	30.2465

S-IC OUTBOARD-ENGINE CUTOFF - TB 3

	A	B	C	D	
1	151.0400	1810461.9	7071773.2	219140.2	282791.1
2	8866.48	7675.74	21128657.0	20909759.0	.0170
3	217211.1	6438210.4	429050.9	3528730.8	-79.7643
4	480.1	37990.8	-1701.4	-18150022.0	28.6841
5	285522.1	147615.0	356820.8	9777901.8	28.6841
6	3207.05	945.94	4422.57	6844.14	104.53
7	17.03	118.10	-46.87	-1580.66	51.50.
8	6973.63	2528.79	7405.21	-5005.76	-47.09
9	7144788.5	7071771.7	451.7	214.4	-.2
10	-3914.0	-3919.0	5.1	512098.4	-7.7
11	-1911.8	-1899.1	.2	-178922.1	578.2
12	-65.889	.011	7675.74	2935195.40	.2703
13	-.082	-.000	.00	325093860.00	.0818
14	-.000	-.000	252.000	325093860.00	.0000
15	-65.619	-.000	.0188	-.000	1805.1
16	.000	.000	.0008	.011	.5
17	.000	.000	.0188	-.000	-.4
18	25.4220	.4928	21.8163	989.78	125.674
19	72.4715	131.0661	75.3063	-12.11	589824.010
20	7.89	7.755	.19	.006	3125.03
21	.000	-451.73	5.09	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1131428.0	153717.08	.89922
25	21321967.0	8156.84	31.9415	1992.095	39.5880
26	2.595	289.1809	2244977.1	-73.8079	30.2866

S-II ULLAGE IGNITION

	A	B	C	D	
1	151.5400	1805703.5	1378938.4	220792.2	286233.1
2	8897.17	7705.66	21130306.0	20909759.0	.0172
3	218815.8	6438683.7	431249.5	3532150.2	-79.7540
4	488.7	38049.8	-1718.3	-18150830.0	28.6869
5	289019.7	148882.7	360544.6	9775380.9	28.6869
6	3207.07	945.70	4422.16	6856.21	20.44
7	17.29	118.06	-47.12	-1593.70	10.07
8	7006.54	2538.88	7438.13	-5033.48	-9.21
9	1379411.4	1378938.1	474.0	37.4	-1.4
10	-760.7	-765.9	4.7	92884.0	-3108.3
11	-221.4	-296.6	28.5	-342500.8	534.9
12	-65.882	.017	7705.66	2934145.90	.2628
13	-.082	-.000	.00	323038030.00	.0820
14	-.000	-.000	252.000	323038030.00	.0001
15	-65.619	-.000	.1137	-.000	1808.8
16	.000	.000	.1122	.017	.5
17	.000	.000	.0185	-.000	-.4
18	25.3293	.4967	21.7481	986.45	24.570
19	72.4782	131.1833	75.3009	.88	-1572864.000
20	7.44	7.812	.17	.834	3122.96
21	.000	-473.97	28.92	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1141019.5	153037.32	.89842
25	21324009.0	8188.82	31.9462	1993.643	39.6074
26	2.609	289.8791	2262218.5	-73.7548	30.2979

S-IC/S-II SEPARATION SIGNAL

	A	B	C	D	
1	151.7400	1803800.2	532530.0	221452.4	287612.4
2	8897.93	7706.07	21130965.0	20909759.0	.0172
3	219456.8	6438872.7	432128.0	3533518.2	-79.7499
4	492.2	38073.5	-1725.1	-18151155.0	28.6881
5	290421.4	149390.6	362036.8	9774370.0	28.6881
6	3202.24	944.16	4417.27	6852.73	7.91
7	17.37	118.05	-47.19	-1596.15	3.90
8	7009.19	2539.70	7440.74	-5037.02	-3.56
9	533003.4	532530.0	470.5	10.3	-1.8
10	-241.5	-243.6	4.5	-11670.2	-4235.1
11	-320.7	-89.9	38.9	1382395.9	515.5
12	-65.879	.017	7706.07	2933726.20	.2594
13	-.082	-.000	.00	322215710.00	.0821
14	-.000	-.000	252.000	322215710.00	.0002
15	-65.619	-.000	.1582	-.000	1810.3
16	.000	.000	.1571	.017	.5
17	.000	.000	.0183	-.000	-.4
18	25.2923	.4982	21.7161	985.11	9.499
19	72.4809	131.2213	75.3024	-.07	7340032.000
20	7.24	7.823	.17	1.137	3122.00
21	.000	-470.47	39.15	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1141833.3	152980.03	.89835
25	21324182.0	8191.53	31.9466	1993.774	39.6089
26	2.607	289.7805	2263679.8	-73.7503	30.2988

S-IC/S-II PHYSICAL SEPARATION

	A	B	C	D	
1	151.8100	1420944.0	94147.0	221696.9	288123.6
2	8897.51	7705.52	21131209.0	20909759.0	.0173
3	219694.2	6438942.7	432448.2	3534019.7	-79.7484
4	493.5	38081.7	-1727.4	-18151276.0	28.6885
5	290940.9	149577.2	362588.1	9773995.4	28.6885
6	3200.27	943.54	4415.28	6851.01	1.76
7	17.39	118.04	-47.22	-1596.84	.87
8	7009.49	2539.79	7441.02	-5037.80	-.79
9	93334.5	94147.0	-812.5	-3.1	-3.1
10	6.9	.0	6.9	-2781.3	-2711.8
11	65.3	.0	65.1	4500.4	247.0
12	-65.877	.017	7705.52	801951.40	.2582
13	-.082	-.001	.00	96328789.00	.0821
14	-.000	-.000	252.000	96328789.00	.0002
15	-65.619	-.000	.1738	-.000	627.4
16	.000	.000	.1729	.017	.6
17	.000	.000	.0182	-.001	.0
18	25.2794	.4987	21.7047	984.62	2.132
19	72.4819	131.2341	75.3032	5.74	-16410.940
20	7.16	7.826	.17	1.238	1127.66
21	.000	812.45	65.43	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1141936.1	152972.80	.89834
25	21324219.0	8191.87	31.9467	1993.793	39.6091
26	2.605	289.7271	2263915.8	-73.7496	30.2990

S-II ENGINE START SEQUENCE INITIATED

	A	B	C	D	
1	152.4400	1420705.6	93063.8	223764.8	292468.6
2	8891.50	7698.39	21133272.0	20909759.0	.0175
3	221700.8	6439534.1	435202.5	3538317.1	-79.7354
4	504.6	38156.1	-1749.0	-18152303.0	28.6921
5	295357.3	151177.4	367289.5	9770806.9	28.6921
6	3181.55	937.65	4396.45	6833.95	1.74
7	17.63	118.02	-47.43	-1602.53	.86
8	7010.17	2540.01	7441.52	-5043.44	-.78
9	92312.9	93063.8	-750.9	-5.2	-5.2
10	6.1	.0	6.1	-4758.4	-4687.8
11	107.1	.0	107.0	4403.0	230.0
12	-65.866	.019	7698.39	800080.31	.2465
13	-.082	-.000	.00	96313015.00	.0824
14	-.000	-.000	252.000	96313015.00	.0004
15	-65.619	-.000	.3162	-.000	627.5
16	.000	.000	.3156	.019	.6
17	.000	.000	.0177	-.000	.0
18	25.1624	.5033	21.6004	980.46	2.108
19	72.4905	131.3476	75.3104	5.67	-16410.940
20	6.58	7.852	.15	2.025	1148.62
21	.000	750.89	107.18	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1142281.1	152948.54	.89831
25	21324291.0	8193.01	31.9468	1993.849	39.6095
26	2.592	289.1398	2264532.2	-73.7477	30.2994

S-II IGNITION

	A	B	C	D	
1	153.4400	1420327.3	91586.7	227033.6	299365.2
2	8881.98	7687.11	21136536.0	20909759.0	.0178
3	224871.2	6440468.3	439559.2	3545124.8	-79.7149
4	522.3	38274.1	-1783.1	-18153938.0	28.6977
5	302367.8	153717.5	374752.6	9765741.0	28.6977
6	3151.84	928.30	4366.55	6806.87	1.71
7	18.00	117.97	-47.77	-1611.55	.85
8	7011.23	2540.36	7442.30	-5052.36	-.77
9	90976.6	91586.7	-659.3	-8.0	-7.9
10	6.0	.0	5.1	-28064.2	-7573.8
11	-300.1	.0	164.2	1972457.3	203.6
12	-65.846	.022	7687.11	797110.32	.2265
13	-.083	-.000	.00	96287974.00	.0827
14	-.001	-.001	252.000	96287974.00	.0009
15	-65.619	-.000	.5443	-.001	627.6
16	.000	.000	.5440	.022	.6
17	.000	.000	.0169	-.000	.0
18	24.9764	.5105	21.4348	973.90	2.075
19	72.5040	131.5281	75.3219	-.00	83886080.000
20	5.70	7.893	.13	3.103	1181.32
21	.000	659.25	164.23	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1142822.7	152910.48	.89827
25	21324404.0	8194.82	31.9469	1993.936	39.6101
26	2.571	288.2067	2265498.4	-73.7447	30.3000
1	155.0001	1418246.3	795405.0	232074.9	310126.4
2	8876.56	7678.99	21141568.0	20909759.0	.0184
3	229753.8	6441905.6	446290.8	3555688.0	-79.6829
4	550.9	38458.0	-1836.7	-18156509.0	28.7066
5	313310.8	157682.2	386401.7	9757815.0	28.7066
6	3109.39	914.88	4323.72	6771.30	14.98
7	18.60	117.89	-48.31	-1627.83	7.43
8	7021.27	2543.47	7451.95	-5072.29	-6.76
9	794864.6	795405.0	-540.4	-10.6	-10.6
10	3.6	-.3	3.9	-11695.1	-11050.3
11	219.1	-.4	219.5	38199.0	168.5
12	-65.804	.031	7678.99	792979.36	.1852
13	-.083	-.000	.00	96235185.00	.0829
14	-.003	-.002	252.000	96235185.00	.0029
15	-65.619	-.000	.9105	-.002	627.9
16	.000	.000	.9103	.031	.6
17	.000	.000	.0160	-.000	.0
18	24.6863	.5215	21.1803	963.86	18.044
19	72.5252	131.8170	75.3371	64.69	-12281.945
20	4.59	7.967	.10	4.178	1232.06
21	.000	540.39	219.54	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1146099.6	152680.70	.89799
25	21325085.0	8205.70	31.9483	1994.463	39.6159
26	2.545	287.0515	2271332.2	-73.7267	30.3037

S-II ENGINES AT 90 PERCENT THRUST

	A	B	C	D	
1	155.4400	1417622.9	876421.7	233486.3	313164.5
2	8879.79	7681.48	21142977.0	20909759.0	.0185
3	231119.4	6442307.4	448177.3	3558657.5	-79.6738
4	559.1	38509.9	-1851.9	-18157240.0	28.7091
5	316400.9	158801.5	389690.9	9755573.0	28.7091
6	3099.42	911.69	4313.60	6764.69	16.49
7	18.79	117.87	-48.47	-1633.56	8.20
8	7028.40	2545.66	7458.99	-5080.99	-7.47
9	875908.5	876419.6	-511.1	61.4	-11.1
10	-1106.3	-1109.9	3.6	54269.3	-11854.2
11	-1289.3	-1519.3	230.0	-5952.1	160.2
12	-65.790	.034	7681.48	791826.95	.1709
13	-.083	.000	.00	96219964.00	.0829
14	-.004	-.002	252.000	96219964.00	.0038
15	-65.619	-.000	1.0159	-.002	628.0
16	.000	.000	1.0158	.034	.6
17	.000	.000	.0158	.000	.0
18	24.6051	.5247	21.1109	961.06	19.891
19	72.5312	131.9017	75.3399	-85.59	10240.000
20	4.32	7.993	.10	4.388	1246.54
21	.000	511.14	230.02	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1148271.5	152528.96	.89781
25	21325534.0	8212.91	31.9493	1994.811	39.6200
26	2.540	286.8796	2275193.3	-73.7148	30.3062

S-II ULLAGE THRUST TERMINATION

	A	B	C	D	
1	156.0400	1416221.4	954985.3	235405.3	317313.1
2	8885.42	7686.12	21144892.0	20909759.0	.0187
3	232975.1	6442853.1	450743.2	3562703.4	-79.6614
4	570.4	38580.6	-1872.7	-18158241.0	28.7125
5	320621.2	160329.9	394182.7	9752508.6	28.7125
6	3086.31	907.49	4300.28	6756.54	18.02
7	19.03	117.83	-48.70	-1641.64	8.96
8	7039.23	2548.99	7469.69	-5093.65	-8.17
9	955993.7	954984.2	1009.4	28.4	-11.7
10	-1138.3	-1141.7	3.4	23859.3	-12890.1
11	-604.0	-849.6	242.3	-1199.1	231.9
12	-65.764	.052	7686.12	791827.22	.1446
13	-.082	.003	.00	96202861.00	.0820
14	-.003	.002	252.000	96202861.00	.0034
15	-65.619	-.000	1.1662	.002	628.2
16	.000	.000	1.1660	.052	.6
17	.000	.000	.0166	.003	.0
18	24.4945	.5288	21.0170	957.28	21.696
19	72.5392	132.0180	75.3433	-19.43	49152.000
20	3.98	8.029	.09	4.637	1266.63
21	.000	-1009.41	242.30	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1151557.0	152300.20	.89754
25	21326210.0	8223.79	31.9509	1995.339	39.6264
26	2.535	286.6834	2281020.8	-73.6968	30.3100
1	160.0001	1406334.1	1142133.5	247907.4	344859.5
2	8936.60	7730.94	21157371.0	20909759.0	.0201
3	245035.6	6446394.8	467481.5	3589295.9	-79.5794
4	649.1	39046.8	-2012.6	-18164974.0	28.7351
5	348657.8	170473.5	424012.8	9732075.3	28.7351
6	3005.89	881.56	4218.26	6712.68	21.65
7	20.69	117.59	-50.21	-1697.99	10.85
8	7122.61	2574.59	7552.33	-5185.62	-9.89
9	1143349.6	1142132.4	1217.2	-67.2	-11.9
10	-1031.5	-1035.5	3.9	-66004.1	-15368.5
11	1372.1	1125.8	246.5	9753.4	303.1
12	-65.593	.022	7730.94	791829.27	-.0262
13	-.063	.003	.00	96080651.00	.0630
14	-.001	.000	252.000	96080651.00	.0014
15	-65.619	-.000	2.1450	.000	629.5
16	.000	.000	2.1447	.022	.6
17	.000	.000	.0341	.003	.0
18	23.7760	.5560	20.4121	932.96	26.130
19	72.5928	132.7889	75.3625	428.09	-2667.995
20	2.29	8.287	.05	4.909	1377.61
21	.000	-1217.20	246.54	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1176895.7	150567.87	.89543
25	21331374.0	8307.14	31.9627	1999.402	39.6748
26	2.511	285.8318	2325839.1	-73.5586	30.3390
1	170.0001	1379408.4	1142785.5	278311.5	415856.9
2	9093.10	7872.68	21187715.0	20909759.0	.0237
3	274130.4	6454898.0	508311.1	3655730.1	-79.3676
4	878.2	40219.5	-2382.8	-18183029.0	28.7931
5	421031.4	196571.4	500921.6	9678758.5	28.7931
6	2813.60	819.21	4021.61	6618.90	22.09
7	25.18	116.95	-53.95	-1844.99	11.07
8	7352.69	2645.16	7780.50	-5431.27	-10.09
9	1144276.0	1142784.7	1491.3	-33.5	-4.6
10	-1150.2	-1150.8	.6	-32283.8	-6090.1
11	662.1	567.9	94.2	5153.8	114.3
12	-65.586	-.001	7872.68	791833.98	-.0334
13	-.065	.000	.00	95726601.00	.0650
14	-.000	.000	252.000	95726601.00	.0002
15	-65.619	-.000	4.1278	.000	633.4
16	.000	.000	4.1277	-.001	.6
17	.000	.000	.0279	.000	.0
18	22.0297	.6202	18.9502	883.99	26.655
19	72.7307	134.7110	75.4096	424.41	-2692.625
20	.52	8.906	.01	2.132	1408.65
21	.000	-1491.28	94.25	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1248391.7	145963.75	.88949
25	21345269.0	8536.78	31.9940	2010.791	39.8033
26	2.463	284.3792	2450218.1	-73.1746	30.4185

	A	B	C	D	
1	180.0001	1352475.0	1142754.9	307107.2	488982.2
2	9261.51	8027.95	21216450.0	20909759.0	.0273
3	301319.4	6462782.1	547119.7	3721195.7	-79.1492
4	1153.7	41385.7	-2778.3	-18202598.0	28.8523
5	495725.3	223380.5	580157.6	9622938.1	28.8523
6	2624.74	757.76	3828.14	6529.47	22.53
7	29.97	116.29	-57.57	-1992.65	11.29
8	7586.69	2716.81	8012.46	-5679.16	-10.30
9	1144334.2	1142754.2	1580.0	-25.9	-1.4
10	-1183.7	-1183.8	.1	-23241.3	-1529.6
11	490.3	463.4	26.9	5066.2	85.8
12	-65.592	-.000	8027.95	791835.62	-.0267
13	-.066	-.000	.00	95336727.00	.0664
14	.000	.000	252.000	95336727.00	-.0001
15	-65.619	-.000	6.0121	.000	637.5
16	.000	.000	6.0121	-.000	.6
17	.000	.000	.0221	-.000	.0
18	20.3740	.6773	17.5643	910.08	27.185
19	72.8719	136.5824	75.4624	424.27	-2693.602
20	.10	8.821	.00	.620	1319.62
21	.000	-1579.97	26.89	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1323824.1	141510.81	.88327
25	21358864.0	8770.85	32.0242	2022.687	39.9279
26	2.413	283.0272	2578113.7	-72.7791	30.4990

S-II SECOND-PLANE SEPARATION

	A	B	C	D	
1	181.5400	1348238.9	1142748.3	311402.3	500434.6
2	9288.47	8053.03	21220735.0	20909759.0	.0279
3	305339.1	6463941.8	552918.1	3731193.1	-79.1150
4	1200.4	41564.7	-2841.6	-18205746.0	28.8615
5	507435.9	227572.6	592568.0	9614118.6	28.8615
6	2595.98	748.38	3798.64	6516.10	22.60
7	30.73	116.19	-58.12	-2015.44	11.32
8	7623.07	2727.95	8048.52	-5717.53	-10.33
9	1144335.0	1142747.6	1587.5	-25.4	-1.1
10	-1186.8	-1186.8	.1	-22774.1	-1247.5
11	478.1	456.9	22.3	4810.6	84.8
12	-65.593	-.000	8053.03	791082.90	-.0262
13	-.067	-.000	.00	95269700.00	.0666
14	.000	.000	252.000	95269700.00	-.0001
15	-65.619	-.000	6.2951	.000	638.2
16	.000	.000	6.2951	-.000	.6
17	.000	.000	.0211	-.000	.0
18	20.1273	.6855	17.3578	919.37	27.270
19	72.8939	136.8657	75.4711	-3.49	327680.010
20	.08	8.759	.00	.511	1308.65
21	.000	-1587.51	22.31	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1335802.9	140838.10	.88229
25	21360932.0	8807.29	32.0287	2024.566	39.9467
26	2.406	282.8294	2598138.2	-72.7171	30.5114

LAUNCH ESCAPE TOWER JETTISON

	A	B	C	D	
1	187.2400	1323064.4	1142769.8	326986.6	543281.6
2	9391.76	8149.64	21236284.0	20909759.0	.0300
3	319835.8	6468109.6	573974.1	3768013.3	-78.9869
4	1383.8	42225.9	-3080.9	-18217715.0	28.8959
5	551276.4	243240.9	638999.6	9580947.5	28.8959
6	2490.74	714.01	3690.62	6468.38	23.03
7	33.64	115.81	-60.12	-2100.22	11.54
8	7759.62	2769.71	8183.84	-5860.78	-10.52
9	1144378.0	1142769.1	1608.9	-31.3	-.6
10	-1124.7	-1124.8	.0	-29424.5	-610.2
11	541.4	529.9	11.6	5212.0	80.9
12	-65.589	-.000	8149.64	709083.88	-.0301
13	-.063	-.000	.00	94265828.00	.0631
14	.000	.000	252.000	94265828.00	-.0001
15	-65.619	-.000	7.3289	.000	644.7
16	.000	.000	7.3288	-.000	.6
17	.000	.000	.0219	-.000	.1
18	19.2348	.7146	16.6108	952.30	27.790
19	72.9763	137.9028	75.5041	-69.75	16384.000
20	.04	8.558	.00	.261	1268.46
21	.000	-1608.93	11.61	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1381350.4	138359.44	.87856
25	21368587.0	8944.10	32.0454	2031.689	40.0159
26	2.378	282.1621	2673629.2	-72.4833	30.5581

	A	B	C	D	
1	190.0001	1306861.4	1142398.4	334357.6	564288.5
2	9443.59	8198.41	21243637.0	20909759.0	.0310
3	326640.7	6470057.4	583940.7	3785739.2	-78.9240
4	1478.7	42545.3	-3200.0	-18223689.0	28.9128
5	572785.7	250913.7	661763.7	9564587.1	28.9128
6	2440.42	697.55	3638.93	6446.19	23.31
7	35.08	115.62	-61.07	-2141.48	11.68
8	7826.69	2790.21	8250.31	-5930.76	-10.65
9	1144014.9	1142397.7	1617.3	-31.8	-.4
10	-1174.6	-1174.7	.0	-28988.5	-443.4
11	535.3	530.8	8.5	4829.0	81.7
12	-65.589	-.000	8198.41	708301.13	-.0300
13	-.065	-.001	.00	87642841.00	.0649
14	.000	.000	252.000	87642841.00	-.0001
15	-65.619	-.000	7.8164	.000	633.6
16	.000	.000	7.8164	-.000	.6
17	.000	.000	.0187	-.001	.1
18	18.8142	.7279	16.2589	976.00	28.125
19	73.0166	138.3982	75.5207	-4.96	229344.740
20	.02	8.400	.00	.190	1249.74
21	.000	-1617.26	8.50	.000	.000
22	.000	.000	.000	.000	.000
23	224.960	104.216	144.000	.000	.000
24	.000	321.953	1404067.1	137167.87	.87671
25	21372285.0	9011.34	32.0534	2035.229	40.0493
26	2.365	281.8718	2710908.5	-72.3677	30.5810

INITIATION OF IGM

	A	B	C	D	
1	192.0000	1301475.5	1142066.0	339628.7	579617.3
2	9481.67	8234.34	21248896.0	20909759.0	.0318
3	331485.0	6471440.6	591069.9	3798542.3	-78.8782
4	1549.9	42776.4	-3287.5	-18228091.0	28.9250
5	588486.8	256508.7	678374.1	9552610.2	28.9250
6	2404.14	685.66	3601.63	6430.33	23.38
7	36.14	115.48	-61.76	-2171.40	11.76
8	7875.47	2805.12	8298.65	-5981.57	-10.69
9	1143686.8	1142064.1	1622.8	79.2	-.3
10	-1181.3	-1181.3	.0	70168.3	-352.1
11	-1683.1	-1690.0	6.9	4563.8	81.8
12	-65.589	-.000	8234.34	708300.72	.0951
13	-.066	-.000	.00	87561382.00	.0661
14	.000	.000	252.000	87561382.00	-.0002
15	-65.494	1.000	8.1654	.000	634.5
16	.000	.001	8.1654	-.000	.6
17	.000	.000	.0167	-.000	.1
18	18.5142	.7372	16.0077	993.64	28.233
19	73.0460	138.7542	75.5329	416.20	-2744.000
20	.02	8.287	.00	.152	1237.18
21	.000	-1622.75	6.88	-.816	28.362
22	4658.663	2514.967	-75.446	-23.499	.167
23	223.960	104.216	144.267	-.103	.001
24	483.094	321.953	1420736.7	136311.46	.87535
25	21374953.0	9060.26	32.0592	2037.821	40.0732
26	2.355	281.6683	2738116.2	-72.2833	30.5977

1	200.0001	1279929.8	1142151.4	360148.9	641841.6
2	9637.11	8381.93	21269365.0	20909759.0	.0348
3	350153.8	6476740.5	618828.5	3849431.9	-78.6918
4	1856.3	43698.0	-3648.3	-18246306.0	28.9745
5	652272.0	279188.4	745796.7	9503672.7	28.9745
6	2265.71	640.11	3459.08	6372.65	22.94
7	40.47	114.92	-64.46	-2288.80	12.90
8	8069.80	2864.49	8491.23	-6182.32	-11.58
9	1143790.6	1142148.7	1641.9	-113.6	-.2
10	-1199.7	-1199.7	.0	-100741.4	-189.3
11	2139.6	2135.4	4.2	4730.9	83.6
12	-63.369	-.166	8381.93	708298.86	-.4011
13	-.065	.000	.00	87235032.00	.0682
14	-.004	.004	252.000	87235032.00	.0045
15	-63.770	-.127	11.7068	.004	638.3
16	.003	.001	11.7068	-.166	.6
17	.000	.000	.0148	.000	.1
18	17.3917	.7727	15.0684	1059.53	28.711
19	73.1644	140.1179	75.5848	424.06	-2693.375
20	.01	7.911	.00	.085	1156.08
21	.000	-1641.87	4.23	-.812	28.129
22	4611.788	2465.467	-74.120	-22.951	.167
23	216.460	104.216	143.656	-.102	.001
24	476.756	321.953	1488348.4	132984.51	.86987
25	21386000.0	9254.99	32.0816	2048.378	40.1668
26	2.321	281.1948	2850060.4	-71.9358	30.6654

PREDICTED S-IC AND S-II STAGE TRAJECTORY

	A	B	C	D	
1	220.0001	1226052.9	1142636.2	407781.1	803820.7
2	10056.77	8784.99	21316864.0	20909759.0	.0426
3	392071.4	6488420.1	683100.9	3974574.4	-78.2058
4	2781.2	45982.1	-4626.7	-18296074.0	29.1019
5	818633.8	337993.5	921245.9	9374147.2	29.1019
6	1924.61	527.30	3106.84	6238.13	25.09
7	52.24	113.47	-70.91	-2587.50	12.17
8	8571.42	3017.48	8988.10	-6695.83	-11.15
9	1144318.3	1142635.3	1682.9	-35.9	-.0
10	-1267.9	-1267.9	.0	-31169.1	-36.1
11	555.0	555.1	.7	3436.7	89.7
12	-66.178	-.152	8784.99	708294.35	-.3106
13	-.059	.012	.00	86345797.00	.1436
14	.000	.000	252.000	86345797.00	-.0001
15	-66.489	-.145	11.9949	.000	648.7
16	.085	.009	11.9948	-.152	.6
17	.000	.000	.0090	.012	.1
18	14.8077	.8439	12.9003	1389.74	29.985
19	73.4712	143.3954	75.7302	424.15	-2693.937
20	.00	6.321	.00	.013	1152.54
21	.000	-1682.91	.66	-.800	27.404
22	4493.472	2329.573	-70.719	-21.234	.152
23	197.710	104.216	142.951	-.100	.001
24	457.315	321.953	1672207.3	124965.28	.85512
25	21412478.0	9759.16	32.1350	2076.696	40.3920
26	2.234	280.2423	3142416.3	-71.0258	30.8374
1	240.0002	1172172.9	1142526.6	450247.3	975510.1
2	10525.08	9239.88	21359192.0	20909759.0	.0507
3	427066.6	6497805.9	739887.0	4096769.4	-77.6891
4	3963.5	48238.4	-5712.9	-18352117.0	29.2344
5	995343.1	399949.8	1107010.7	9233926.1	29.2344
6	1573.22	410.64	2742.96	6104.89	27.31
7	66.47	112.21	-76.01	-2903.19	11.34
8	9104.72	3179.67	9515.90	-7237.66	-10.59
9	1144244.2	1142525.7	1718.5	-37.9	-.0
10	-1253.0	-1253.0	.0	-32253.4	-17.6
11	567.5	567.5	.2	5640.3	95.9
12	-68.792	-.119	9239.88	708289.37	-.2571
13	.064	.003	.00	85312591.00	.1263
14	-.000	-.000	252.000	85312591.00	.0002
15	-69.049	-.118	12.3038	-.000	660.7
16	.190	.003	12.3033	-.119	.7
17	.000	.000	.1134	.003	.1
18	12.4263	.8925	10.8891	1746.77	31.360
19	73.8002	146.5846	75.9028	423.96	-2694.875
20	.00	5.290	.00	.004	1124.11
21	.000	-1718.47	.23	-.790	26.667
22	4350.138	2184.711	-67.112	-19.544	.144
23	177.085	104.216	142.858	-.098	.001
24	436.750	321.953	1883135.7	117229.71	.83849
25	21435894.0	10298.59	32.1832	2108.398	40.5983
26	2.131	278.8486	3449645.4	-70.0657	31.0097
1	260.0002	1118296.8	1142443.9	487638.8	1157620.3
2	11042.08	9746.33	21396440.0	20909759.0	.0593
3	454941.9	6504823.0	788940.7	4216025.3	-77.1395
4	5455.7	50471.4	-6891.8	-18414768.0	29.3720
5	1183039.2	465243.3	1303701.1	9082440.9	29.3720
6	1212.87	290.48	2368.65	5974.19	29.47
7	83.10	111.10	-79.90	-3235.60	10.64
8	9670.21	3351.23	10075.09	-7807.96	-10.08
9	1144192.7	1142443.0	1749.7	-39.3	-.0
10	-1286.7	-1286.7	.0	-32764.5	-13.5
11	564.9	564.8	.1	5432.5	102.0
12	-71.066	-.109	9746.33	708283.95	-.2400
13	.097	.001	.00	84120467.00	.1261
14	-.000	.000	252.000	84120467.00	.0003
15	-71.306	-.109	12.7542	-.000	674.4
16	.223	.001	12.7536	-.109	.7
17	.000	.000	.1237	.001	.1
18	10.2706	.9174	9.0546	2009.28	32.869
19	74.1508	149.6557	76.1023	424.78	-2689.500
20	.00	4.851	.00	.002	1110.55
21	.000	-1749.66	.13	-.782	25.918
22	4194.859	2038.528	-63.629	-17.974	.142
23	156.460	104.216	142.568	-.096	.001
24	416.124	321.953	2125111.1	109790.52	.81977
25	21456528.0	10873.94	32.2269	2144.114	40.7886
26	2.014	277.2589	3774118.9	-69.0477	31.1823

PREDICTED S-IC AND S-II STAGE TRAJECTORY

	A	B	C		D
1	280.0002	1064421.8	1142387.8	520113.9	1350887.0
2	11608.32	10304.47	21428765.0	20909759.0	.0683
3	475526.1	6509403.1	830038.7	4332375.9	-76.5543
4	7301.4	52682.3	-8159.3	-18484344.0	29.5149
5	1382378.0	534064.7	1511943.0	8919110.2	29.5149
6	844.08	166.94	1984.35	5846.92	31.72
7	101.80	109.99	-83.02	-3584.79	9.95
8	10269.34	3532.56	10667.12	-8408.02	-9.54
9	1144163.6	1142386.9	1776.7	-43.2	-.0
10	-1329.8	-1329.8	.0	-35003.7	-13.7
11	576.0	576.0	.1	5444.1	109.5
12	-73.202	-.105	10304.47	708277.62	-.2334
13	.108	.000	.00	82741734.00	.1297
14	-.000	.000	252.000	82741734.00	.0003
15	-73.436	-.105	13.1381	-.000	690.1
16	.237	.001	13.1376	-.105	.7
17	.000	.000	.1102	.000	.1
18	8.3500	.9165	7.4066	2170.03	34.531
19	74.5205	152.5909	76.3272	423.97	-2694.500
20	.00	4.749	.00	.002	1107.30
21	.000	-1776.74	.10	-.775	25.227
22	4042.889	1904.785	-60.419	-16.629	.141
23	137.710	104.216	142.237	-.095	.001
24	397.367	321.953	2403254.3	102642.68	.79870
25	21474603.0	11486.89	32.2673	2184.640	40.9677
26	1.881	275.6983	4118788.2	-67.9621	31.3557
1	300.0002	1010549.7	1142303.3	547877.4	1556094.3
2	12225.07	10915.16	21456372.0	20909759.0	.0778
3	488646.2	6511476.6	862952.2	4445864.0	-75.9310
4	9541.8	54870.9	-9516.5	-18561181.0	29.6630
5	1594055.6	606616.6	1732400.7	8743316.8	29.6630
6	466.33	39.77	1589.36	5723.34	34.09
7	122.60	108.86	-85.45	-3951.84	9.21
8	10904.51	3724.40	11294.35	-9040.03	-8.93
9	1144102.2	1142302.3	1799.9	-44.1	-.0
10	-1363.9	-1363.9	.0	-34901.0	-13.2
11	557.0	556.9	.1	5455.6	116.7
12	-75.267	-.102	10915.16	708270.88	-.2259
13	.113	-.000	.00	81151637.00	.1319
14	-.000	.000	252.000	81151637.00	.0003
15	-75.493	-.101	13.3938	-.000	708.2
16	.245	.000	13.3935	-.102	.8
17	.000	.000	.0915	-.000	.1
18	6.6621	.8898	5.9455	2259.84	36.369
19	74.9103	155.3846	76.5783	424.08	-2693.625
20	.00	4.830	.00	.001	1108.43
21	.000	-1799.88	.08	-.767	24.455
22	3863.056	1756.833	-56.791	-15.229	.140
23	117.085	104.216	141.841	-.093	.001
24	376.743	321.953	2724191.8	95769.59	.77499
25	21490268.0	12140.13	32.3047	2230.998	41.1373
26	1.735	274.3659	4487176.5	-66.7973	31.5295
1	320.0002	956679.9	1142252.7	571174.0	1774089.4
2	12894.27	11579.92	21479506.0	20909759.0	.0879
3	494113.9	6510967.7	887432.5	4556533.8	-75.2666
4	12220.1	57036.5	-10965.2	-18645637.0	29.8164
5	1818821.7	683117.6	1965792.0	8554092.8	29.8164
6	78.65	-91.37	1182.58	5603.54	36.63
7	145.61	107.69	-87.21	-4338.23	8.41
8	11578.74	3927.64	11959.76	-9706.81	-8.24
9	1144071.0	1142251.7	1819.3	-45.0	-.0
10	-1393.1	-1393.2	.0	-34958.2	-12.9
11	539.6	539.6	.1	5473.3	124.2
12	-77.275	-.099	11579.92	708263.23	-.2204
13	.117	.000	.00	79300610.00	.1357
14	-.000	.000	252.000	79300610.00	.0003
15	-77.495	-.099	13.5151	-.000	729.0
16	.253	.000	13.5149	-.099	.8
17	.000	.000	.0718	.000	.1
18	5.1998	.8375	4.6685	2315.36	38.415
19	75.3210	158.0375	76.8565	424.09	-2693.437
20	.00	5.001	.00	.001	1111.37
21	.000	-1819.29	.07	-.758	23.666
22	3668.922	1607.935	-53.028	-13.905	.137
23	96.460	104.216	141.427	-.092	.001
24	356.110	321.953	3096372.8	89150.68	.74826
25	21503660.0	12837.06	32.3393	2284.496	41.2983
26	1.576	273.4845	4883856.5	-65.5381	31.7034

	A	B	C	D	
1	340.0002	902811.9	1142168.3	590291.7	2005796.3
2	13618.64	12301.12	21498457.0	-20909759.0	.0986
3	491719.5	6507792.5	903204.3	4664430.5	-74.5580
4	15382.2	59178.3	-12508.0	-18738106.0	29.9748
5	2057493.9	763806.6	2212900.2	8351608.6	29.9748
6	-320.10	-226.94	762.66	5487.69	39.37
7	171.02	106.49	-88.26	-4745.90	7.55
8	12295.76	4143.38	12667.02	-10411.75	-7.45
9	1144002.5	1142167.2	1835.2	-48.6	-.0
10	-1431.2	-1431.2	.0	-36988.0	-14.3
11	539.6	539.6	.1	5404.3	132.9
12	-79.237	-.097	12301.12	708255.06	-.2166
13	.120	.000	.00	77140815.00	.1396
14	-.000	.000	252.000	77140815.00	.0003
15	-79.454	-.097	13.5035	-.000	752.9
16	.260	.000	13.5034	-.097	.9
17	.000	.000	.0509	.000	.1
18	3.9541	.7604	3.5710	2353.16	40.704
19	75.7548	160.5537	77.1636	424.28	-2692.000
20	.00	5.227	.00	.001	1115.71
21	.000	-1835.22	.07	-.751	22.931
22	3478.881	1471.762	-49.482	-12.765	.134
23	77.710	104.216	141.062	-.090	.001
24	337.362	321.953	3530690.8	82763.18	.71806
25	21514922.0	13581.79	32.3713	2346.845	41.4511
26	1.405	273.3334	5315050.4	-64.1640	31.8767
1	360.0002	848946.8	1142103.3	605570.6	2252228.9
2	14401.73	13082.03	21513561.0	20909759.0	.1099
3	481228.8	6501858.0	909962.5	4769601.6	-73.8016
4	19073.1	61294.1	-14152.6	-18839017.0	30.1382
5	2310971.4	848946.5	2474588.7	8134156.8	30.1382
6	-731.20	-367.39	328.10	5376.05	42.34
7	198.48	105.07	-89.14	-5176.57	6.61
8	13060.07	4372.98	13420.54	-11159.20	-6.56
9	1143950.1	1142102.3	1848.0	-47.9	-.0
10	-1453.2	-1453.2	.0	-35908.0	-14.1
11	498.3	498.4	.1	5641.0	141.5
12	-81.153	-.095	13082.03	708245.20	-.2320
13	.105	.002	.00	74615328.00	.2121
14	-.000	-.000	252.000	74615328.00	.0005
15	-81.385	-.095	13.3704	-.000	780.6
16	.317	.002	13.3704	-.095	.9
17	.000	.000	.0150	.002	.1
18	2.9160	.6565	2.6486	2382.93	43.284
19	76.2109	162.9391	77.4988	424.18	-2692.500
20	.00	5.490	.00	.001	1121.70
21	.000	-1847.96	.06	-.738	22.097
22	3253.480	1320.898	-45.256	-11.581	.124
23	57.085	104.216	140.683	-.089	.001
24	316.735	321.953	4041363.5	76583.43	.68384
25	21524215.0	14379.22	32.4016	2420.307	41.6002
26	1.226	274.2905	5789535.1	-62.6460	32.0488
1	380.0002	795084.2	1142023.0	617409.8	2514509.2
2	15248.40	13927.24	21525221.0	20909759.0	.1221
3	462377.1	6493059.7	907364.1	4872097.4	-72.9936
4	23345.3	63382.5	-15903.2	-18948853.0	30.3065
5	2580253.9	938830.8	2751819.4	7901139.1	30.3065
6	-1156.53	-513.43	-123.24	5268.86	45.63
7	229.30	103.78	-88.74	-5634.05	5.52
8	13877.24	4618.10	14225.84	-11953.83	-5.52
9	1143879.7	1142021.9	1857.8	-51.8	-.0
10	-1500.7	-1500.7	.0	-37839.8	-15.6
11	492.4	492.4	.1	5523.4	153.0
12	-83.043	-.093	13927.24	708234.79	-.2276
13	.132	.001	.00	71631960.00	.2163
14	-.001	.000	252.000	71631960.00	.0006
15	-83.271	-.093	13.1103	-.000	813.0
16	.348	.001	13.1103	-.093	1.0
17	.000	.000	.0197	.001	.1
18	2.0750	.5305	1.8952	2405.75	46.213
19	76.6962	165.2039	77.8687	424.06	-2693.070
20	.00	5.789	.00	.001	1130.25
21	.000	-1857.82	.06	-.727	21.228
22	3008.977	1168.788	-40.980	-10.480	.117
23	36.460	104.216	140.345	-.087	.001
24	296.109	321.953	4647520.5	70585.11	.64495
25	21531713.0	15235.47	32.4287	2507.970	41.7385
26	1.044	276.8644	6319814.5	-60.9429	32.2170

PREDICTED S-IC AND S-II STAGE TRAJECTORY

	A	B	C	D	
1	400.0002	741226.6	1141834.9	626278.2	2793887.9
2	16164.74	14842.62	21533905.0	20909759.0	.1350
3	434861.2	6481279.1	895020.2	4971973.8	-72.1297
4	28267.7	65445.5	-17753.6	-19068169.0	30.4791
5	2866463.7	1033789.2	3045674.6	7651549.3	30.4791
6	-1597.93	-665.75	-593.53	5166.66	49.26
7	263.51	102.52	-87.29	-6121.45	4.32
8	14754.01	4880.75	15089.54	-12801.86	-4.35
9	1143698.9	1141833.7	1865.2	-55.7	-.0
10	-1530.8	-1530.8	.0	-40002.4	-17.1
11	487.0	486.9	.1	5591.3	164.5
12	-84.886	-.091	14842.62	708222.17	-.2235
13	.143	.000	.00	68089033.00	.2202
14	-.001	.000	252.000	68089033.00	.0006
15	-85.109	-.091	12.7549	-.000	850.9
16	.363	.001	12.7549	-.091	1.1
17	.000	.000	.0076	.000	.1
18	1.4232	.3814	1.3068	2421.11	49.563
19	77.2119	167.3570	78.2740	424.47	-2690.000
20	.00	6.130	.00	.001	1140.95
21	.000	-1865.21	.06	-.717	20.396
22	2768.107	1029.203	-36.975	-9.563	.113
23	17.710	104.216	140.091	-.086	.001
24	277.384	321.953	5375173.7	64742.01	.60055
25	21537632.0	16157.74	32.4534	2614.119	41.8687
26	.870	281.8331	6925028.6	-58.9917	32.3778
1	420.0002	687377.3	1141611.4	632735.8	3091768.1
2	17158.61	15835.89	21540172.0	20909759.0	.1489
3	398339.4	6466382.9	872493.5	5069297.7	-71.2049
4	33909.9	67483.4	-19702.0	-19197588.0	30.6559
5	3170873.7	1134196.4	3357384.4	7384242.6	30.6559
6	-2057.53	-825.14	-1085.29	5070.26	53.36
7	301.33	101.27	-84.88	-6642.75	2.96
8	15698.76	5163.45	16019.94	-13710.94	-3.01
9	1143480.6	1141610.1	1870.6	-86.4	-.0
10	-1569.0	-1569.0	-.0	-60805.1	-18.4
11	760.1	760.1	.1	5064.1	177.4
12	-86.696	-.100	15835.89	708208.20	-.2771
13	.149	.001	.00	63844696.00	.2263
14	-.001	-.001	252.000	63844696.00	.0009
15	-86.973	-.141	12.3004	-.001	895.7
16	.375	.002	12.3004	-.100	1.1
17	.000	.000	.0082	.001	.1
18	.9538	.2087	.8803	2429.89	53.435
19	77.7600	169.4079	78.7167	424.08	-2691.998
20	.00	6.517	.00	.001	1150.45
21	.000	-1870.59	.06	-.705	19.382
22	2480.245	872.547	-32.357	-8.595	.107
23	-1.875	102.936	139.855	-.084	.001
24	258.659	320.673	6260906.8	59025.93	.54963
25	21542256.0	17154.93	32.4758	2744.911	41.9924
26	.721	290.4319	7635845.1	-56.6918	32.5240
1	440.0002	635181.0	900852.9	637343.0	3409716.7
2	18210.81	16887.67	21544585.0	20909759.0	.1638
3	352316.8	6448188.1	839183.6	5164040.3	-70.2139
4	40351.4	69497.1	-21746.2	-19337841.0	30.8361
5	3494903.6	1240470.6	3688319.0	7097913.3	30.8361
6	-2556.09	-997.86	-1618.86	4952.59	45.72
7	343.31	100.16	-80.94	-7195.58	-.53
8	16689.58	5459.30	16994.49	-14667.49	.43
9	902725.9	900850.5	1874.4	179.4	-.0
10	-1013.0	-1013.1	.0	118327.5	-18.1
11	-1872.1	-1832.5	.1	71420.3	193.0
12	-90.373	-.226	16887.67	708191.81	-.0531
13	.228	.013	.00	58890031.00	.2099
14	-.002	.003	252.000	58890031.00	.0025
15	-90.427	-.044	9.9334	.002	947.4
16	.438	-.003	9.9333	-.226	1.2
17	.000	.000	.0488	.013	.1
18	.5843	.0031	.5418	2436.13	45.631
19	78.3462	171.4343	79.2036	10.99	-81906.875
20	.00	6.932	.00	.001	1170.47
21	.000	-1874.43	.05	-.696	17.958
22	2172.940	704.264	-27.759	-6.581	.046
23	-1.859	77.564	140.378	-.072	.000
24	258.659	295.301	7326346.3	53550.12	.49249
25	21545578.0	18209.15	32.4950	2904.695	42.1031
26	.558	302.6000	8460398.0	-54.0157	32.6352

PREDICTED S-IC AND S-II STAGE TRAJECTORY

	A	B	C	D	
1	460.0002	593259.1	899627.6	639792.2	3746639.4
2	19137.28	17813.87	21546838.0	20909759.0	.1796
3	295782.2	6426377.8	794050.7	5254675.8	-69.1595
4	47642.5	71490.5	-23873.0	-19488645.0	31.0175
5	3837097.1	1352147.5	4036957.0	6793555.5	31.0175
6	-3096.37	-1183.09	-2191.71	4744.58	48.88
7	386.01	99.08	-75.85	-7703.81	-.85
8	17538.46	5710.94	17825.05	-15513.93	.73
9	901502.7	899626.2	1876.5	117.7	-.0
10	-1066.4	-1066.4	-.0	78246.6	-19.7
11	-1168.1	-1168.5	.1	19519.0	206.1
12	-90.772	-.017	17813.87	708177.05	.1754
13	.148	-.003	.00	54207055.00	.1932
14	-.001	-.000	252.000	54207055.00	.0007
15	-90.597	-.019	10.9093	-.000	996.0
16	.341	-.003	10.9092	-.017	1.3
17	.000	.000	.0576	-.003	.1
18	.2027	-.2530	.1886	2439.44	48.789
19	78.9708	173.4962	79.7421	427.99	-2102.002
20	.00	7.302	.00	.001	1164.52
21	.000	-1876.47	.06	-.696	17.668
22	1919.822	611.506	-24.467	-6.422	.093
23	-1.694	55.610	147.588	-.074	.001
24	258.659	273.347	8391517.8	49138.39	.43942
25	21546987.0	19137.04	32.5085	3067.129	42.1857
26	.241	313.4278	9267577.5	-51.3911	32.6828
1	480.0002	551354.6	899275.1	640650.3	4102171.5
2	20130.50	18806.99	21547500.0	20909759.0	.1963
3	228467.0	6400855.9	736779.2	5340665.1	-68.0423
4	55806.0	73457.5	-26102.9	-19649815.0	31.1983
5	4196849.5	1469028.2	4402644.9	6471620.0	31.1983
6	-3635.82	-1369.57	-2766.94	4556.67	52.55
7	430.80	97.57	-71.06	-8235.96	-1.40
8	18447.17	5980.18	18714.44	-16410.28	1.27
9	901150.9	899273.7	1877.2	116.2	-.0
10	-1105.9	-1105.9	-.0	75846.2	-21.0
11	-1077.9	-1078.1	.1	19670.7	223.3
12	-91.354	-.041	18806.99	708159.50	.1185
13	.104	-.001	.00	48654994.00	.2041
14	-.001	-.000	252.000	48654994.00	.0010
15	-91.235	-.044	11.5360	-.000	1052.8
16	.308	-.001	11.5354	-.041	1.4
17	.000	.000	.1228	-.001	.1
18	.0393	-.5315	.0367	2440.60	52.477
19	79.6245	175.4194	80.3135	432.34	-2080.003
20	.00	7.706	.00	.002	1158.27
21	.000	-1877.18	.08	-.680	17.017
22	1623.943	497.011	-20.164	-6.421	.132
23	.000	31.923	151.992	-.078	.002
24	258.659	251.537	9687808.4	44773.98	.37969
25	21547507.0	20130.48	32.5220	3268.555	42.2732
26	.060	332.5379	10288000.4	-48.0720	32.6580
1	500.0002	509440.1	898538.1	641239.2	4477689.9
2	21197.73	19874.16	21547894.0	20909759.0	.2141
3	150438.6	6371611.0	667332.1	5422448.9	-66.8575
4	64889.7	75390.3	-28460.4	-19821845.0	31.3774
5	4575462.4	1591497.0	4786643.5	6131031.9	31.3774
6	-4168.15	-1555.56	-3338.74	4398.26	56.80
7	478.17	95.69	-66.39	-8794.73	-1.96
8	19426.27	6270.28	19673.43	-17363.86	1.83
9	900414.5	898536.9	1877.7	115.8	-.0
10	-1127.9	-1127.9	-.0	75051.5	-22.2
11	-1006.6	-1006.5	.1	20367.8	240.6
12	-91.837	-.110	19874.16	708139.61	-.0095
13	.075	.002	.00	41992981.00	.2136
14	-.001	.000	252.000	41992981.00	.0013
15	-91.846	-.107	12.0832	-.000	1120.2
16	.289	.002	12.0821	-.110	1.5
17	.000	.000	.1684	.002	.1
18	.1079	-.8249	.1012	2441.40	56.748
19	80.3111	177.1948	80.9214	428.69	-2095.987
20	.00	8.140	.00	.002	1155.36
21	.000	-1877.66	.09	-.640	15.984
22	1305.737	374.024	-15.165	-7.012	.191
23	.000	11.298	156.532	-.082	.002
24	258.659	245.083	11295429.2	40438.09	.31216
25	21547968.0	21197.62	32.5352	3524.188	42.3645
26	.223	371.3743	11776329.9	-43.2430	32.4489

END IGM — BEGIN CHI FREEZE

	A	B	C	D	
1	509.0000	490591.1	897987.0	641777.3	4653601.7
2	21707.34	20383.73	21548345.0	20909759.0	.2224
3	111810.8	6357220.6	632057.7	5457977.7	-66.3009
4	69295.3	76247.8	-29566.8	-19902967.0	31.4571
5	4752386.2	1648547.6	4965799.7	5971346.3	31.4571
6	-4417.17	-1642.75	-3606.89	4326.83	58.87
7	501.03	94.87	-63.84	-9060.03	-3.00
8	19893.07	6408.52	20130.55	-17817.05	2.86
9	899863.8	897985.6	1878.1	129.6	-.0
10	-1143.4	-1143.4	-.0	83553.0	-23.5
11	-1078.7	-1078.7	.1	20395.3	250.6
12	-92.762	-.096	20383.73	708129.12	.0264
13	.088	.001	.00	38538075.00	.2158
14	-.001	.000	252.000	38538075.00	.0013
15	-92.735	-.098	11.5991	-.000	1154.8
16	.304	.002	11.5980	-.096	1.6
17	.000	.000	.1624	.001	.2
18	.1806	-.9660	.1696	2442.12	58.892
19	80.6334	177.9809	81.2092	443.67	-2024.000
20	.00	8.347	.00	.002	1161.14
21	.000	-1878.11	.09	-.620	15.301
22	1183.570	323.815	-13.282	-7.009	.197
23	.000	3.798	156.597	-.081	.002
24	258.659	235.804	12155608.8	38480.61	.27869
25	21548589.0	21707.00	32.5406	3663.641	42.4040
26	.439	397.0519	12655578.7	-40.4049	32.2298
1	520.0001	467569.5	896776.5	642846.4	4874784.6
2	22356.64	21032.96	21549453.0	20909759.0	.2329
3	61517.5	6338552.4	585411.7	5500314.9	-65.5996
4	74966.6	77285.9	-30956.3	-20005406.0	31.5535
5	4974463.9	1720004.8	5190432.9	5770469.4	31.5535
6	-4726.73	-1751.47	-3941.09	4242.79	61.67
7	530.31	93.87	-60.38	-9396.12	-3.29
8	20488.10	6584.70	20713.31	-18392.63	3.14
9	898654.2	896775.2	1879.0	115.5	-.0
10	-1158.4	-1158.4	-.0	73836.6	-24.7
11	-935.5	-935.3	.1	19697.3	262.9
12	-92.899	.001	21032.96	708115.81	.1637
13	.088	-.000	.00	33856009.00	.2162
14	-.001	-.000	252.000	33856009.00	.0009
15	-92.735	-.098	11.9723	.000	1201.2
16	.304	.002	11.9711	.001	1.7
17	.000	.000	.1725	-.000	.2
18	.3146	-1.1443	.2960	2443.57	61.708
19	81.0389	178.9223	81.5735	-15.62	57609.508
20	.00	8.607	.00	.002	1160.45
21	.000	-1879.00	.10	-.620	15.301
22	1183.570	323.815	-13.282	-7.009	.197
23	.000	3.798	156.597	-.081	.002
24	258.659	226.602	13351864.1	36082.14	.23490
25	21550245.0	22355.37	32.5468	3860.686	42.4514
26	.964	441.7423	14057470.6	-35.9155	31.7359

S-II ENGINE CUTOFF — TB 4

	A	B	C	D	
1	520.1180	467324.7	896380.7	642861.2	4877192.1
2	22363.74	21040.06	21549322.0	20909759.0	.2331
3	60960.3	6338346.0	584890.8	5500762.2	-65.5920
4	75029.1	77297.0	-30971.5	-20006524.0	31.5546
5	4976878.9	1720781.0	5192874.3	5768282.5	31.5546
6	-4730.03	-1752.63	-3944.67	4241.94	61.68
7	530.63	93.86	-60.34	-9399.78	-3.29
8	20494.62	6586.63	20719.69	-18398.91	3.14
9	898257.7	896379.4	1878.2	115.3	-.0
10	-1157.9	-1157.9	-.0	73668.3	-24.7
11	-935.6	-934.3	.1	20527.0	263.0
12	-92.899	.001	21040.06	708115.66	.1636
13	.088	-.000	.00	33804268.00	.2163
14	-.001	-.000	252.000	33804268.00	.0009
15	-92.735	-.098	11.9776	-.000	1201.7
16	.304	.002	11.9764	.001	1.7
17	.000	.000	.1726	-.000	.2
18	.3164	-1.1463	.2977	2443.59	61.713
19	81.0433	178.9322	81.5775	-3.42	259286.880
20	.00	8.610	.00	.002	1160.43
21	.000	-1878.19	.10	-.620	15.300
22	1183.473	323.762	-13.280	-7.006	.197
23	.000	3.796	156.590	-.081	.002
24	258.659	226.602	13365616.4	36056.48	.23441
25	21550272.0	22362.46	32.5469	3862.972	42.4519
26	.972	442.3348	14075246.2	-35.8589	31.7285

S-IVB ULLAGE IGNITION

	A	B	C	D	
1	520.8180	466884.7	41245.4	642949.2	4891500.9
2	22377.89	21054.19	21549404.0	20909759.0	.2337
3	57642.6	6337116.8	581787.8	5503414.0	-65.5466
4	75401.1	77362.7	-31061.2	-20013168.0	31.5607
5	4991231.3	1725393.4	5207382.6	5755284.0	31.5607
6	-4749.14	-1759.10	-3964.45	4227.42	2.83
7	531.98	93.80	-60.12	-9409.64	-.15
8	20504.68	6589.37	20728.99	-18411.93	.14
9	41244.9	41245.4	-.0	5.3	-.0
10	-53.3	-53.2	-.0	3725.8	.4
11	-39.0	-42.8	.1	-25030.1	-.0
12	-92.898	.001	21054.19	708111.87	.1630
13	.088	-.000	.00	33717234.00	.2163
14	-.001	.000	252.000	33717234.00	.0009
15	-92.735	-.098	12.0252	.000	1202.6
16	.304	.002	12.0240	.001	1.7
17	.000	.000	.1736	-.000	.2
18	.3111	-1.1607	.2927	2443.71	2.842
19	81.0701	179.0017	81.6023	.01	-6397537.500
20	.00	8.616	.00	.002	1160.12
21	.000	.04	.10	-.572	11.817
22	963.106	201.507	-9.833	-.435	-.155
23	.000	.000	139.728	-.005	-.002
24	258.659	226.602	13393196.2	36005.13	.23344
25	21550327.0	22376.63	32.5470	3867.559	42.4528
26	.961	443.0645	14111013.6	-35.7451	31.7135

S-II/S-IVB SEPARATION SIGNAL

	A	B	C	D	
1	520.9180	466821.8	38573.9	642961.5	4893545.4
2	22378.14	21054.44	21549415.0	20909759.0	.2338
3	57167.5	6336940.8	581343.3	5503791.8	-65.5401
4	75454.3	77372.0	-31074.0	-20014117.0	31.5615
5	4993281.7	1726052.3	5209455.3	5753426.6	31.5615
6	-4751.83	-1760.00	-3967.18	4224.74	2.65
7	532.14	93.79	-60.08	-9410.30	-.14
8	20504.31	6589.21	20728.51	-18412.26	.13
9	38571.0	38573.9	-.0	4.1	-.0
10	-42.3	-42.0	-.0	18077.9	.4
11	134.9	-33.8	.1	-169363.4	-.0
12	-92.898	.001	21054.44	708111.32	.1629
13	.088	-.000	.00	33704801.00	.2163
14	-.001	.000	252.000	33704801.00	.0009
15	-92.735	-.098	12.0330	.000	1202.7
16	.304	.002	12.0318	.001	1.7
17	.000	.000	.1738	-.000	.2
18	.3093	-1.1629	.2910	2443.72	2.659
19	81.0739	179.0123	81.6059	.00	-41943040.000
20	.00	8.616	.00	.002	1160.07
21	.000	.04	.10	-.572	11.817
22	963.106	201.507	-9.833	-.435	-.155
23	.000	.000	139.728	-.005	-.002
24	258.659	226.602	13393716.4	36004.16	.23342
25	21550328.0	22376.90	32.5470	3867.646	42.4528
26	.956	442.9914	14111687.4	-35.7430	31.7132

TABLE AP 3-2 (SHEET 1 OF 10)
PREDICTED S-IVB-503N STAGE TRAJECTORY FIRST BURN
AND PARKING ORBIT

Legend (row labels)

#				
1	TIME	HEIGHT	F SB T	ALTITUDE	RANGE
2	V SB I	V SB E	R SB C	R SUB PF	RANGE ANGLE
3	X SB E	X SB P (M)	X SB S	XI	D* SB 1
4	Y SB E	Y SB P (M)	Y SB S	ETA	A* SB 1
5	Z SB E	Z SB P (M)	Z SB S	ZETA	C* SB 1
6	D-X SB E	D-X SB P (M)	D-X SB S	D-XI	A SB X%
7	D-Y SB E	D-Y SB P (M)	D-Y SB S	D-ETA	A SB Y%
8	D-Z SB E	D-Z SB P (M)	D-Z SB S	D-ZETA	A SB Z%
9	F SB X	F SB TX	F SB AX	4 SF X	H SB AX
10	F SB Y	F SB TY	F SB AY	4 SB Y	H SB AY
11	F SB Z	F SB TZ	F SB AZ	4 SB Z	H SB AZ
12	THETA(M) QRP	DTHETA(M)QRP	F AUX SB X	I SB XX	EPS(THETA)
13	PSI(M) QRP	D-PSI(M)QRP	F AUX SB Y	I SB YY	EPS(PSI)
14	PHI(M) QRP	D-PHI(M)QRP	F AUX SB Z	I SB ZZ	EPS(PHI)
15	CHI SB P	D-CHI SB P	THETA SB C	P SB M	X SB CC
16	CHI SB Y	D-CHI SB Y	PSI SB C	Q SB M	Y SB C'
17	CHI SB R	D-CHI SB R	PHI SB C	Z SB Q	Z SB CC
18	GAMMA SB 1	GAMMA SB 1I	GAMMA(1)P%	DELTA(A)	D-DELTA(4)
19	GAMMA SB 2	GAMMA SB 2I	GAMMA(2)P%	DELTA(B)	D-DELTA(B)
20	I SB SP	AVG I SB SP	HEIGHT FLOW	AVG D-H	AVG F SB L
21	R	MACH NO.	PRESSURE	TEMPERATURE	X SB CP
22	ALPHA*	ALPHA	BETA	CHORD FORCE	V SB R%
23	HU	RHO	RHO PRIME	G(RHO)	G(PSI)
24	T(2)	TAU(2)	PHI(T)	D-N(LOYB3)	DELTA-D-X(V)
25	T(3)	TAU(3)	SMCP	D-N(LH2B3)	DELTA-D-Y(M)
26	DELTA-T(CO)	DELTA-T(3)	SMCY	D-N(LH2PR%	DELTA-D-Z(V)
27	V(T)	CHI(P)-TILDE	K(1)	N(LOX)RES	HDOTSUB%
28	Y(V,T)	CHI(Y)-TILDE	K(3)	N(LH2)RES	HDOTSUBF
29	K(PER)	R(AP)	V(PER)		
30	BETA	ECCENTRICITY	INCLINATION	THETA SUB NG	C SUB 3S
31	TAU	E SUB T	I SUB T	THETA SUB Y	C3 SUB T

Data block (TIME = 524.0000)

#					
1	524.0000	355909.6	442.2	643254.8	4945862.9
2	22336.9160	21013.1800	21549563.0	21549875.0	13.5535
3	43990.7	6332089.8	-135303.2	-.11	15895268.
4	76857.2	77631.2	198555.5	.0	77.3912
5	5049905.9	1744280.1	5740912.5	1.1	-19.7748
6	-4812.5990	-1780.2333	-5840.6523	-.0369	.8174
7	535.2335	93.3546	306.3144	.0010	-.0001
8	20447.6453	6570.7605	21557.6134	.7234	.0003
9	9042.0	442.1	-.2	.555	-.000
10	-1.5	-1.5	-.5	153.168	-.014
11	3.8	3.8	-.0	-4.271	.021
12	-92.8945	.0025	8500.0	151992.0	.6086
13	.0879	-.0001	.0	9616354.0	.2398
14	-.0000	-.0000	.0	9614345.2	.0000
15	-92.2860	.0000	-92.2860	.0000	479.47
16	.3277	.0000	.3277	.0095	-1.40
17	.0000	-.0000	.0000	-.0001	-.90
18	.2925	.2752	.2511	.1740	.0001
19	81.1835	81.7071	81.7063	.4915	-.0022
20	268.5470	.0000	-33.6706	.0000	.0
21	.0002	8.5976	.0000	2485.7502	.00
22	12.2439	12.2427	.1776	-.181	21013.180
23	65.3517	31.7522	31.5854	-30.3200	-.0414
24	.0030	.0000	.0000	.0	.00
25	144.4419	.0000	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	7791.0507	.0000	.00000	.0	-.0000
28	6563465.0	.0000	.00000	-8.7	-3.1706
29					
30				.00000	.0
31		.00000	32.55754	123.19350	-1426555.0

S-II/S-IVB PHYSICAL SEPARATION (TIME = 520.9927)

#					
1	520.9927	356010.0	.7	642900.2	4884562.0
2	27334.9840	21011.2290	21549357.0	21549548.0	13.3855
3	58341.9	6337402.8	-117870.9	.0	15843364.
4	75254.5	77350.0	197732.9	.0	77.4964
5	4988089.2	1724510.0	5676349.9	.0	-19.6926
6	-4731.6709	-1753.3930	-5752.6016	.0000	.7777
7	530.6030	93.6540	307.2658	.0000	.0000
8	20464.7120	6577.3599	21579.2860	.0000	.0008
9	6599.8	.0	-.2	.000	-.000
10	.0	-.0	-.0	-.014	-.014
11	.0	.0	.0	.021	.021
12	-92.8980	.0000	8500.0	151994.1	.6120
13	.0860	.0000	.0	9617034.5	.2397
14	.0000	-.0000	.0	9615028.1	.0000
15	-92.2860	.0000	-92.2860	.0000	479.43
16	.3277	.0000	.3277	.0000	-1.40
17	.0000	-.0000	.0000	.0000	-.50
18	.3502	.3295	.3051	.0000	.0000
19	81.0649	81.5984	81.5975	.0000	.0000
20	281.9672	.0000	-30.5900	.0000	.0
21	.0002	8.5986	.0000	2484.7776	.00
22	12.0044	12.0032	.1724	-.181	21011.259
23	65.5555	31.7262	31.5595	-30.3209	-.0414
24	.0000	.0000	.0000	.0	.00
25	144.4419	.0000	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	7791.0507	.0000	.00000	.0	.0000
28	6563365.0	.0000	.00000	.0	.0000
29					
30				.00000	.0
31		.00000	32.55754	123.19350	-1426555.0

Data block (TIME = 525.0000)

#					
1	525.0000	355874.6	11280.1	643353.5	4966248.3
2	22337.5410	21013.7900	21549778.0	21549969.0	13.6093
3	39164.7	6330305.1	-141158.5	-.1	15912525.
4	77393.2	77724.5	198961.7	.0	77.3557
5	5070055.6	1750849.8	5762465.4	1.9	-19.8021
6	-4839.4374	-1789.1531	-5869.9268	-.0470	1.2056
7	536.7718	93.2679	305.9971	.0012	-.0035
8	20441.8810	6568.5363	21550.3160	.9546	.0087
9	13279.4	11279.6	-.2	14.109	-.000
10	-38.2	-38.2	-.5	3889.802	-.014
11	96.2	96.2	-.5	-109.516	.021
12	-92.8910	.0081	2500.0	151991.3	.6050
13	.0378	-.0002	.0	9616125.7	.2399
14	-.0000	-.0000	.5	9614116.4	.0000
15	-92.2860	.0000	-92.2860	.0000	479.49
16	.3277	.0000	.3277	.0081	-1.40
17	.0000	-.0000	.0000	-.0002	-.90
18	.2733	.2571	.2332	.1941	.0001
19	81.2191	81.7432	81.7425	.4887	-.0030
20	266.8296	.0000	-49.7350	.0000	.0
21	.0002	8.5974	.0000	2486.0346	.00
22	12.3260	12.3248	.1793	-.161	21013.790
23	65.2969	31.7508	31.5940	-30.3197	-.0414
24	.0000	.0000	.0000	.0	.00
25	144.4419	.0000	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	7791.0507	.0000	.00000	.0	-.0000
28	6563365.0	.0000	.00000	-13.2	-19.2550
29					
30				.00000	.0
31		.00000	32.55754	123.19350	-1426555.0

Data block (TIME = 522.0000)

#					
1	522.0000	355976.9	441.9	643026.2	4905094.4
2	22335.6150	21011.9120	21549474.0	21549664.0	13.4417
3	53562.2	6332632.2	-123560.4	-.0	15860751.
4	75789.9	77444.3	198342.3	.0	77.4664
5	5008599.3	1731134.2	5697762.9	.1	-19.7291
6	-4754.7845	-1752.3357	-5782.1058	-.0115	.8172
7	532.1539	93.5572	306.9462	.0003	-.0001
8	20459.0140	6575.1565	21572.0360	.2258	.0063
9	9041.7	441.9	-.2	.557	-.000
10	-1.5	-1.5	-.5	153.697	-.014
11	3.8	3.8	-.0	-4.367	.021
12	-92.8978	.0007	8500.0	151993.4	.6118
13	.0880	-.0000	.0	9616810.3	.2397
14	-.0000	-.0000	.0	9614803.4	.0000
15	-92.2860	.0000	-92.2860	.0000	479.44
16	.3277	.0000	.3277	.0007	-1.40
17	.0000	-.0000	.0000	-.0000	-.90
18	.3309	.3113	.2870	.1935	.0129
19	81.1035	81.6348	81.6339	.4942	.0325
20	254.5454	.0000	-33.6599	.0000	.0
21	.0002	8.5982	.0000	2485.1231	.00
22	12.0337	12.0826	.1743	-.181	21011.913
23	65.4913	31.7350	31.5682	-30.3236	-.0414
24	.0000	.0000	.0000	.0	.00
25	144.4419	.0000	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	7791.0507	.0000	.00000	.0	-.0001
28	6563365.0	.0000	.00000	-2.3	-3.1699
29					
30				.00000	.0
31		.00000	32.55754	123.19350	-1426555.0

Data block (TIME = 526.0000)

#					
1	526.0000	355734.8	129119.4	643455.2	4986634.8
2	22342.7080	21019.1410	21549366.0	21550057.0	13.6652
3	34311.5	6328511.5	-147043.1	-.2	15929782.
4	77930.7	77817.7	199267.5	.0	77.3203
5	5090491.3	1757417.6	5784914.4	3.3	-19.8294
6	-4866.5132	-1798.1568	-5899.4572	-.1253	11.8585
7	538.3935	93.1692	305.6692	-.0011	-.0397
8	20440.9270	6567.7745	21547.8170	2.2875	.0936
9	131114.4	129114.5	-.2	153.837	-.000
10	-439.2	-439.2	-.5	42435.912	-.014
11	1035.1	1034.4	-.0	-1198.438	.021
12	-92.8449	.1279	2500.0	151988.5	.5599
13	.0805	-.0036	.5	9615191.0	.2412
14	-.0000	-.0001	.5	9613178.5	.0000
15	-92.2860	.0000	-92.2860	.0002	479.55
16	.3277	.0000	.3277	.1279	-1.40
17	.0000	-.0000	.0000	-.0035	-.90
18	.2559	.2416	.2178	.1949	.0014
19	81.2575	81.7792	81.7785	.4570	-.0488
20	430.3323	.0000	-3040.6821	.0000	.0
21	.0002	8.5991	.0000	2486.2939	.00
22	12.4479	12.4466	.1822	-.181	21019.141
23	65.2321	31.7693	31.6025	-30.3194	-.0414
24	.0000	.0000	.0000	.0	.00
25	144.4419	.0000	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	7791.0507	.0000	.00000	-86.0	-242.6881
28	6563365.0	.0000	.00000	-64.4	-61.9940
29					
30				.00000	.0
31		.00000	32.55754	123.19350	-1426555.0

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 1    527.0000    355368.2    186591.5     643547.8    5007032.3
 2  22358.0070  21034.2300  21549948.0   21550140.0        13.7211
 3  29431.5     6326708.9   -152957.5          -.4     15947047.
 4  78470.0       77910.9    199573.0          -.0         77.2849
 5  5110935.9   1763986.3   5805565.3          7.7        -19.8570
 6  -4893.6904  -1807.3104  -5929.4990       -.3692        17.0743
 7    540.1980     93.0615    305.3198       -.0100         -.0598
 8  20449.9100   6570.0371  21555.2400       6.8092          .0529
 9   188589.2    186589.4         -.2       117.712         -.000
10     -660.5       -660.6        -.0     32509.644         -.014
11      584.1        581.6        -.0      -933.154          .021
12     -92.5843       .3798     2000.0     151981.0         -.2017
13       .0791       -.0107         .0    9512584.5          .2162
14      -.0000       -.0001         .0    9510663.7          .0000
15     -92.7860     -1.0000      -92.7860       .0005       479.71
16       .2952       -.0649        .2952       .3788        -1.40
17       .0000        .0000        .0000      -.0157         -.90
18       .2463        .2317        .2085       .2028         .0105
19     81.2957      81.8148      81.8141       .1786         -.3702
20    485.6995        .0000    -388.2841       .0000          .0
21       .0302       8.5049        .0000    2486.5541         .00
22     12.7785      12.7771        .1917      -.181      21034.230
23     65.1372      31.7778      31.6110    -30.3192         -.0415
24       .0300       1.3000      -1.6259         .0        960.45
25    155.7533     745.0000       .00000         .0        237.95
26    144.44190      -.0974       .00000         .0         -9.85
27   7791.0507        .2429      -.01589     -385.2      -318.5308
28   6563365.0       -.0100      -.00012     -131.9       -69.7534
29
30                                              .00000         .0
31                    .00000     32.55754   123.19350   -1426555.0
```

```
 1    528.0000    354962.3    191545.0     643636.2    5027445.5
 2  22374.2400  21050.8500  21550029.0   21550220.9        13.7770
 3   2452.4      6324897.3   -158702.0          -.9     15964326.
 4  79011.1       74003.9    199879.2          -.9         77.2495
 5  5131391.1   1770557.8   5927125.2         17.1        -19.8945
 6  -4920.5541  -1815.3863  -5959.2327       -.5627        17.3595
 7    542.0087     97.9537    304.9563       -.0207         -.0527
 8  20460.5120   6572.7949  21564.2870      12.0437         -.2775
 9   191519.4    191519.6         -.2      -315.079         -.000
10     -581.9       -582.1        -.0    -82516.154         -.014
11    -3061.8      -3063.1        -.0     -4015.239          .021
12     -92.2439       .1347         .0     151972.7        -1.3421
13       .0522       -.0262         .0    9609933.9          .1681
14       .0000        .0003         .0    9607903.9          .0000
15     -93.7860     -1.0000      -93.7860       .0002       479.89
16       .2303       -.0649        .2303       .1847        -1.41
17       .0000        .0000        .0000      -.0252         -.90
18       .2373        .2237        .2000       .1742         -.0333
19     81.3339      81.8503      81.8497      -.9153        -1.1513
20    452.2575     468.6252    -423.4745    -405.8791    193106.7
21       .0002       8.6112        .0000    2486.7950         .00
22     13.1871      13.1855        .2097      -.131      21050.850
23     65.1022      31.7863      31.6194    -30.3189         -.0415
24       .0000       1.0000      -1.6258         .0        960.45
25    155.7533     745.0000       .00000         .0        737.95
26    144.44190      -.0974       .00000         .0         -9.85
27   7791.0507        .2429      -.01589     -719.3      -349.7799
28   6563365.0       -.0100      -.00012     -203.6       -73.6947
29
30                                              .00000         .0
31                    .00000     32.55754   123.19350   -1426555.0
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 1    529.0000    354522.5    192489.0     643722.3    5047874.8
 2  22391.4300  21067.6010  21550105.0   21550297.0        14.8330
 3  19599.5     6323076.4   -164876.0         -1.5     15961618.
 4  79554.0       78096.8    200183.0          -.0         77.2142
 5  5151855.8   1777131.9   5848594.0         31.8        -19.9120
 6  -4947.1225  -1825.3727  -5988.7594       -.6576        17.4630
 7    543.8300     92.8453    304.6104       -.0322         -.0494
 8  20471.2990   6575.6100  21573.5230      17.3517         -.4540
 9   192423.2    192423.4         -.2      -549.414         -.000
10     -543.9       -544.3        -.0   -143952.270         -.014
11    -5002.5      -4998.2        -.0     -5349.006          .021
12     -92.4350       -.5618        .0     151963.7        -2.3810
13       .0215       -.0562         .0    9606949.4          .1817
14       .0300        .0001         .0    9604909.9          .0000
15     -94.7860     -1.0000      -94.7860      -.0002       480.08
16       .2033        .0109        .2033      -.5618        -1.41
17       .0000        .0000        .0000      -.0562         -.90
18       .2303        .2167        .1931       .1621         -.0035
19     81.3722      81.8858      81.8852     -1.4879        -.3342
20    428.0707     452.9616    -449.5130    -422.8309    191132.6
21       .0302       8.6177        .0000    2487.0328         .00
22     13.0335      13.0912        .2515      -.181      21067.601
23     65.0372      31.7947      31.6278    -30.3197         -.0415
24       .0000       1.0000      -1.6259         .0        950.77
25    153.7043     743.0221       .00000         .0        233.86
26    155.75334      -.0020       .00000         .0         -9.69
27   7791.0507        .2412      -.00821    -1083.6      -372.8678
28   6563365.0       -.0099      -.00055     -279.2       -76.6452
29
30                                              .00000         .0
31                    .00000     32.55754   123.19350   -1426555.0
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 1    530.0000    354070.6    193512.5     643906.0    5068320.1
 2  22404.2390  21084.4780  21550179.0   21550371.0        13.8891
 3  14633.1     6321246.6   -170879.5         -2.2     15991925.
 4  80098.8       75189.5    200487.4          -.1         77.1790
 5  5172333.0   1783708.9   5870272.1         51.8        -19.9395
 6  -4973.8318  -1834.4040  -6018.3905       -.7936        17.5805
 7    545.6293     92.7254    304.2271       -.0506         -.0702
 8  20482.1500   6578.4419  21582.6140      22.6863         -.3572
 9   193471.3    193471.5         -.2      -402.249         -.000
10     -773.1       -773.6        -.0   -139967.953         -.014
11    -3930.5      -3920.1        -.0      1766.943          .021
12     -93.3725     -1.3341        .0     151954.5        -2.4135
13      -.0429       -.0653         .0    9603889.9          .2571
14       .0000       -.0008         .0    9601840.4          .0000
15     -95.7860     -1.0000      -95.7860       .0010       480.28
16       .2142        .0109        .2142     -1.3341        -1.41
17       .0000        .0000        .0000      -.0653         -.90
18       .2225        .2095        .1960       .2291         .3780
19     81.4104      81.9213      81.9203     -1.1608         .5177
20    425.8472     444.1846    -454.3214    -432.5252    191718.7
21       .0302       8.5242        .0000    2487.2672         .00
22     12.1349      12.1910        .3162      -.181      21084.478
23     64.9722      31.8032      31.6362    -30.3185         -.0415
24       .0000       1.0000      -1.6259         .0        950.77
25    153.7548     743.0221       .00000         .0        233.86
26    155.75334      -.0020       .00000         .0         -9.69
27   7791.0507        .2412      -.00821    -1458.5      -377.0185
28   6563365.0       -.0099      -.00055     -356.1       -77.3028
29
30                                              .00000         .0
31                    .00000     32.55754   123.19350   -1426555.0
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 2  22588.0070  21264.1030  21550590.0   21550886.0        14.4519
 3  -36539.2    6302422.5   -232541.3        -46.7     16172755.
 4  85545.9       79110.6    203509.1         -1.9         75.3285
 5  5377710.3   1949637.7   6060573.8        550.1        -20.2171
 6  -5264.9585  -1932.1073  -6338.9940      -9.6752        18.0395
 7    563.9032     91.4998    300.1961       -.2973         -.0818
 8  20594.2770   6657.5263  21578.2330      77.3087          .1137
 9   202245.5    202240.7         -.2       214.659         -.000
10     -383.0       -887.7        -.0     54750.824         -.014
11     1233.9       1231.6        -.0      4175.295          .022
12    -102.1283       .2576        .0     151356.3          .3049
13       .0275        .0360         .0    9571289.3          .3459
14      -.0000       -.0001         .0    9559133.0          .0000
15    -101.8241      -.6681     -101.8241       .0001       482.38
16       .3735        .0426        .3735       .2576        -1.43
17       .0000        .0000        .0700       .0337         -.92
18       .0937        .0382        .0653       .2515         -.0018
19     81.7944      82.2787      82.2785       .3470         -.4362
20    425.6414     429.2660    -475.1435    -459.8072    197167.9
21       .0000       8.6948        .0000    2488.9132         .00
22      4.1581       4.1606        .2507      -.184      21264.104
23     64.3173      31.8856      31.7184    -30.3169         -.0415
24       .0000       1.0000      -1.6235         .0        897.62
25    145.7313     742.0623      -.00083         .0        220.15
26    148.88530      -.0510       .00172         .0         -4.77
27   7791.0507        .2405      -.00191    -5353.9      -396.4191
28   6563365.0       -.0095      -.00161    -1140.7       -78.7254
29
30                                              .00000         .0
31                    .00000     32.55754   123.19350   -1426555.0
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 1    550.0000    344514.6    202905.5     644508.0    5480886.8
 2  22774.6260  21450.6610  21550704.0   21550900.0        15.0197
 3  -90082.4    6282601.8   -297672.5       -201.1     16347996.
 4  91381.0       80020.4    236494.3         -5.1         76.4818
 5  5584223.3   1915860.0   6303938.8       1602.2        -20.4986
 6  -5564.4237  -2032.4292  -6668.0892     -21.4872        18.8649
 7    583.4274     90.5262    297.0015       -.2775         -.0714
 8  20708.1500   6636.8914  21774.5730     133.1655         -.0702
 9   202902.5    252032.7         -.2       -32.070         -.000
10     -764.3       -764.1        -.0     -8485.446         -.014
11     -751.9       -752.3        -.0        38.756          .023
12    -102.4158       .0908        .0     151759.5         -.1895
13       .3511        .0217         .0    9539121.5          .2907
14       .0000        .0001         .0    9536859.5          .0000
15    -102.0363       .0123     -102.0363       .0005       484.46
16       .6418        .0177        .6418       .0908        -1.45
17       .0000        .0000        .0000       .0217         -.93
18      -.0337       -.0367       -.0581       .2167         -.0048
19     82.1861      82.6430      82.6431      -.2134         -.0869
20    425.6715     427.6703    -474.5507    -466.2452    199265.8
21       .0002       8.7700        .0000    2489.1879         .00
22      4.6078       4.607x       -.0598      -.187      21450.662
23     63.6565      31.9550      31.7975    -30.3166         -.0416
24       .0000       1.0000      -1.6355         .0        842.17
25    133.9618     723.4978      -.00373         .0        204.72
26    135.97394      -.0005       .00481         .0         -8.34
27   7791.0507        .2385       .00935    -9313.0      -325.8591
28   6563365.0       -.0093      -.00293    -1927.7       -78.5916
29
30                                              .00000         .0
31                    .00000     32.55754   123.19350   -1426555.0
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3	-147827.5	6251775.3	-366303.7	-477.6	15524677.
4	9/315.9	80921.6	209450.9	-6.9	76.1387
5	5791875.9	1982375.5	6522065.0	3215.8	-20.7846
6	-5864.8226	-2133.0991	-6996.3762	-33.9235	19.1368
7	603.8548	89.7332	294.4000	-.0641	-.0720
8	20822.3830	6666.1847	21870.6770	189.8849	-.0371
9	202531.7	202632.1	-.2	11.159	-.000
10	-760.2	-750.2	-.0	3185.680	-.015
11	-392.2	-392.3	-.0	-394.094	.023
12	-102.6581	.0153	.0	151662.3	-.1316
13	.4404	.0067	.0	9506858.8	.2750
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15	-102.7897	.0128	-102.7897	.0001	486.54
16	.7554	.0065	.7554	.0133	-1.47
17	.0000	-.0000	.0000	.0057	-.94
18	-.1565	-.1475	-.1679	.2149	.0104
19	82.5835	83.0133	83.0138	-.1109	-.0033
20	425.7715	427.0598	-475.9174	-469.2058	200281.8
21	.0002	8.8502	.0000	2488.1655	.00
22	5.0939	5.0910	-.1745	-.120	21640.969
23	62.9382	32.0411	31.8735	-30.3178	-.0416
24	.0000	1.0000	-1.6260	.0	785.45
25	123.6180	711.3207	-.00490	.0	191.30
26	125.56509	.0019	.0642	.0	-7.54
27	7791.0507	.2389	.01131	-13285.2	-397.0377
28	6563365.0	-.0093	-.00379	-2715.7	-78.8796
29					
30				.00000	.0
31		.00000	32.55754	123.19350	-1426555.0

#					
1	590.0000	325445.3	203424.9	640772.9	6378245.7
2	23555.8850	22231.9690	21546557.0	21546861.0	17.3419
3	-337272.7	6193255.5	-590314.1	-2373.8	1705370>
4	116382.2	83581.1	218176.3	4.8	75.13.5
5	6421711.0	2183675.0	7182499.3	11525.7	-21.6647
6	-6753.9509	-2434.8590	-7986.4174	-72.7738	20.1197
7	.667.6093	87.5636	287.2916	.8600	-.0781
8	21167.5130	6753.8008	22158.1245	365.4370	-.0379
9	203422.8	203423.0	-.2	14.673	-.011
10	-790.2	-790.2	-.0	3861.136	-.017
11	-383.6	-383.4	-.0	-191.932	.026
12	-102.6521	-.0328	.0	151370.3	-.1592
13	.5094	-.0013	.0	9409873.7	.2734
14	.0000	-.0001	.0	9407188.0	.0010
15	-102.8213	.0013	-102.8213	-.0003	492.41
16	.7828	-.0024	.7828	-.0328	-1.54
17	.0000	-.0000	.0305	-.0013	-.77
18	-.3792	-.3768	-.3939	.2226	-.0011
19	83.8047	84.1542	84.1553	-.1030	.0343
20	426.6537	425.6381	-476.7870	-472.9055	201707.4
21	.0002	9.1088	.0000	2478.9418	.00
22	7.1835	7.1820	-.1575	-.207	22231.970
23	60.9401	37.2490	32.0803	-30.3274	-.0418
24	.0000	1.0000	-1.6264	.0	609.91
25	93.0350	678.5125	-.00557	.0	150.79
26	95.03502	-.0000	.00312	.0	-6.31
27	7791.0507	.2424	.01575	-25214.2	-397.1131
28	6563365.0	-.0100	-.00272	-5596.0	-79.6739
29					
30				.00000	0
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1	570.0000	334986.1	203724.0	643346.1	5900760.6
2	23158.7840	21834.7910	21549379.0	21549580.0	16.1704
3	-207975.7	6239941.7	-437938.9	-880.2	16702887.
4	103459.8	81815.3	212382.6	-6.1	75.7992
5	6000570.9	2049183.2	6741250.3	5402.8	-21.0743
6	-6164.9778	-2233.7585	-7328.6285	-46.6413	19.5466
7	624.8000	89.0067	292.0165	.2283	-.0753
8	20937.0580	6695.4485	21966.0850	247.5107	-.0543
9	203721.4	-203721.6	-.2	-11.052	-.000
10	-784.4	-784.3	-.0	-2904.956	-.015
11	-585.3	-585.9	-.0	26.859	.024
12	-102.6319	-.0462	.0	151565.0	-.2456
13	.5215	.0037	.0	9474539.2	.2758
14	.0000	.0001	.0	9472065.6	.0000
15	-102.8775	-.0416	-102.8775	-.0004	488.63
16	.7985	.0034	.7985	-.0452	-1.49
17	.0000	-.0000	.0000	.0037	-.98
18	-.2560	-.2414	-.2507	.2205	-.0004
19	82.9861	83.3889	83.3896	-.1646	.0098
20	425.9065	426.7775	-478.3247	-470.9822	200928.4
21	.0002	8.9334	.0000	2486.0008	.00
22	5.8322	5.8288	-.2005	-.195	21834.792
23	62.3128	32.1139	31.9460	-30.3200	-.0417
24	.0000	1.0000	-1.6264	.0	727.86
25	113.2115	699.5714	-.00539	.0	177.65
26	115.4249J	-.0075	.00731	.0	-7.12
27	7791.0507	.2394	.01390	-17263.0	-399.0492
28	6563365.0	-.0095	-.00333	-3506.3	-79.2855
29					
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31		.00000	32.55754	123.19350	-1426555.0

#					
1	600.0000	320679.8	203365.7	639125.5	6544927.3
2	23758.7420	22434.8900	21544947.0	21545148.0	17.9347
3	-406405.1	6168405.7	-672344.5	-2868.0	17246489.
4	123166.5	84453.0	221035.7	14.9	74.8011
5	6533903.5	2251358.3	7404553.8	15480.7	-21.9650
6	-7062.1858	-2535.1152	-8317.3462	-86.0252	20.4047
7	689.2921	86.7944	284.7570	1.1457	-.0814
8	21283.2320	6782.8742	22253.5070	425.7285	-.0488
9	203364.3	203364.5	-.2	2.211	-.000
10	-801.4	-801.5	-.0	585.750	-.017
11	-485.4	-486.6	-.0	-35.340	.028
12	-102.3931	.0147	.0	151273.1	-.1521
13	.4719	-.0036	.0	9377574.1	.2751
14	.0000	-.0000	.0	9374782.6	.0030
15	-102.5453	.0167	-102.5453	.0001	494.89
16	.7470	-.0034	.7470	.0147	-1.56
17	.0000	-.0000	.0000	-.0035	-.98
18	-.4418	-.4172	-.4432	.2258	.0001
19	84.2205	84.5435	84.5448	-.1371	.0073
20	426.9511	426.6605	-476.3181	-473.4064	201938.6
21	.0002	9.2003	.0000	2474.4254	.10
22	8.1222	8.1216	-.1048	-.213	22434.840
23	60.2428	32.3111	32.1427	-30.3321	-.0419
24	.0000	4.0000	-1.6263	.0	549.67
25	83.2525	570.1991	-.00489	.0	137.44
26	85.24567	.0005	.00830	.0	-5.57
27	7791.0507	.2447	.01345	-29182.4	-396.5141
28	6563365.0	-.0104	-.00217	-5893.3	-79.8030
29					
30				.00000	0
31		.00000	32.55754	123.19350	-1426555.0

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1	580.0000	330218.8	203196.6	642203.1	6113534.3
2	23355.7950	22031.7410	21548159.0	21548361.0	16.7535
3	-271127.6	6217101.2	-512577.4	-1411.8	16882497.
4	109814.0	82701.8	215291.5	-2.2	75.4632
5	6210615.2	2115283.3	6961395.1	8169.5	-21.3678
6	-6454.9598	-2334.4254	-7558.9057	-59.6697	19.7977
7	646.0935	88.2964	289.6859	.5492	-.0768
8	21051.9480	6724.6012	22062.3280	305.9754	-.0519
9	203194.2	203194.4	-.2	-4.408	-.000
10	-788.0	-788.0	-.0	-1127.934	-.016
11	-532.8	-532.9	-.0	-13.796	.025
12	-102.5707	.0058	.0	151467.7	-.1706
13	.5233	-.0010	.0	9442227.3	.2735
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16	.7768	-.0011	.7968	.0058	-1.52
17	.0000	-.0000	.0000	-.0010	-.95
18	-.3377	-.3185	-.3368	.7222	-.0003
19	83.3932	83.7693	83.7702	-.1503	.0051
20	426.3903	425.6674	-476.5455	-472.0583	201353.8
21	.0002	9.0196	.0000	2482.8652	.00
22	6.5717	6.5691	-.1867	-.201	22031.742
23	61.6301	32.1832	32.0152	-30.3233	-.0418
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25	103.3514	570.6076	-.00519	.0	164.73
26	105.34230	.0006	.00781	.0	-6.73
27	7791.0507	.2413	.01349	-21236.9	-397.0641
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29					
30				.00000	.0
31		.00000	32.55754	123.19350	-1426555.0

#					
1	610.0000	315918.8	203307.3	637339.4	6763606.1
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3	-478511.9	6142555.7	-757716.0	-3794.3	17430886.
4	130168.9	85316.8	223570.7	27.5	74.4748
5	6847375.3	2319332.1	7627564.9	20093.4	-22.2654
6	-7358.9349	-2634.9842	-4545.0064	-99.2256	20.7051
7	711.9989	85.9734	242.0542	1.3939	-.0824
8	21399.3240	6811.9241	22348.8110	486.9580	-.0513
9	203304.8	703305.1	-.2	.435	-.020
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11	-503.5	-503.7	-.0	-8.278	.049
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13	.4343	-.0039	.0	9345308.5	.2773
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16	.7115	-.0036	.7115	.0152	-1.58
17	.0000	-.0000	.0000	-.0039	-.99
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19	84.6403	84.9371	84.9384	-.1419	.0015
20	427.2134	425.7115	-475.8364	-473.7308	202106.3
21	.0002	9.2938	.0000	2469.5230	.J0
22	6.9354	6.9362	-.0524	-.220	22640.455
23	59.5381	32.3695	32.2209	-30.3372	-.0419
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25	73.2871	563.4048	-.00481	.0	122.95
26	75.27759	.0001	.00344	.0	-5.37
27	7791.0507	.2465	.01265	-33144.3	-395.9791
28	6563365.0	-.0107	-.00167	-6691.9	-79.9073
29					
30				.00000	.0
31		.00000	32.55754	123.19350	-1426555.0

Left block — 620.0000 / Right block — 650.0000

#						#					
1	620.0000	311162.1	203249.2	535490.0	5984310.7	1	650.0000	296883.6	203388.3	630374.5	7659851.1
2	24172.3630	22848.6610	21541181.0	21541390.0	19.1399	2	24812.9490	23489.4550	21535912.0	21536127.0	20.9885
3	-553579.5	6115708.6	-845240.9	-4852.6	17516927.	3	-796421.5	6029217.4	-1129913.8	-8824.3	18185290.
4	137388.7	36172.2	226577.3	42.6	74.1517	4	160372.1	88682.3	234912.5	97.2	73.2000
5	706195.4	2387596.3	7851523.7	25223.0	-22.5746	5	7712725.0	2594137.0	8529154.5	44567.0	-23.5086
6	-76544.393	-2734.5280	-8971.5987	-112.4593	21.0155	6	-8532.5040	-3031.0261	-9944.3761	-152.2219	22.0414
7	732.9975	35.0993	279.1963	1.6091	-.0843	7	799.4268	32.1580	269.5461	1.9717	-.0891
8	21515.9920	6840.9558	22444.0570	549.1358	-.0525	8	21870.3400	6928.5592	22731.4599	742.0194	-.0572
9	203245.7	203249.9	-.5	.157	-.000	9	203385.7	203385.9	-.3	-.566	-.000
10	-315.2	-815.2	-.0	41.748	-.019	10	-822.4	-822.5	-.0	-142.403	-.022
11	-503.3	-503.4	-.0	3.150	.030	11	-527.5	-527.6	-.5	8.735	.035
12	-102.0507	.0189	.0	151078.8	-.1549	12	-101.4298	.0128	.0	150787.4	-.1673
13	.3352	-.0039	.0	9312727.6	.2775	13	.2819	-.0031	.0	9180954.4	.2828
14	.0000	-.0000	.0	9309732.5	.0000	14	.0000	.0000	.0	9178470.2	.0000
15	-102.2156	.0187	-102.2156	.0001	499.39	15	-101.5971	.0135	-101.5971	.0000	508.31
16	.6747	-.0037	.6747	.0189	-1.59	16	.5547	-.0030	.5647	.0128	-1.65
17	.0000	-.0000	.0000	-.0039	-1.30	17	.0000	-.0000	.0000	-.0031	-1.35
18	-.4651	-.396	-.4533	.2298	.0002	18	-.3474	-.3288	-.3390	.2317	.0001
19	85.0541	85.3351	85.3364	-.1433	-.0003	19	86.3500	86.5544	86.5254	-.1495	.0012
20	427.4562	425.7791	-475.4778	-473.9398	202232.4	20	427.7299	426.9801	-475.5008	-474.4312	202546.4
21	.0002	9.3890	.0000	2464.4495	.00	21	.0002	9.6799	.0000	2450.4168	.00
22	9.7500	9.7499	.0012	-.228	22348.651	22	12.2153	12.2144	.1559	-.251	23489.455
23	58.8259	32.4239	32.2551	-30.3425	-.0420	23	56.6441	32.5625	32.3933	-30.3570	-.0421
24	.0000	1.0000	-1.6263	.0	426.99	24	.0000	1.0000	-1.6263	.0	235.93
25	63.3044	650.6190	-.00473	.0	108.23	25	33.2794	520.4654	-.00454	.0	61.15
26	65.29900	.0001	.00855	.0	-4.92	26	35.27841	.0000	.00875	.0	-2.83
27	7791.0507	.2483	.01149	-37102.1	-395.5008	27	7791.0507	.2536	.00627	-48978.0	-395.3701
28	6563365.0	-.0109	-.00115	-7491.4	-79.9770	28	6563365.0	-.0116	.00057	-9894.1	-80.1807
29						29	3154.3474	3545.3667	27880.0720	24805.4870	81.05164
30				.00000	.0	30	-174.51875	.05836	32.55511	.00000	.0
31		.00000	32.55754	123.19350	-1426555.0	31	-2348.4851	.00000	32.55754	123.19350	-1426555.0

CHI TILDE ($\tilde{\chi}$) INITIATION

Left block — 630.0000 / Right block — 650.5000

#						#					
1	630.0000	306398.3	204076.4	633557.3	7207067.5	1	650.5000	295645.8	203385.1	630303.9	7670254.0
2	24383.4730	23059.3460	21539293.0	21539504.0	19.7954	2	24823.8060	23500.3140	21535840.0	21536054.0	21.0197
3	-631595.2	6087867.9	-936585.1	-6043.3	17804649.	3	-800591.3	6027700.8	-1133990.0	-8900.5	18194897.
4	144828.7	37018.6	229454.2	59.5	73.8316	4	160772.1	88723.4	235047.3	98.2	73.1843
5	727595.0	2456151.2	8576446.1	31029.7	-22.8835	5	7723662.5	2597601.6	8540521.3	44936.8	-23.5243
6	-7948.5875	-2833.7463	-9297.1229	-125.7099	21.4292	6	-8547.0048	-3035.7319	-9960.4717	-152.8790	22.0589
7	755.0029	34.1722	276.1547	1.7654	-.0861	7	800.5429	82.1048	269.3715	1.9746	-.0892
8	21633.4550	6870.1287	22539.7560	612.4224	-.0527	8	21870.3330	6930.0248	22736.7580	745.314+	-.0569
9	204073.9	204074.2	-.2	1.940	-.000	9	203383.5	203383.7	-.3	-.176	-.000
10	-319.9	-819.9	-.0	488.524	-.020	10	-822.5	-822.5	-.0	-50.533	-.022
11	-501.6	-501.3	-.0	-25.519	.032	11	-525.0	-525.1	-.5	8.053	.035
12	-102.0332	-.0330	.0	150981.6	-.2015	12	-101.4235	.0125	.0	150782.6	-.1669
13	.3620	-.0020	.0	9266755.9	.2818	13	.2803	-.0031	.0	9178770.5	.2828
14	.0000	-.0000	.0	9265938.3	.0000	14	.0000	.0000	.0	9176284.5	.0000
15	-102.2048	-.0159	-102.2048	-.0002	502.16	15	-101.5904	.2359	-101.5904	.0001	508.46
16	.6439	-.0026	.6439	-.0330	-1.62	16	.5532	.0234	.5632	.0125	-1.65
17	.0000	-.0000	.0000	-.0020	-1.02	17	.0000	.0000	.0000	-.0031	-1.35
18	-.4462	-.4219	-.4345	.2332	-.0007	18	-.3433	-.3235	-.3356	.2317	.0000
19	85.4920	85.7372	85.7385	-.1437	.0198	19	86.3819	36.5751	86.5760	-.1479	.0014
20	427.4591	426.8462	-477.4009	-474.1772	202359.1	20	427.7305	426.9831	-475.4955	-474.4355	202549.7
21	.0002	9.4854	.0000	2459.4223	.00	21	.0002	9.6847	.0000	2450.2231	.00
22	10.4333	10.4332	.0482	-.235	23059.847	22	12.2311	12.2501	.1581	-.252	23500.314
23	58.1062	32.4743	32.3054	-30.3477	-.0420	23	56.6072	32.5645	32.3753	-30.3572	-.0421
24	.0000	1.0000	-1.6265	.0	364.17	24	.0000	1.0000	-1.6263	.0	222.92
25	53.0931	638.2954	-.00518	.0	92.86	25	31.7810	518.4670	-.00417	.0	57.84
26	55.15325	-.0014	.00865	.0	-4.21	26	33.27938	.0000	.00381	.0	-2.67
27	7791.0507	.2497	.01298	-41045.3	-397.2446	27	7791.0507	.2539	.00000	-49175.5	-395.3085
28	6563365.0	-.0112	-.00075	-8091.3	-80.1564	28	6563365.0	-.0116	.00003	-9934.2	-80.1855
29	2957.0524	3545.9445	29230.0030	24375.7180	77.55770	29	3159.5863	3545.3495	27846.2710	24816.3840	81.14569
30	-175.53075	.09056	32.55504	.00000	.0	30	-174.49151	.05753	32.55614	.00000	.0
31	-2257.8402	.00000	32.55754	123.19350	-1426555.0	31	-2350.9305	.00000	32.55754	123.19350	-1426555.0

Left block — 640.0000 / Right block — 560.0000

#						#					
1	640.0000	301639.2	203932.1	631922.6	7431905.3	1	560.0000	292129.2	203364.5	629105.1	7887917.1
2	24597.0050	23274.5400	21537720.0	21537720.0	20.3665	2	25031.0380	23707.5880	21534602.2	21534820.0	21.6162
3	-712549.2	6059035.7	-1031182.0	-7367.7	17994592.	3	-883190.8	5998419.1	-1230061.7	-10411.7	18378282.
4	152469.7	37855.5	232199.9	77.9	73.5344	4	168479.1	89498.6	237590.8	117.3	72.8884
5	7494615.5	2524998.0	8302321.3	37474.3	-23.1949	5	7932025.1	2663559.2	9756949.8	52318.5	-23.8243
6	-8241.7317	-2932.7135	-9621.8234	-139.0973	21.6986	6	-8820.9465	-3128.6997	-102644.8325	-165.1157	22.3954
7	777.1905	33.1962	272.9523	1.8937	-.0678	7	821.9325	81.1160	266.1274	2.0575	-.0935
8	21751.4940	6899.2916	22635.4410	676.6799	-.0659	8	21990.1140	6957.9705	22827.9490	808.4853	-.0330
9	203429.2	203429.5	-.2	-13.173	-.000	9	203342.3	203342.5	-.3	33.885	-.000
10	-823.5	-873.5	-.5	-3325.094	-.021	10	-848.8	-848.8	-.0	7822.135	-.023
11	-517.5	-617.8	-.0	109.747	.033	11	-297.4	-299.5	-.0	845.600	.036
12	-191.6031	.0387	.0	150834.5	-.1408	12	-101.1525	.0093	.0	150690.4	-.1300
13	.3163	-.0042	.0	9224849.5	.2314	13	.2995	-.0004	.0	9137090.5	.2918
14	-.0000	.0001	.0	9222188.4	.0000	14	.0000	-.0001	.0	9134763.3	.0000
15	-101.7539	.0336	-101.7539	.0002	505.24	15	-101.2925	.0931	-101.2925	.0000	511.38
16	.5978	-.0041	.5778	.0387	-1.63	16	.5913	-.0005	.5913	.0093	-1.57
17	.0000	-.0000	.0000	-.0042	-1.03	17	.0000	-.0000	.0000	-.0004	-1.27
18	-.4083	-.3860	-.3774	.2319	-.0001	18	-.2545	-.2507	-.2595	.2392	-.0030
19	85.9241	86.1437	86.1449	-.1740	.0014	19	86.8303	86.7697	86.9704	-.0844	-.0357
20	427.6365	426.9147	-475.6509	-474.3310	202470.1	20	427.7424	427.0368	-475.5072	-474.5072	202637.8
21	.0002	9.5826	.0000	2454.5637	.00	21	.0002	9.7767	.0000	2446.9376	.00
22	11.4460	11.4455	.1050	-.244	23273.540	22	13.0515	13.0508	.1519	-.259	23707.589
23	57.3789	32.5206	32.3515	-30.3525	-.0421	23	55.7918	32.6001	32.4309	-30.3606	-.0421
24	.0000	1.0000	-1.6263	.0	300.45	24	.0000	1.0000	-1.6262	.0	163.92
25	43.2587	630.2407	-.00429	.0	77.44	25	22.7999	609.7053	-.00463	.0	42.46
26	45.23551	.0004	.00869	.0	-3.55	26	24.29377	.0001	.00891	.0	-2.00
27	7791.0507	.2523	.00791	-45023.5	-395.5698	27	7791.0507	.2534	.00000	-52930.0	-395.0874
28	5563365.0	-.0115	-.00092	-7992.7	-80.0711	28	6563365.0	-.0118	.00000	-10696.5	-80.2980
29	3053.2259	3545.6847	28555.1570	24589.1510	79.22858	29	3260.9854	3544.9854	272044.4540	25024.8600	82.98633
30	-175.06433	.07463	32.55558	.00000	.0	30	-174.02446	.04173	32.55558	.00000	.0
31	-2301.3370	.00000	32.55754	123.19350	-1426555.0	31	-2399.8357	.00000	32.55754	123.19350	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY FIRST BURN
AND PARKING ORBIT

#						#					
1	670.0000	287376.1	203290.9	628210.9	8119125.5	1	690.0000	280592.5	140.0	627761.6	8587662.2
2	25251.6460	23928.2240	2153350.0	21533889.0	22.2499	2	25566.6870	24243.2550	21533164.0	21533394.0	23.5339
3	-972838.1	5986645.2	-1334308.9	-12127.7	18573109.	3	-1160578.9	59002044.4	-1552304.6	-15938.4	18968029.
4	176812.0	90304.5	240234.7	138.3	72.5795	4	194152.4	91803.2	245414.4	161.8	71.9700
5	8152524.3	2733295.9	8985711.7	60740.7	-24.1419	5	8596762.7	287353.5	9445742.0	79519.6	-74.7818
6	-7108.4505	-3226.1368	-10564.5791	-178.2251	22.7597	6	-9660.4755	-3412.4733	-11195.6636	-197.3584	.0160
7	844.6714	30.0546	262.6452	2.1354	-.0922	7	886.9070	77.8006	255.7497	2.1949	.0000
8	22110.6890	6987.4708	22924.7320	876.0253	-.0513	8	22217.6510	7005.3974	22983.5380	973.8472	.0000
9	203288.2	203288.5	-.3	-2.430	-.000	9	139.7	140.0	-.3	.138	-.000
10	-823.5	-823.5	-.0	-535.947	-.024	10	.0	.0	-.0	30.103	-.025
11	-547.2	-547.2	-.0	-85.075	.037	11	.0	.0	-.0	5.634	.039
12	-101.1740	-.0010	.0	155593.4	-.1942	12	-101.2347	.0000	.0000	150448.2	.0000
13	.2949	-.0023	.0	9093228.2	.2840	13	.2555	.0000	.0	9042170.0	.0000
14	.0000	.0000	.0	9091057.8	.0000	14	.0000	-.0000	.0	9040170.0	.0000
15	-101.3682	-.0086	-101.3682	-.0000	514.45	15	-101.2347	.0000	-101.2347	.0000	518.12
16	.5649	-.0036	.5689	-.0010	-1.68	16	.2555	.0000	.2555	.0000	-1.70
17	.0030	-.0000	.0000	-.0023	-1.08	17	.0000	.0000	.0000	.0000	-1.10
18	-.1633	-.1547	-.1624	.2321	-.0007	18	.0090	.0086	.0034	.0000	.0000
19	87.2448	87.3893	87.3898	-.1542	-.0050	19	88.1485	88.2445	88.2445	.0000	.0000
20	427.7529	427.0864	-475.2475	-474.5639	202657.3	20	190.4762	417.9340	-.7350	-457.9537	195352.9
21	.0002	9.8726	.0000	2444.4818	.00	21	.0003	10.0051	.0000	2443.2493	.00
22	13.6170	13.6159	.1795	-.256	23928.224	22	14.7370	14.7353	.2367	-.274	24243.256
23	55.1518	32.6331	32.4637	-30.3632	-.0422	23	53.6305	32.6849	32.5153	-30.3645	-.0422
24	.0000	1.0000	-1.6262	.0	94.02	24	.0000	1.0000	-1.6262	0	63.68
25	12.3208	599.5729	-.00528	.0	24.26	25	7.6246	595.0415	-.00549	.0	16.39
26	13.81872	.0000	.00892	.0	-1.20	26	.00001	.0000	.00891	.0	-.84
27	7791.0637	.2525	.00000	-56880.0	-394.9321	27	7791.0607	.2519	.00000	-62345.0	.0000
28	6563365.0	-.0123	.00000	-11499./	-80.3154	28	6563366.0	-.9127	.00000	-12610.7	.0000
29	3373.5387	3544.5587	26527.4290	25247.5150	85.04593	29	3543.5925	3543.9101	25568.9770	25566.6840	88.18284
30	-173.56902	.02472	32.55699	.00000	.7	30	179.99999	.00000	32.55747	123.1917+	-60737450.0
31	-2455.6415	.00000	32.55754	123.19350	-1426555.0	31	2645.4453	.00000	32.55754	123.19350	-1426555.0

PARKING ORBIT INSERTION

#						#					
1	680.0000	282623.4	203300.0	627769.1	8352495.4	1	693.8374	280589.7	140.0	627776.1	8677975.5
2	25474.8580	24151.4530	21533197.0	21533421.0	22.8894	2	25566.7360	24243.2980	21533170.0	21533400.0	23.7814
3	-1065357.2	5933899.0	-1441751.2	-13976.8	18769802.	3	-1197933.8	5887048.6	-1595468.2	-16695.8	19044113.
4	185372.7	91099.5	242843.0	159.9	72.2732	4	191563.2	92180.9	246391.1	190.2	71.8550
5	8374238.4	2803317.6	9215541.1	69842.7	-24.4612	5	8681938./	2700355.8	9533839.7	83256.7	-24.9049
6	-9395.2992	-3323.4821	-10903.8922	-191.6480	23.1453	6	-9756.4502	-3444.3671	-11300.5039	-197.3720	.9160
7	867.5495	78.9436	259.0001	2.1749	-.0941	7	893.3319	77.3520	253.7780	2.1950	.0000
8	22232.1520	7017.0333	23021.8520	944.6703	-.0614	8	22175.6430	6989.7926	22932.3400	973.8665	.0000
9	203297.3	203297.6	-.3	-.637	-.000	9	139.7	140.0	-.3	.138	-.000
10	-627.0	-627.0	-.7	-133.844	-.025	10	.0	.0	-.0	30.103	-.025
11	-539.5	-539.6	-.7	-30.976	.038	11	.0	.0	-.0	5.634	.039
12	-101.2360	.0025	.0	150495.9	-.1855	12	-101.2347	.0000	.0000	150443.1	.0000
13	.7541	.0014	.0	9050293.6	.2895	13	.2555	.0000	.0	9042158.7	.0000
14	.0000	.0000	.0	9048293.6	.0000	14	.0000	-.0000	.0	9040158.8	.0000
15	-101.4215	.0000	-101.4215	.0000	517.46	15	-101.2347	.0000	-101.2347	.0000	518.12
16	.5435	.0000	.5436	.0025	-1.70	16	.2555	.0000	.2555	.0000	-1.70
17	.0000	-.0000	.0000	.0014	-1.10	17	.0000	.0000	.0000	.0000	-1.10
18	-.0440	-.0417	-.0482	.2331	-.0012	18	.0085	.0080	.0033	.0000	.0000
19	87.6733	37.8132	87.6133	-.1521	-.0018	19	88.3245	88.4112	88.4112	.0000	.0000
20	427.7248	427.1290	-475.3000	-474.6136	202699.1	20	190.4762	412.7023	-.7350	-447.4373	190862.9
21	.0003	9.9672	.0000	2443.2597	.00	21	.0003	10.0051	.0000	2443.2890	.00
22	14.1099	14.1083	.2230	-.272	24151.453	22	14.9983	14.9965	.2434	-.274	24243.298
23	54.3943	32.6614	32.4919	-30.3644	-.0422	23	53.3371	32.5925	32.5229	-30.3645	-.0422
24	.0000	1.0000	-1.6262	63.68	63.68	24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	-.00549	.0	16.39	25	7.6245	595.0415	-.00549	.0	16.39
26	3.83208	.0000	.00891	.0	-.84	26	.00001	.0000	.00891	.0	-.84
27	7791.0507	.2519	.00000	-60829.7	-395.0000	27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.9127	.00000	-12302.7	-83.3000	28	6563365.0	-.9127	.00000	-12610.9	.0000
29	3472.6771	3544.0868	25846.5420	25473.6280	87.24348	29	3543.6382	3543.9109	25568.9200	25566.7310	88.18338
30	-173.42914	.00731	32.55735	.00000	.0	30	179.99999	.00000	32.55745	123.19126	-60737188.0
31	-2520.3595	.00000	32.55754	123.19350	-1426555.0	31	2645.5010	.00000	32.55754	123.19350	-1426555.0

FIRST S-IVB GUIDANCE CUTOFF COMMAND

#						#					
1	683.8374	280799.6	203300.0	627737.6	8447624.9	1	700.0000	280585.2	140.0	627796.5	8823013.6
2	25561.2150	24237.7950	21533155.0	21533383.0	23.1364	2	25566.8140	24243.3670	21533170.0	21533410.0	24.1789
3	-1101621.0	5921075.5	-1483928.1	-14722.2	188.5784.	3	-1258533.1	5865655.2	-1665925.5	-17912.1	19156234.
4	188713./	91401.6	243334.2	168.3	72.1564	4	203105.1	92655.4	247947.7	203.7	71.6719
5	8459633.7	2830265.9	9303554.0	73518.8	-24.5841	5	8818385.3	2943353.1	9674906.7	89258.3	-25.1025
6	-9505.1181	-3350.7749	-11025.2464	-196.8579	23.2597	6	-9910.1361	-3495.4369	-11468.0591	-197.3779	.9160
7	876.3853	78.5100	257.5774	2.1857	.0000	7	903.6181	76.5283	251.4035	2.1951	.0000
8	22279.0350	7028.4888	23059.3000	971.3200	.0000	8	22106.8390	6964.4295	22849.1240	973.8950	.0000
9	202999.7	203000.0	-.3	.138	-.000	9	139.7	140.0	-.3	.138	-.000
10	.0	.0	-.5	30.103	-.025	10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039	11	.0	.0	-.0	5.634	.039
12	-101.2347	-.0007	.0	150453.0	.0000	12	-101.2347	.0000	.0	150448.0	.0000
13	.2555	-.0002	.7	9042993.5	.0000	13	.2555	.0000	.0	9042140.8	.0000
14	.0000	-.0000	.0	9040993.5	.0000	14	.0000	-.0000	.0	9040140.7	.0000
15	-101.2347	.0000	-101.2347	.0000	518.05	15	-101.2347	.0000	-101.2347	.0000	518.12
16	.2555	.0000	.2556	.0000	-1.70	16	.2555	.0000	.2555	.0000	-1.70
17	.0000	.0000	.0000	.0000	-1.10	17	.0000	.0000	.0000	.0000	-1.10
18	.0075	.0063	.0004	.0000	.0000	18	.0075	.0072	.0033	.0000	.0000
19	87.8565	87.9770	87.9770	.0000	.0000	19	88.6070	88.5791	88.6791	.0000	.0000
20	500.0000	427.1436	-4061.0000	-474.6723	202713.7	20	190.4760	404.7860	-.7350	-431.5248	184068.9
21	.0003	10.0030	.0007	2443.1833	.00	21	.0003	10.0050	.0000	2443.3450	.00
22	14.3207	14.3191	.2262	-.274	24237.776	22	15.4178	15.4159	.2540	-.274	24243.357
23	54.1017	32.6710	32.5015	-30.3645	-.0422	23	52.8558	32.7032	32.5335	-30.3644	-.0422
24	.0000	1.0000	-1.6262	.0	63.68	24	.0000	1.0010	-1.6262	.0	63.68
25	7.6246	595.0415	-.00549	.0	16.39	25	7.6245	595.0415	-.00549	.0	16.39
26	.00001	.0000	.00591	.0	-.84	26	.00001	.0000	.00893	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000	27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.0127	.00000	-12610.9	.0000	28	6563365.0	-.9127	.00000	-12610.9	.0000
29	3540.2913	3543.7086	25587.3320	25561.6250	88.12618	29	3543.9202	3543.7125	25571.9940	25566.8140	88.18436
30	179.99999	.00052	32.55749	123.19281	-60736493.0	30	179.99999	.00008	32.55743	123.19019	-60735761.0
31	2643.7855	.00000	32.55754	123.19350	-1426555.0	31	2645.5308	.00000	32.55754	123.19350	-1426555.0

1	1000.0000	280447.3	39.5	626019.1	15864039.2	1	2500.0000	279877.4	29.0	607847.6	51188831.0
2	25570.0190	24248.0620	21533395.0	21533635.0	43.5272	2	25589.1640	24277.3540	21528304.0	21528941.0	140.2290
3	-5285995.0	4470713.7	-6242290.7	-77188.0	24941359.	3	-37450362.0	-5634847.9	-39396534.0	-375028.6	41911835.
4	54.739.7	109713.8	304568.9	863.5	54.5073	4	194d722.4	13152.8	-12971.4	4158.4	11.0016
5	14824173.7	484115.6	15779705.8	381553.1	-34.7407	5	13651422.2	3362802.4	1104991S.3	1843580.5	-80.7065
6	-16680.6050	-5735.7541	-18719.9130	-197./335	.0044	6	-15483.9018	-3995.6878	-13107.6058	-199.2636	.0033
7	1333.9248	37.1742	121.9978	2.2098	.0000	7	-734.3508	-135.3805	-444.1671	2.1454	.0000
8	17548.4360	5300.9575	17417.6715	974.5136	.0030	8	-18634.0450	-6696.9946	-21972.6475	974.3903	.0000
9	38.3	38.5	-.3	.138	-.000	9	23.6	29.0	-.3	.138	-.000
10	.0	.0	-.0	33.103	-.025	10	.0	.0	-.0	33.103	-.025
11	.0	.0	-.0	5.634	.039	11	.0	.0	-.0	5.634	.039
12	-136.0424	-.0680	.0	150444.8	.0000	12	121.6517	-.0681	.0	150431.4	.0000
13	.2612	-.0011	.0	9041587.3	.0000	13	-.9831	-.0001	.0	9039309.8	.0000
14	.0000	-.0000	.0	9039589.2	.0000	14	-.0000	.0000	.0	9037309.7	.0000
15	-136.0424	-.0680	-136.0424	-.0003	518.16	15	121.8518	-.0681	121.8513	.0012	518.35
16	.2612	-.0011	.2612	-.0680	-1.70	16	-.9831	-.0001	-.9831	-.0681	-1.70
17	.0000	-.0000	.0700	-.0011	-1.10	17	-.0000	-.0000	-.0000	-.0011	-1.10
18	-.0341	-.0324	.0001	.0000	.0000	18	.0399	.0378	-.0093	.0000	.0000
19	107.0151	101.3864	101.3864	.0000	.0000	19	120.5479	118.8293	118.8294	.0000	.0000
20	101.4417	234.0803	-.3800	-158.124.9	67367.0	20	76.7094	123.6485	-.3800	-38.1945	16176.0
21	.0003	10.0169	.0000	2438.4692	.00	21	.0003	10.1594	.0000	2371.6014	.00
22	1.2151	1.0318	.6413	-.278	24248.063	22	1.9977	1.0383	1.7071	-.327	24277.354
23	30.1355	30.8772	30.7129	-30.3678	-.0409	23	-58.3904	-15.9913	-15.8926	-30.4094	.0246
24	-.0000	1.0300	-1.6762	.0	63.58	24	-.0000	1.3000	-1.6262	.0	63.68
25	7.6246	595.0415	.00000	.0	16.39	25	7.6246	595.0415	.0000	.0	16.39
26	.00031	.0000	.00000	.0	-.84	26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62343.5	.0000	27	7731.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.0127	.00000	-12610.9	.0000	28	4563365.0	-.0127	.00000	-12610.9	.0000
29	3543.9309	3543.2374	25509.7830	25560.7210	88.22920	29	3543.0340	3553.4292	25589.7159	25514.8540	88.35608
30	.00000	.00018	32.56133	123.19019	-60735761.0	30	-7.83944	.00146	32.58708	123.19049	-60735761.0
31	-.0000	.00000	32.55754	123.19350	-1426555.0	31	-144.4735	.00070	32.55754	123.19350	-1426555.0

1	1500.0000	280257.4	35.4	614576.0	27657718.0	1	3000.0000	279687.5	25.8	618556.9	62821651.0
2	25576.8360	24254.9930	21532430.0	21533121.0	75.7710	2	25585.1530	24264.8330	21527538.0	21528669.0	172.1433
3	-15602899.1	1019738.1	-17574361.0	-176190.2	33238405.	3	-42228158.0	-6551385.4	-42402906.0	-474702.6	41453093.
4	1291022.3	199955.1	304700.2	1264.1	55.8934	4	112835.41	-53902.1	-292902.5	5249.5	273.4557
5	21843218.0	5493131.6	212851p1.0	868895.7	-50.7800	5	2704792.9	-368058.9	-1190945.3	2330665 +	-77.4750
6	-23491.0560	-7792.1671	-25209.7745	-198.2959	.0040	6	-3156.8934	437.3305	1437.5266	-199.3857	.0029
7	1522.3604	-37.3946	-122.6977	2.2095	.0000	7	-2521.2789	-125.3751	-411.3336	2.1736	.0000
8	5885.7580	1207.8509	3962.1735	974.7996	.0000	8	-23926.1220	-1784.7343	-25541.4263	973.9307	.0000
9	35.0	35.4	-.3	.138	-.000	9	25.5	25.8	-.0	.138	-.000
10	.0	.0	-.0	33.103	-.025	10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039	11	.0	.0	-.0	5.634	.039
12	-170.0536	-.0681	.0	150440.3	.0000	12	87.7990	-.0681	.0	150426.9	.0000
13	-.3147	-.0011	.0	9040823.5	.0000	13	-.6450	-.0006	.0	9038550.0	.0000
14	-.0000	-.0000	.0	9038829.5	.0000	14	.0000	.0000	.0	9036550.0	.0000
15	-170.0607	-.0681	-170.0607	.0004	518.23	15	87.7949	-.0681	87.7989	.0010	518.41
16	-.3147	-.0011	-.3147	-.0681	-1.70	16	-.8460	.0006	-.8460	-.0681	-1.70
17	-.0000	-.0000	-.0000	-.0011	-1.10	17	-.0000	.0000	-.0000	.0006	-1.10
18	-.0610	-.0579	-.0054	.0000	.0000	18	.0538	.0482	.0062	.0000	.0000
19	118.4558	116.8725	116.8725	.0000	.0000	19	106.1471	105.2928	105.2929	.0000	.0000
20	93.0311	163.7597	-.3800	-77.0623	32767.8	20	67.7986	113.2068	-.3800	-30.5536	12911.0
21	.0003	10.1085	.0000	2397.8258	.00	21	.0003	10.0772	.0000	2412.7315	.00
22	1.9356	1.0552	1.6231	-.307	24264.994	22	1.2778	1.0130	.1790	-.297	24264.833
23	-3.2110	19.2731	19.1569	-30.3908	-.0290	23	-90.4610	-29.2551	-29.1060	-30.3876	.0397
24	.0000	1.0000	-1.6262	.0	63.68	24	.0000	1.0000	-1.6262	.0	63.68
25	7.6246	595.0415	.00000	.0	16.39	25	7.6246	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84	26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000	27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.0127	.00000	-12610.9	.0000	28	6553365.0	-.0127	.00000	-12610.9	.0000
29	3543.7534	3547.7373	25579.5390	25534.9800	68.30431	29	3543.0238	3550.7923	25584.9850	25529.0110	88.30621
30	-14.7487d	.00087	32.58244	123.19019	-60735761.0	30	.00000	.00110	32.56484	123.19049	-60735761.0
31	-216.6395	.00000	32.55754	123.19350	-1426555.0	31	-.0000	.00000	32.55754	123.19350	-1426555.0

1	2000.0000	280067.4	32.2	605245.1	39433058.0	1	3500.0000	279497.5	22.5	625851.1	56599888.0
2	25587.2190	24279.1920	21530911.0	21531306.0	108.0113	2	25579.9260	24259.9090	21531579.0	21532904.0	155.1065
3	-27554666.0	-2786494.1	-30052122.0	-275485.3	39084342.	3	-40447703.0	-5223455.1	-38044227.0	-574371.0	37728444.
4	1909809.5	74179.6	187317.8	3065.1	45.3383	4	-481312.5	-105241.7	-401331.0	6337.5	252.2236
5	20403491.0	5941341.2	19510172.0	1356277.1	-55.5993	5	-9020481.1	-3972457.2	-13016409.0	2817529.2	-62.3717
6	-23047.0800	-7050.2359	-23153.0850	-198.6676	.0037	6	13115.8782	4715.3359	15479.0914	-199.2574	.0026
7	794.4687	-104.9775	-334.9135	2.1913	.0000	7	-3759.7887	-74.0159	-242.7987	2.1738	.0000
8	-7594.6454	-3311.5951	-10865.7788	974.7313	.0030	8	-21723.4990	-6207.0725	-20363.4925	973.5484	.0000
9	31.8	32.2	-.3	.138	-.000	9	22.3	22.6	-.3	.138	-.000
10	.0	.0	-.0	30.103	-.025	10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039	11	.0	.0	-.0	5.634	.039
12	155.9037	-.0681	.0	150435.8	.0000	12	53.7543	-.0681	.0	150422.4	.0000
13	-.7830	-.0007	.0	9040069.5	.0000	13	-.4191	.0011	.0	9037790.1	.0000
14	-.0000	-.0000	.0	9038069.5	.0000	14	.0000	.0000	.0	9035790.1	.0000
15	155.9037	-.0681	155.9037	.0009	518.29	15	53.7612	-.0681	53.7612	.0005	518.47
16	-.7830	-.0007	-.7830	-.0681	-1.70	16	-.4191	.0011	-.4191	-.0681	-1.70
17	-.0000	-.0000	-.0000	-.0007	-1.10	17	-.0000	.0000	-.0000	.0011	-1.10
18	-.0190	-.0180	-.0114	.0000	.0000	18	.0143	.0136	.0299	.0000	.0000
19	124.5415	122.5488	122.5488	.0000	.0000	19	84.1402	84.4443	94.4444	.0000	.0000
20	84.6203	138.3238	-.3800	-51.0340	21656.4	20	59.3878	104.8627	-.3900	-25.4745	10743.7
21	.0003	10.1717	.0000	2361.6173	.00	21	.0003	10.0215	.0000	2438.0032	.00
22	2.2853	1.0585	2.0259	-.335	24279.162	22	1.0920	1.0043	-.4295	-.278	24256.910
23	-31.0904	1.8946	1.8922	-30.4113	-.0092	23	-127.9941	-32.3010	-32.1325	-30.3697	.0420
24	.0000	1.0000	-1.6262	.0	63.58	24	-.0000	1.0000	-1.6262	.0	63.68
25	7.6246	595.0415	.00001	.0	16.39	25	7.6246	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84	26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000	27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.0127	.00000	-12610.9	.0000	28	6563365.0	-.0127	.00000	-12610.9	.0000
29	3543.4308	3553.5210	25587.6410	25514.6270	88.35801	29	3543.1544	3550.3990	25593.6130	25531.4590	88.30174
30	-3.72519	.00143	32.59719	123.19019	-60735761.0	30	30.93657	.00102	32.55846	123.19019	-60735761.0
31	-128.1539	.00000	32.55754	123.19350	-1426555.0	31	452.9382	.00000	32.55754	123.19350	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY FIRST BURN
AND PARKING ORBIT

#					
1	4000.0000	279307.6	19.4	625512.7	44889162.0
2	25575.8960	24259.0850	21540277.0	21541252.0	122.9881
3	-32646918.0	-2106957.8	-27817785.0	-673927.3	31033623.
4	-2420971.8	-123559.7	-461901.3	7424.0	244.7611
5	-17887877.0	-6217302.0	-20380256.0	330424.4	-46.2522
6	20258.4360	7380.8411	24218.0370	-198.9570	.0022
7	-3749.9723	3.1810	10.5111	2.1728	.0000
8	-12807.6919	-2507.3701	-3222.7174	973.3320	.0000
9	19.1	19.4	-.3	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	19.7443	-.0680	.0	150416.0	.0000
13	.1512	.0012	.0	9037030.3	.0000
14	.0000	.0000	.0	9035030.2	.0000
15	19.7442	-.0680	19.7442	-.0002	518.54
16	.1512	.0012	.1512	-.0680	-1.70
17	.0000	.0000	.0000	.0012	-1.10
18	-.0104	-.0098	.0443	.0000	.0000
19	65.1567	56.5152	66.5152	.0000	.0000
20	50.9770	97.7103	-.3800	-21.8634	9200.0
21	.0003	10.0243	.0000	2437.0801	.00
22	1.7906	1.0137	-1.4961	-.279	24259.085
23	-163.2153	-23.3867	-23.2509	-30.3633	.0338
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563366.0	-.0127	.00000	-12610.9	.0000
29	3544.1177	3552.8672	25582.8380	25519.8360	88.36583
30	38.79628	.00123	32.57595	123.19019	-60736751.0
31	570.0749	.00000	32.55754	123.19350	-1426555.0

#					
1	5500.0000	278891.9	14.5	646331.3	9785540.0
2	25555.5230	24235.5980	21556428.0	21557052.0	25.8123
3	-1668058.3	6524726.0	498738.5	-971797.5	3676187.
4	-3357851.1	26689.5	31506.9	10689.8	137.8110
5	-9126403.1	-774520.8	-2519080.5	4764355.6	5.1941
6	10792.5814	917.1447	3005.2893	-198.3390	.0016
7	3652.9285	146.7409	481.3785	2.1832	.0000
8	21390.1970	7734.2006	25373.6350	973.6733	.0000
9	14.2	14.5	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-82.2150	-.0679	.0	150408.2	.0000
13	.9295	-.0004	.0	9035357.5	.0000
14	.0000	-.0000	.0	9033357.5	.0000
15	-82.2150	-.0679	-82.2150	-.0011	518.57
16	.9205	-.0004	.9205	-.0579	-1.70
17	.0000	-.0000	.0000	-.0004	-1.10
18	.0538	.0511	.0000	.0000	.0000
19	66.6556	69.8075	69.8075	.0000	.0000
20	76.0335	87.1302	-.1900	-15.3524	6429.8
21	.0002	9.8993	.0000	2494.1897	.00
22	1.4275	1.0258	-.9932	-.235	24235.598
23	110.7359	26.2623	26.1144	-30.3056	-.0367
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563366.0	-.0127	.00000	-12610.9	.0000
29	3548.0613	3549.5552	25555.5710	25544.6150	88.37775
30	.00000	.00021	32.57055	123.19019	-60736761.0
31	-.0000	.00000	32.55754	123.19350	-1426555.0

#					
1	4500.0000	279117.6	16.2	525222.3	33169809.0
2	25570.9860	24251.0610	21549907.0	21550179.0	90.8577
3	-21240219.0	1731473.1	-15223753.3	-773335.1	21925490.
4	-3971823.4	-101828.0	-390063.2	8510.8	238.9887
5	-21170372.0	-6335957.2	-20765428.0	3790893.9	-29.7299
6	24150.6920	7519.3152	24668.9810	-198.6644	.0018
7	-2204.6310	81.7243	268.2000	2.1751	.0000
8	12.9734	2048.8314	6726.4260	973.3148	.0000
9	15.9	16.2	-.3	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-14.2554	-.0680	.0	150413.5	.0000
13	.6695	.0009	.0	9036270.5	.0000
14	.0000	.0000	.0	9034270.5	.0000
15	-14.2555	-.0680	-14.2555	-.0008	518.60
16	.6695	.0009	.6695	-.0680	-1.70
17	.0000	.0000	.0000	.0009	-1.10
18	.0154	.0146	.0387	.0000	.0000
19	56.1423	58.0897	58.0897	.0000	.0000
20	42.5561	91.2997	-.3800	-19.1577	8044.4
21	.0003	10.0268	.0000	2436.2833	.00
22	2.2511	1.0250	-2.0158	-.230	24261.062
23	167.7586	-7.0744	-7.0287	-30.3558	.0112
24	.0000	1.0000	-1.6202	.0	63.68
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563366.0	-.0127	.00000	-12610.9	.0000
29	3545.9366	3554.7013	25576.4690	25513.1750	88.43346
30	34.25298	.00124	32.59928	123.19019	-60736761.0
31	503.6749	.00000	32.55754	123.19350	-1426555.0

#					
1	5959.9999	278797.0	14.1	651847.0	2468310.1
2	25554.0330	24229.0950	21557211.0	21555471.0	6.7642
3	501884.1	5843505.9	-1737527.5	-10709.0	13255964.
4	-903793.8	92689.1	246114.5	11762.3	79.1415
5	2371655.2	3001859.6	9869577.7	5251252.4	-15.4545
6	-2336.8212	-3551.5534	-11686.1221	-198.3777	.0016
7	5932.2304	109.6631	350.7980	2.1865	.0000
8	23374.9350	6926.6411	22722.5390	973.9138	.0000
9	13.9	14.1	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-116.1789	-.0679	.0	150406.0	.0000
13	.5683	-.0010	.0	9034955.0	.0000
14	.0000	-.0000	.0	9032955.0	.0000
15	-116.1789	-.0679	-116.1789	-.0007	518.70
16	.5683	-.0010	.5683	-.0679	-1.70
17	.0000	-.0000	.0000	-.0010	-1.10
18	-.0077	-.0073	-.0094	.0000	.0000
19	59.2405	89.2799	89.2800	.0000	.0000
20	74.3293	86.0409	-.1900	-13.9672	5843.7
21	.0002	9.8668	.0000	2509.3294	.00
22	1.0566	1.0377	.1992	-.224	24229.095
23	74.3597	32.7198	32.5503	-30.2957	-.0420
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563366.0	-.0127	.00000	-12610.9	.0000
29	3547.1307	3548.8631	25559.3410	25546.8540	88.34732
30	-81.43178	.00024	32.55743	123.19019	-60736761.0
31	-1196.6393	.00000	32.55754	123.19350	-1426555.0

#					
1	5000.0000	278986.8	14.8	533307.6	21454836.0
2	25563.1970	24251.7240	21556457.0	21555825.0	58.7706
3	-9737240.2	4978573.9	-4571936.1	-872560.5	11279733.
4	-4419584.5	-45958.5	-200738.0	9599.3	228.3423
5	-17893131.0	-42871224.4	-14043565.4	4277578.8	-12.3039
6	20636.5960	5089.8831	16682.2020	-198.4436	.0017
7	556.4815	135.7789	445.4925	2.1789	.0000
8	12726.6406	5901.5889	19364.4710	973.4475	.0000
9	14.5	14.8	-.3	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-46.2416	-.0680	.0	150410.5	.0000
13	.9587	.0003	.0	9035797.3	.0000
14	.0000	-.0000	.0	9033747.2	.0000
15	-48.2417	-.0680	-48.2417	-.0011	518.54
16	.9587	.0003	.9587	-.0680	-1.70
17	.0000	.0000	.0000	.0003	-1.10
18	.0580	.0550	.0189	.0000	.0000
19	57.2743	59.1440	59.1439	.0000	.0000
20	77.8380	88.2570	-.1900	-17.0473	7145.9
21	.0002	9.9776	.0000	2458.4630	.00
22	2.0978	1.0265	-1.6300	-.252	24251.724
23	140.9372	11.1265	11.0563	-30.3341	-.0176
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563366.0	-.0127	.00000	-12610.9	.0000
29	3547.3883	3553.2027	25566.7750	25523.9200	88.43319
30	28.54425	.00082	32.59219	123.19019	-60736761.0
31	421.5211	.00000	32.55754	123.19350	-1426555.0

#					
1	6500.0000	278702.1	13.9	643291.7	13815550.2
2	25561.1980	24240.9420	21554949.0	21552987.0	37.8552
3	-3885724.2	3167831.3	-10515783.4	-11701.8	23752089.
4	2267867.7	130073.4	370744.5	5738255.9	71.4096
5	13033092.2	5753633.0	18896551.0	5738255.9	-32.6491
6	-14750.7581	-6825.4647	-22395.5490	-198.5402	.0016
7	6391.6879	35.2677	115.6797	2.1878	.0000
8	18143.4420	3755.8495	12320.7493	974.0874	.0000
9	13.5	13.8	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-150.1445	-.0679	.0	150403.8	.0000
13	.0223	-.0012	.0	9033546.4	.0000
14	-.0000	-.0000	.0	9031546.3	.0000
15	-150.1447	-.0679	-150.1447	-.0000	518.80
16	.0223	-.0012	.0223	-.0579	-1.70
17	.0000	-.0000	.0000	-.0012	-1.10
18	-.0561	-.0527	-.0133	.0000	.0000
19	110.2231	109.1366	109.1367	.0000	.0000
20	72.5749	34.9871	-.1900	-12.8139	5355.7
21	.0002	9.9181	.0000	2485.8515	.00
22	1.6606	1.0606	1.3239	-.241	24240.942
23	37.6737	27.0204	26.8695	-30.3158	-.0375
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563366.0	-.0127	.00000	-12610.9	.0000
29	3547.2290	3551.9319	25562.5720	25535.3650	88.39014
30	-25.79717	.00053	32.56914	123.19019	-60736761.0
31	-382.5887	.00000	32.55754	123.19350	-1426555.0

#					
1	7000.0000	278637.1	13.5	628612.0	25506597.0
2	25577.3090	24260.7320	21551210.0	21550003.0	69.8704
3	-13459092.4	-590337.4	-22845332.0	-1269521.1	32538970.
4	5105213.6	125578.0	395991.5	13969.6	67.7773
5	19582460.0	6540653.3	21478362.0	5225317.2	-49.2298
6	-22653.9750	-7762.9269	-25467.9140	-198.7651	.0015
7	4582.9745	-53.2231	-174.6071	2.1857	.0000
8	7374.0675	-701.6930	-2301.7215	974.1392	.0000
9	13.2	13.5	-.3	.138	-.000
10	.0	.0	-.0	30.133	-.025
11	.0	.0	-.0	5.634	.039
12	175.8730	-.0680	.0	150401.5	.0000
13	-.5320	-.0010	.0	9032137.8	.0000
14	-.0000	-.0000	.3	9030137.7	.0000
15	175.8729	-.0680	175.8729	.0006	518.89
16	-.5320	-.0010	-.5320	-.0680	-1.70
17	-.0000	-.0000	-.0000	-.0013	-1.10
18	-.0500	-.0569	-.0177	.0000	.0000
19	122.3003	120.4609	120.4509	.0030	.0000
20	70.8205	83.9605	-.1900	-11.8338	4943.0
21	.0303	10.0076	.0000	2445.5619	.00
22	2.2521	1.0737	1.9901	-.272	24260.733
23	7.0668	12.2685	12.1912	-30.3478	-.0193
24	.0000	1.0000	-1.6262	.0	63.66
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	5563365.0	-.0127	.00000	-12610.9	.0000
29	3546.6801	3555.5214	25573.7499	25510.1050	88.46327
30	-17.31832	.00124	32.59111	123.19019	-60736761.0
31	-254.7136	.00000	32.55754	123.19350	-1426555.0

#					
1	8500.0000	278322.4	12.5	637223.9	60478646.0
2	25574.7120	24251.1790	21543316.0	21543672.0	165.7349
3	-41793244.0	-6273237.1	-41491336.0	-1568040.1	41922324.
4	3002249.4	-72520.8	-293935.4	17242.3	270.5382
5	4335388.0	-1939150.5	-6342085.1	7686240.8	-80.8396
6	-5715.4769	2301.4859	7549.3918	-199.1059	.0014
7	-7405.1751	-142.0815	-466.1751	2.1757	.0000
8	-22374.4590	-7445.0437	-24430.6220	973.5638	.0000
9	12.2	12.5	-.3	.138	-.000
10	.0	.0	-.0	30.133	-.025
11	.0	.0	-.0	5.634	.039
12	73.8355	-.0680	.0	150394.9	.0000
13	-.6994	.0008	.0	9027912.0	.0000
14	.0000	.0000	.0	9025912.0	.0000
15	73.8355	-.0680	73.8355	.0008	519.17
16	-.6994	.0008	-.6994	-.0680	-1.70
17	-.0001	.0000	-.0000	.0008	-1.10
18	.0343	.0325	.0123	.0000	.0000
19	97.3127	96.9323	96.9324	.0000	.0000
20	65.5573	80.9933	-.1900	-9.6472	4015.5
21	.0002	9.9557	.0000	2469.2051	.00
22	1.0031	1.0025	.0352	-.283	24251.179
23	-84.3559	-32.0598	-31.8721	-30.3375	.0418
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	5563365.0	-.0127	.00000	-12610.9	.0000
29	3545.4891	3552.8415	25575.3730	25522.4450	88.39096
30	12.84835	.00104	32.55900	123.19019	-60736761.0
31	188.8912	.00000	32.55754	123.19350	-1426555.0

#					
1	7500.0000	278512.2	13.1	621899.8	37217955.0
2	25579.5380	24270.0300	21546907.0	21546340.0	151.9455
3	-25369094.0	-414/202.4	-34514701.0	-1368956.7	38853986.
4	652/311.6	79340.8	204303.1	15092.3	63.8335
5	2304411.0	5091575.0	15724538.3	6712370.6	-65.6107
6	-23611.1100	-6043.8778	-19829.5595	-198.9757	.0015
7	860.0332	-126.9009	-410.3239	2.1337	.0000
8	-5550.6969	-4923.8443	-16153.2573	974.0583	.0000
9	12.8	13.1	-.3	.138	-.000
10	.0	.0	-.0	30.133	-.025
11	.0	.0	-.0	5.634	.039
12	141.8660	-.0680	.0	150399.3	.0000
13	-.9044	-.0005	.0	9030709.2	.0000
14	-.0000	-.0000	.3	9028729.3	.0000
15	141.8679	-.0680	141.8679	.0011	518.9E
16	-.9044	-.0005	-.9044	-.0680	-1.70
17	-.0000	-.0000	-.0000	-.0005	-1.10
18	.0305	.0005	-.0197	.0000	.0000
19	124.0847	122.1223	122.1223	.0030	.0000
20	69.0561	82.9554	-.1900	-11.0035	4589.5
21	.0003	10.0526	.0000	2425.5696	.00
22	2.2051	1.0596	1.9343	-.298	24270.031
23	-19.8267	-5.8969	-5.6588	-30.3649	.0094
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	5563366.0	-.0127	.00000	-12610.9	.0000
29	3545.9913	3557.3952	25520.8390	25498.9280	88.48543
30	-14.48362	.00161	32.55569	123.19019	-60736761.0
31	-212.8762	.00000	32.55754	123.19350	-1426555.0

#					
1	9000.0000	278227.5	12.1	640312.4	58794411.0
2	25570.2520	24248.1870	21548795.0	21549398.0	161.1102
3	-41300905.0	-4115807.7	-34416898.0	-1667568.5	38518167.
4	-1205069.8	-128621.8	-478010.3	18330.2	257.8615
5	-6854065.7	-5119256.6	-16756534.3	8173024.7	-64.7683
6	7632.4574	6069.5784	19913.1620	-198.9918	.0014
7	-8966.9326	-75.6462	-248.2184	2.1750	.0000
8	-21197.0350	-4888.0500	-16038.7717	973.4807	.0000
9	11.9	12.1	-.7	.138	-.000
10	.0	.0	-.0	30.133	-.025
11	.0	.0	-.0	5.634	.039
12	39.8382	-.0580	.0	150392.6	.0000
13	-.1923	.0011	.0	9026503.3	.0000
14	.0000	.0000	.3	9024503.4	.0000
15	39.8381	-.0680	39.8381	.0002	519.26
16	-.1923	.0011	-.1923	-.0680	-1.70
17	-.0000	.0000	-.0000	.0011	-1.10
18	-.0039	.0037	.0353	.0000	.0000
19	75.1519	75.9359	75.9359	.0000	.0000
20	63.8029	80.0306	-.1900	-9.0851	3779.3
21	.0002	9.9374	.0000	2477.6737	.00
22	1.5238	1.3024	-1.1479	-.247	24248.187
23	-120.9923	-29.8370	-29.6762	-30.3258	.0400
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	5563365.0	-.0127	.00000	-12610.9	.0000
29	3545.7841	3553.6794	25575.2840	25518.4630	88.41212
30	34.54441	.00111	32.56368	123.19019	-60736761.0
31	509.4308	.00000	32.55754	123.19350	-1426555.0

#					
1	8000.0000	278417.3	12.8	627722.0	48910752.0
2	25579.3240	24252.7190	21543768.0	21546236.0	134.0041
3	-35879349.0	-6282204.5	-41529763.0	-1468462.8	42019903.
4	5831185.3	5397.0	-38290.5	16153.2	48.9952
5	14346565.2	1900984.3	6257136.4	7199306.6	-81.6210
6	-17317.6810	-2255.6717	-7402.2093	-199.1025	.0014
7	-3652.3034	-160.6755	-527.2205	2.1800	.0000
8	-15596.6210	-7451.2655	-24479.2000	973.8782	.0000
9	12.5	12.8	-.3	.138	-.000
10	.0	.0	-.0	30.133	-.025
11	.0	.0	-.0	5.634	.039
12	107.8496	-.0680	.0	150397.1	.0000
13	-.9675	.0002	.0	9029320.6	.0000
14	-.0000	.0000	.0	9027726.6	.0000
15	107.8495	-.0680	107.8495	.0011	519.08
16	-.9675	.0002	-.9575	-.0680	-1.70
17	-.0000	.0000	-.0000	.0002	-1.13
18	.0464	.0440	-.0103	.0000	.0000
19	115.7457	114.3319	114.3320	.0000	.0000
20	67.3117	81.9674	-.1900	-10.2830	4283.3
21	.0003	10.0035	.0000	2443.1436	.00
22	1.5793	1.0269	1.2002	-.274	24262.919
23	-48.5561	-22.4917	-22.3900	-30.3554	.0327
24	.0000	1.0000	-1.6262	.0	63.66
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	5563366.0	-.0127	.00000	-12610.9	.0000
29	3545.4715	3555.3746	25579.9912	25506.8050	89.43832
30	-10.43628	.00139	32.5/740	123.19019	-60736761.0
31	-153.4024	.00000	32.55754	123.19350	-1426555.0

#					
1	9500.0000	278132.6	11.8	638150.3	47187456.0
2	25566.4010	24252.2570	21557784.0	21557784.0	179.2697
3	-34554928.0	-559223.5	-22725441.0	-1767919.0	32077696.
4	-5463237.3	-143573.4	-527082.0	19417.7	255.1359
5	-15771740.4	-6545907.6	-21457903.0	8659742.8	-48.3389
6	18642.3220	-7764.3538	25473.7259	-198.8045	.0013
7	-7554.4183	18.0093	59.0494	2.1750	.0000
8	-13548.6755	-652.0822	-2174.1123	973.4075	.0000
9	11.5	11.8	-.3	.138	-.000
10	.0	.0	-.0	30.133	-.025
11	.0	.0	-.0	5.634	.039
12	5.8588	-.0679	.0	150390.4	.0000
13	.3803	.0011	.0	9025094.9	.0000
14	.0000	.0000	.0	9023074.8	.0000
15	5.8586	-.0679	5.8585	-.0095	519.36
16	.3803	.0011	.3803	-.0679	-1.71
17	.0000	.0000	-.0000	.0011	-1.10
18	-.0073	-.0069	.0425	.0000	.0000
19	60.0929	61.7729	61.7729	.0000	.0000
20	62.0486	79.0775	-.1900	-8.5933	3569.3
21	.0002	9.9509	.0000	2471.7751	.00
22	2.1785	1.0152	-1.9279	-.251	24252.258
23	-153.4399	-17.1032	-16.9985	-30.3235	.0259
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	5563366.0	-.0127	.00000	-12610.9	.0000
29	3547.1088	3550.7031	25572.6550	25507.2590	88.48402
30	36.05154	.00126	32.58560	123.19019	-60736761.0
31	530.3920	.00000	32.55754	123.19350	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY FIRST BURN
AND PARKING ORBIT

#				
1	10000.0000	278037.7	11.5	640536.6	35498843.0
2	25560.4370	24250.3240	21566270.0	21565585.0	97.2349
3	-23620805.0	320270.2	-10410534.4	-1866371.4	23113884.
4	-8292615.5	-111138.6	-420588.5	20505.8	253.6633
5	-19727997.0	-5740448.3	-18816365.0	9146450.1	-31.6346
6	23939.4370	6806.9529	22333.2800	-198.6105	.0013
7	-3375.9470	108.5058	355.9449	2.1775	.0000
8	-1893.2723	3785.5019	12427.1442	973.4474	.0000
9	11.2	11.5	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-28.1064	-.0679	.0	150388.2	.0000
13	.8228	.0006	.0	9023685.1	.0000
14	.0000	.0000	.0	9021686.1	.0000
15	-28.1065	-.0679	-28.1065	-.0010	519.45
16	.8228	.0006	.8228	-.0579	-1.71
17	.0000	.0000	.0000	.0006	-1.10
18	.0337	.0320	.0305	.0000	.0000
19	55.4057	57.4075	57.4075	.0000	.0000
20	60.2942	78.1323	-.1900	-8.1497	3381.6
21	.0002	9.9370	.0000	2478.2937	.00
22	2.2682	1.0195	-2.0265	-.245	24250.324
23	179.1624	.5936	.5893	-30.311/	-.0011
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6246	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.0127	.00000	-12610.9	.0000
29	3548.8839	3556.6419	25553.8520	25508.0910	68.52539
30	28.67360	.00109	32.59725	123.19019	-60736751.0
31	422.1718	.00000	32.55754	123.19350	-1426555.0

#				
1	11499.9999	277752.9	11.8	662376.7	1171928.4
2	25548.6350	24223.7630	21568764.0	21567358.0	3.2115
3	628496.0	4964894.0	-4516153.1	-2164096.1	11357024.
4	-1189555.9	118713.3	333386.6	23779.0	83.2424
5	201387.1	4308932.6	14145521.8	10506966.6	-12.2305
6	387.5794	-5105.2068	-16744.1730	-198.5154	.0013
7	10955.6034	116.0942	330.9487	2.1059	.0000
8	21601.2730	5879.7549	19293.0150	973.9508	.0000
9	11.6	11.8	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-129.9289	-.0679	.0	150381.5	.0000
13	.3508	-.0011	.0	9019460.5	.0000
14	-.0000	-.0000	.0	9017460.5	.0000
15	-129.9291	-.0679	-129.9291	-.0004	519.73
16	.3508	-.0011	.3508	-.0679	-1.71
17	.0000	-.0000	.0000	-.0011	-1.11
18	-.0376	-.0357	-.0119	.0000	.0000
19	98.6431	98.1869	98.1889	.0000	.0000
20	62.1900	75.5504	-.1900	-7.0616	2920.8
21	.0002	9.8083	.0001	2538.2057	.00
22	1.4005	1.0341	.9449	-.236	24223.763
23	81.1535	31.7896	31.6231	-30.2663	-.3413
24	.0000	1.0000	-1.6262	.0	53.68
25	7.6246	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.64
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.0127	.00000	-12610.9	.0000
29	3549.3319	3551.2693	25551.7830	25537.8380	88.48339
30	-56.72966	.00027	32.55945	123.19019	-60736751.0
31	-835.7473	.00000	32.55754	123.19350	-1426555.0

#				
1	10500.0000	277942.7	11.1	651640.0	23795090.0
2	25552.1340	24236.5820	21570542.0	21569402.0	53.1904
3	-11851006.4	5862004.5	-1677175.2	-1965638.9	12354907.
4	-8577299.9	-40714.8	-189564.0	21595.4	251.0933
5	-17606241.0	-2976133.8	-9748347.8	9633202.3	-13.9867
6	21899.5710	3526.8912	11573.5370	-198.4744	.0013
7	2351.0844	155.4787	542.8500	2.1407	.0000
8	10114.2472	6942.3918	22774.3310	973.5831	.0000
9	10.9	11.1	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-62.0585	-.0679	.0	150385.9	.0000
13	.9846	-.0000	.0	9022277.6	.0000
14	.0000	-.0000	.0	9020277.6	.0000
15	-62.0587	-.0679	-62.0587	-.0012	519.54
16	.9845	-.0000	.9845	-.0679	-1.71
17	.0000	-.0000	.0000	-.0000	-1.11
18	.0535	.0502	.0092	.0000	.0000
19	60.7399	62.3795	62.3795	.0000	.0000
20	58.5399	77.1940	-.1900	-7.7506	3212.6
21	.0002	9.8710	.0000	2508.7526	.00
22	1.7331	1.0125	-1.4070	-.225	24236.683
23	151.5994	18.1246	18.0145	-30.2859	-.0273
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6246	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.0127	.00000	-12610.9	.0000
29	3549.9055	3553.8794	25553.3760	25524.8930	88.49286
30	24.07483	.00056	32.58406	123.19100	-60736761.0
31	354.6866	.00000	32.55754	123.19350	-1426555.0

#				
1	11999.9999	277658.0	12.3	669445.7	11426303.5
2	25556.4370	24241.2040	21565594.0	21564808.0	31.3049
3	-2480467.5	1712600.2	-1528432.0	-2263393.9	22232985.
4	4373609.4	154597.3	451167.0	24872.1	80.8403
5	11315825.4	6349037.9	2083122.0	11397972.0	-30.0751
6	-12524.7937	-7521.8188	-24675.2920	-198.6892	0014
7	10664.5952	22.8866	75.2225	2.1862	.0000
8	1/805.4170	2024.2025	6660.1865	974.0629	.0000
9	12.1	12.3	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-163.8568	-.0679	.0	150379.5	.0000
13	-.2122	-.0011	.0	9018051.8	.0000
14	-.0000	-.0000	.0	9016051.9	.0000
15	-163.8590	-.0679	-163.8590	.0003	519.92
16	-.2122	-.0011	-.2122	-.0679	-1.71
17	-.0000	-.0000	-.0001	-.0011	-1.11
18	-.0745	-.0698	-.0157	.0000	.0000
19	116.5203	115.0559	115.0567	.0000	.0000
20	64.8219	75.0733	-.1900	-6.7622	2794.1
21	.0002	9.8347	.0000	2502.7332	.00
22	2.1284	1.0617	1.8451	-.229	24241.204
23	46.7934	21.6635	21.5358	-30.2944	-.0917
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6246	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.0127	.00000	-12610.9	.0000
29	3549.0437	3554.9887	25560.0220	25517.2770	88.49749
30	-22.21151	.00084	32.57869	123.19019	-60736751.0
31	-327.0776	.00000	32.55754	123.19350	-1426555.0

#				
1	10999.9999	277847.8	11.3	662890.6	1211J479.5
2	25546.3770	24222.5660	215/0851.0	21569321.0	35.1859
3	-2849945.6	6525031.8	499859.3	-2064892.5	1446205.
4	-5994349.7	45316.2	92971.7	22686.5	190.8514
5	-10174148.8	892312.9	2647131.2	10120036.9	25.5292
6	13157.8340	-952.0931	-3119.1040	-198.4389	.0013
7	7760.1297	168.9095	554.1499	2.1838	.0000
8	18798.4760	7726.7589	25349.1920	973.7692	.0000
9	11.1	11.3	-.2	.136	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-95.9972	-.0679	.0	150383.7	.0000
13	.6108	-.0007	.0	9020859.0	.0000
14	-.0000	-.0000	.0	9018869.0	.0000
15	-95.9974	-.0679	-95.9974	-.0010	519.64
16	.6108	-.0007	.6108	-.0679	-1.71
17	.0000	-.0000	.0000	-.0007	-1.11
18	.0321	.0304	-.0057	.0000	.0000
19	76.4061	77.1230	77.1230	.0000	.0000
20	59.5587	76.3034	-.1900	-7.4897	3059.7
21	.0002	9.8051	.0000	2539.5153	.00
22	1.0521	1.0129	-.2846	-.255	24222.557
23	118.7578	30.3312	30.1589	-30.2635	-.0432
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6246	595.0415	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.0127	.00000	-12610.9	.0000
29	3550.3599	3550.6918	25544.5975	25542.3770	88.43733
30	.00000	.00000	32.56251	123.19019	-60736761.0
31	-.0000	.00000	32.55754	123.19350	-1426555.0

#				
1	12500.0000	277563.1	12.8	636436.4	23135519.0
2	25568.7330	24258.7150	21561577.0	21561549.0	63.3712
3	-11254535.4	-2124507.6	-27873127.0	-2362771.4	31394090.
4	8858637.3	139815.5	402743.4	25964.8	80.4039
5	17112438.0	621/521.7	20419332.0	11581005.9	-46.8262
6	-21625.4650	-7374.2109	-24195.7910	-198.9036	.0015
7	6719.8204	-80.8598	-265.1454	2.1843	.0000
8	8698.7549	-2520.3016	-8262.1808	974.0593	.0000
9	12.5	12.8	-.3	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.7	5.634	.039
12	162.1597	-.0679	.0	150317.0	.0000
13	-.7132	-.0008	.0	9016643.2	.0000
14	-.0000	-.0000	.0	9014643.2	.0000
15	162.1595	-.0679	162.1595	.0006	519.92
16	-.7132	-.0008	-.7132	-.0679	-1.71
17	.0000	-.0000	-.0000	-.0008	-1.11
18	-.0389	-.0369	-.0201	.0000	.0000
19	124.2512	122.2749	122.2749	.0000	.0000
20	67.4535	74.7001	-.1900	-6.4877	2677.9
21	.0002	9.9631	.0000	2467.0459	.00
22	2.3596	1.0668	2.0751	-.255	24258.716
23	18.3537	4.8663	4.8349	-30.3236	-.0079
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6246	595.0415	.00000	.0	16.33
26	.00001	.0000	.00000	.0	-.84
27	7791.0507	.2519	.00000	-62345.5	.0000
28	6563365.0	-.0127	.00000	-12610.9	.0000
29	3548.4264	3558.8011	25570.1980	25495.6550	88.55719
30	-15.1247	.00146	32.59525	123.19019	-60736761.0
31	-220.7911	.00000	32.55754	123.19350	-1426555.0

#				
1	13000.0000	277468.2	12.5	635098.3	34868595.0
2	25573.2493	24260.9330	21557193.1	21557806.0	95.5159
3	-22994707.0	-5236552.7	-33085382.3	-2462290.3	38094242.
4	13461307.9	77778.9	199266.7	27056.1	80.0938
5	18606111.3	3958391.6	13042300.6	12066005.7	-63.3187
6	-24093.7593	-4706.5662	-15447.4585	-199.0833	.3014
7	213.3849	-150.5973	-526.8744	7.1810	.0000
8	-2835.0751	-6210.9552	-20373.7400	973.9349	.0000
9	12.3	12.5	-.3	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0.	.0	-.0	5.634	039
12	128.1872	-.0680	.3	150374.8	.0000
13	-.9708	-.0002	.7	9015234.7	.0000
14	-.0000	-.0000	.7	9013234.7	.0000
15	128.1870	-.0680	128.1870	.0012	520.31
16	-.9708	-.0002	-.9708	.0680	-1.71
17	-.0000	-.0000	-.0000	-.0002	-1.11
18	.0247	.0234	-.0192	.0000	.0000
19	121.9341	120.0913	120.0913	.0000	.0000
20	65.9253	74.4096	-.1900	-6.2352	2571.1
21	.0002	9.9715	.0000	2463.3759	.00
22	1.9153	1.0404	1.6932	-.258	24260.953
23	-8.5782	-13.2316	-13.1486	-30.3301	.0205
24	.0000	1.0000	-1.6262	.0	63.58
25	7.6245	595.0415	.30000	.0	16.39
26	.00001	.0000	.30000	.0	-.84
27	7791.0507	.2519	.30000	-62345.5	.0000
28	6563365.0	-.0127	.00003	-12610.9	.0000
29	3547.7153	3558.9595	25574.3243	25493.5250	88.54686
30	-13.75907	.00158	32.59921	123.19019	-60736761.0
31	-195.0519	.00000	32.55754	123.19350	-1426555.0

#				
1	13999.9999	277279.3	11.0	651444.2	58336312.0
2	25565.7059	24240.8290	21556957.0	21557982.0	159.8566
3	-41155433.0	-5644057.7	-39428197.0	-2661428.7	42221093.
4	418056441.8	-13039916	-385333.3	29233.8	272.6569
5	6089371.0	-3353151.9	-11311465.6	13041745.1	-83.8351
6	-8322.5342	3937.3004	13077.7161	-199.1163	.0013
7	11941.4213	-154.3026	-506.3392	2.1749	.0000
8	-19384.4180	-6692.7616	-21961.8385	973.5520	.0000
9	10.8	11.0	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.7	5.634	.039
12	60.2223	-.0679	.0	150370.3	.0000
13	-.5157	.0010	.0	9012417.5	.0000
14	-.0000	.0000	.5	9010417.5	.0000
15	60.2218	-.0679	60.2218	.0005	520.20
16	-.5167	.0010	-.5167	-.0679	-1.71
17	-.0000	.0000	-.0000	.0010	-1.11
18	.0180	.0170	.0228	.0000	.0000
19	87.9477	88.0541	88.0541	.0000	.0000
20	58.0303	73.4869	-.1900	-5.7855	2381.1
21	.0002	9.8737	.0000	2508.2155	.00
22	1.2308	.9949	-.7248	-.225	24240.830
23	-76.4549	-32.6752	-32.5050	-30.2980	.0421
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.30000	.0	16.39
26	.00001	.0000	.30000	.0	-.84
27	7791.0507	.2519	.30000	-62345.5	.0000
28	6563365.0	-.0127	.00003	-12610.9	.0000
29	3547.5247	3554.7263	25567.7550	25515.9570	88.46420
30	22.96202	.00101	32.55769	123.19019	-60736761.0
31	337.8849	.00000	32.55754	123.19350	-1426555.0

#				
1	13499.9999	277373.3	11.8	543959.0	46601350.0
2	25570.6730	24249.9630	21554918.7	21555700.0	127.6915
3	-34100083.0	-6560044.7	-42430738.0	-2561855.9	41799942.
4	8986055.7	-12082.9	-95946.5	28145.7	77.5825
5	14469478.0	364552.7	1219862.6	12554925.4	-79.6984
6	-19157.5703	-431.7967	-1422.9355	-159.1588	.0013
7	-6793.0503	-188.7224	-619.1994	2.1775	.0000
8	13232.3303	-7779.2608	-25523.5449	973.7419	.0000
9	11.5	11.8	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	94.1939	-.0680	.0	150372.5	.0000
13	-.8959	.0005	.0	9013826.1	.0000
14	-.0000	-.0000	.0	9011826.1	.0000
15	94.1987	-.0680	94.1987	.0011	520.10
16	-.8959	.0005	-.8959	-.0680	-1.71
17	-.0000	.0000	-.0000	.0005	-1.11
18	.0479	.0455	-.0724	.0000	.0000
19	109.2369	108.2093	108.2094	.0000	.0000
20	61.9777	74.3065	-.1900	-6.0022	2472.5
21	.0002	9.9186	.0000	2487.4352	.00
22	1.1414	1.0062	.5389	-.240	24249.953
23	-39.5302	-27.6319	-27.4788	-30.3149	.0380
24	.0000	1.0000	-1.6262	.0	63.58
25	7.6245	595.0415	.30000	.0	16.39
26	.00001	.0000	.30000	.0	-.84
27	7791.0507	.2519	.30000	-62345.5	.0000
28	6563365.0	-.0127	.00003	-12610.9	.0000
29	3547.6730	3555.0984	25570.5050	25508.4170	88.48828
30	.00000	.00122	32.56811	123.19019	-60736761.0
31	-.0000	.00000	32.55754	123.19350	-1426555.0

#				
1	14499.9999	277183.4	10.3	651514.2	61272430.0
2	25561.0170	24241.0300	21565034.0	21565034.0	167.8634
3	-41990957.0	-2802309.5	-30106135.0	-2760956.1	39932791.
4	-2329322.8	-157487.1	-572982.7	30321.0	267.0740
5	-3909617.1	-5943642.3	-19479939.0	13528484.1	-67.4711
6	5070.3265	7045.1283	23112.6710	-198.9843	.0012
7	-13378.9313	-67.1153	-220.3072	2.1741	.0000
8	-19569.4220	-3325.5847	-10915.6887	973.4271	.0000
9	10.1	10.3	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	26.2531	-.0679	.0	150368.1	.0000
13	.0397	.0012	.0	9011008.9	.0000
14	-.0000	.0000	.0	9009008.9	.0000
15	26.2628	-.0679	26.2628	-.0000	520.29
16	.0397	.0012	.0397	-.9679	-1.71
17	.0000	.0000	.0000	.0012	-1.11
18	-.0118	-.0111	.0410	.0000	.0000
19	67.7275	68.9341	68.9341	.0000	.0000
20	54.0829	72.8631	-.1900	-5.5863	2296.3
21	.0002	9.8738	.0000	2508.4074	.00
22	2.0112	1.0093	-1.7409	-.225	24241.830
23	-112.5697	-25.5805	-25.4355	-30.2917	.0360
24	.0000	1.0000	-1.6262	.0	63.68
25	7.6245	595.0415	.30000	.0	16.39
26	.00001	.0000	.30000	.0	-.84
27	7791.0507	.2519	.30000	-62345.5	.0000
28	6563365.0	-.0127	.00003	-12610.9	.0000
29	3548.1370	3556.7227	25568.0320	25506.3120	88.51294
30	37.53709	.00121	32.57201	123.19019	-60736761.0
31	553.9917	.00000	32.55754	123.19350	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(FIRST OPPORTUNITY)

1	TIME	WEIGHT	F SB T	ALTITUDE	RANGE
2	V SB I	V SB E	R SB C	R SUB PF	RANGE ANGLE
3	X SB E	X SB P (M)	X SB S	XI	D* SB)
4	Y SB E	Y SB P (M)	Y SB S.	ETA	A* SB)
5	Z SB E	Z SB P (N)	Z SB S	ZETA	E* SB)
6	D-X SB E	D-X SB P (M)	D-X SB S	D-XI	A SB XM
7	D-Y SB E	D-Y SB P (M)	D-Y SB S	D-ETA	A SB YM
8	D-Z SB E	D-Z SB P (M)	D-Z SB S	D-ZETA	A SB ZM
9	F SB X	F SB TX	F SB AX	M SB X	H SB AX
10	F SB Y	F SB TY	F SB AY	M SB Y	M SB AY
11	F SB Z	F SB TZ	F SB AZ	M SB Z	H SB AZ
12	THETA(M) QRP	DTHETA(M)QRP	F AUX SB X	I SB XX	EPS(THETA)
13	PSI(M) QRP	D-PSI(M)QRP	F AUX SB Y	I SB YY	EPS(PSI)
14	PHI(M) QRP	D-PHI(M)QRP	F AUX SB Z	I SB ZZ	EPS(PHI)
15	CHI SB P	D-CHI SB P	THETA SB C	P SB M	X SB CG
16	CHI SB Y	D-CHI SB Y	PSI SB C	Q SB M	Y SB CG
17	CHI SB R	D-CHI SB R	PHI SB C	R SB M	Z SB CG
18	GAMMA SB 1	GAMMA SB 1I	GAMMA(1I)PR.	DELTA(A)	D-DELTA(A)
19	GAMMA SB 2	GAMMA SB 2I	GAMMA(2I)PR.	DELTA(B)	D-DELTA(B)
20	I SB SP	AVG I SB SP	WEIGHT FLOW	AVG D-W	AVG F SB L
21	Q	MACH NO.	PRESSURE	TEMPERATURE	X SB CP
22	ALPHA*	ALPHA	BETA	CHORD FORCE	V SB RM
23	MU	RHO	RHO PRIME	G(RHO)	G(PSI)
24	T(2)	TAU(2)	PHI(T)	D-W(LOXBO)	DELTA-D-X(V)
25	T(3)	TAU(3)	SMCP	D-W(LH2BO)	DELTA-D-Y(V)
26	DELTA-T(CO)	DELTA-T(3)	SMCY	D-W(LH2PR)	DELTA-D-Z(V)
27	V(T)	CHI(P)-TILDE	K(1)	W(LOX)RES	WDOTSUBQ
28	Y(V,T)	CHI(Y)-TILDE	K(3)	W(LH2)RES	WDOTSUBF
29	R(PER)	R(AP)	V(PER)	V(AP)	PERIOD
30	BETA	ECCENTRICITY	INCLINATION	THETA SUB NS	C SUB 3S
31	TAU	E SUB T	I SUB T	THETA SUB V	C3 SUB T

INITIATION OF RESTART PREPARATIONS (TB6)

1	9661.0000	278102.5	15.0	637748.7	43426616.0
2	25564.8150	24252.8950	21560637.0	21558917.0	119.9579
3	-31346559.0	699511.7	-18615378.0	80.0	29435331.
4	-6596105.6	-138151.8	-509331.4	.1	254.6296
5	-17678124.0	-6532358.9	-21415220.0	-37.1	-43.0006
6	21093.5910	7748.3347	25421.2330	.2516	.0017
7	-6470.2738	49.0793	160.9459	.0009	.0000
8	-10069.7030	824.3897	2700.8947	-.0789	.0000
9	14.7	15.0	-.3	.000	.000
10	.0	.0	-.0	.000	.000
11	.0	.0	-.0	.000	.000
12	-6.0324	-.0679	.0	150389.7	.0000
13	.5593	.0010	.0	9024549.3	.0000
14	.0000	.0000	.0	9022649.2	.0000
15	-6.0325	-.0068	-6.0325	-.0001	519.39
16	.5593	.0001	.5593	-.0068	-1.71
17	.0000	.0000	.0000	.0001	-1.10
18	-.0001	-.0001	.0375	.0000	.0000
19	57.4734	59.3296	59.3296	.0000	.0000
20	300.0000	4.5328	-.0500	-.0137	.9
21	.0002	9.9535	.0000	2470.6458	.00
22	2.0556	.0692	-2.0545	-.252	24252.895
23	-162.5957	-11.6800	-11.6062	-30.3220	.0182
24	.0000	1.0000	-2.3689	.0	.00
25	310.8243	684.5038	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	10845.1508	.0000	.00000	-62345.5	.0000
28	6697172.4	.0000	.00000	-12511.0	.0000
29	3547.7024	3556.5463	25570.0630	25506.4800	88.50152
30	33.41263	.00124	32.59177	.00000	.0
31	491.6870	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(FIRST OPPORTUNITY)

1	9800.0000	278095.6	25.1	638081.7	40177057.0
2	25563.5280	24252.9030	21562866.0	21560747.0	110.0515
3	-28299547.0	1762202.4	-15128808.6	120.6	26959433.
4	-7417728.5	-129527.0	-481046.3	.3	254.2355
5	-18853798.0	-6329716.4	-20750955.0	-47.2	-38.3658
6	22659.4650	7507.5126	24631.5840	-.3419	.0029
7	-5320.8151	74.7836	245.2648	.0019	.0000
8	-6814.7562	2084.7096	6835.1279	-.0620	.0000
9	24.8	25.1	-.3	.000	.000
10	.0	.0	-.0	.000	.000
11	.0	.0	-.0	.000	.000
12	-14.8544	-.0679	.0	150389.5	.0000
13	.6771	.0009	.0	9024546.4	.0000
14	.0000	.0000	.0	9022546.3	.0000
15	-14.8544	-.0679	-14.8544	-.0008	519.39
16	.6771	.0009	.6771	-.0679	-1.71
17	.0000	.0000	.0000	.0009	-1.10
18	.0117	.0111	.0341	.0000	.0000
19	56.0698	58.0239	58.0239	.0000	.0000
20	501.0959	10.2331	-.0500	-.0143	1.1
21	.0002	9.9516	.0000	2471.5593	.00
22	2.1898	.6816	-2.0813	-.251	24252.933
23	-170.1827	-6.7322	-6.6889	-30.3194	.0107
24	.0000	1.0000	-2.3689	.0	.00
25	310.8243	684.5038	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	10845.1508	.0000	.00000	-62345.5	.0000
28	6697172.4	.0000	.00000	-12611.0	.0000
29	3548.2082	3556.7941	25567.7760	25506.0570	88.51561
30	30.43625	.00121	32.59544	.00000	.0
31	447.9798	.97655	30.55942	119.72773	-1418676.0

1	10000.0000	278080.5	35.0	639894.0	35498009.0
2	25561.5110	24251.4350	21565628.0	21562876.0	97.2326
3	-23619871.0	3200360.2	-10410193.7	208.7	23112810.
4	-8292465.3	-111118.3	-420569.7	.9	253.6632
5	-19727486.0	-5739453.1	-18815384.0	-52.5	-31.6347
6	23940.8000	6806.5523	22333.1980	.5481	.0040
7	-3375.2632	108.5386	355.9941	.0048	.0000
8	-1891.5129	3790.1527	12429.4975	.0216	.0000
9	34.8	35.0	-.2	.000	.000
10	.0	.0	-.0	.000	.000
11	.0	.0	-.0	.000	.000
12	-28.4510	-.0679	.0	150389.2	.0000
13	.8261	.0006	.0	9024322.7	.0000
14	.0000	.0000	.0	9022322.7	.0000
15	-28.4510	-.0679	-28.4510	-.0010	519.41
16	.8261	.0006	.8261	-.0679	-1.71
17	.0000	.0000	.0000	.0005	-1.10
18	.0312	.0296	.0275	.0000	.0000
19	55.4059	57.4075	57.4075	.0000	.0000
20	176.7005	20.7971	-.1981	-.0156	1.8
21	.0002	9.9410	.0000	2476.5308	.00
22	2.1402	.6797	-2.0295	-.248	24251.435
23	179.1605	.5949	.5910	-30.3135	-.0011
24	.0000	1.0000	-2.3689	.0	.00
25	310.8243	684.5038	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	10845.1508	.0000	.00000	-62345.5	.0000
28	6697172.4	.0000	.00000	-12611.0	.0000
29	3548.8281	3556.8719	25564.5670	25506.7530	88.52865
30	26.50242	.00113	32.59725	.00000	.0
31	391.6562	.97655	30.55942	119.72773	-1418676.0

1	10200.0000	278000.0	140.5	543342.0	30816539.0
2	25559.5360	24248.3470	21567770.0	21564314.0	84.4122
3	-18803389.0	4459367.5	-6279007.8	341.0	18976437.
4	-8750760.1	-86477.9	-339350.2	2.3	252.9665
5	-19606625.0	+4827867.2	-15825770.9	-33.0	-24.7837
6	24022.1810	5724.5842	18785.3190	.8573	.0152
7	-1174.2067	136.8107	448.7375	.0109	.0000
8	3088.4332	5282.9378	17326.2900	.2569	.0000
9	139.8	140.0	-.2	.000	.000
10	.0	.0	-.0	.000	.000
11	.0	.0	-.0	.000	.000
12	-42.0363	-.0679	.0	150387.3	.0000
13	.9289	.0004	.0	9023127.7	.0000
14	.0000	.0000	.0	9021127.7	.0000
15	-42.0363	-.0679	-42.0363	-.0011	519.49
16	.9289	.0004	.9289	-.0679	-1.71
17	.0000	.0000	.0000	.0004	-1.11
18	.0497	.0471	.0205	.0000	.0000
19	56.3252	58.2621	58.2621	.0000	.0000
20	261.6822	23.1583	-.5350	-.0235	2.9
21	.0002	9.9208	.0000	2485.9895	.00
22	1.9782	.6747	-1.8597	-.241	24248.348
23	168.4759	7.8963	7.8457	-30.3048	-.0126
24	.0000	1.0000	-2.3689	.0	.00
25	310.8243	684.5038	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	10845.1608	.0000	.00000	-62345.5	.0000
28	6697172.4	.0000	.00000	-12611.0	.0000
29	3549.3262	3556.6866	25561.5450	25508.6470	88.53449
30	22.48747	.00104	32.59467	.00000	.0
31	331.1500	.97655	30.55942	119.72773	-1418676.0

1	10204.9999	277997.4	140.0	543448.0	30699485.0
2	25559.5290	24248.2930	21567816.0	21564341.0	84.0917
3	-18683311.0	4487911.9	-6185338.6	345.3	18869783.
4	-8756488.0	-85792.3	-337501.4	2.4	252.9458
5	-19590876.0	-4801367.7	-15738361.9	-31.7	-24.6101
6	24008.7230	5693.1505	18682.2380	.8755	.0152
7	-1116.8700	137.4329	450.7786	.0113	.0000
8	3211.4693	5316.7882	17437.3260	.2735	.0000
9	139.8	140.0	-.2	.000	.000
10	.0	.0	-.0	.000	.000
11	.0	.0	-.0	.000	.000
12	-42.3759	-.0679	.0	150387.2	.0000
13	.9308	.0004	.0	9023088.1	.0000
14	.0000	.0000	.0	9021088.1	.0000
15	-42.3759	-.0679	-42.3759	-.0011	519.49
16	.9308	.0004	.9308	-.0679	-1.71
17	.0000	.0000	.0000	.0004	-1.11
18	.0501	.0475	.0203	.0000	.0000
19	56.3686	58.3025	58.3025	.0000	.0000
20	261.6822	23.2815	-.5350	-.0239	3.0
21	.0002	9.9202	.0000	2486.2801	.00
22	1.9727	.6745	-1.8543	-.241	24248.294
23	168.2052	8.0759	8.0242	-30.3046	-.0129
24	.0000	1.0000	-2.3589	.0	.00
25	310.8243	684.5038	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	10845.1608	.0000	.00000	-62345.5	.0000
28	6697172.4	.0000	.00000	-12611.0	.0000
29	3549.3910	3556.6484	25561.1260	25508.9680	88.53499
30	20.16984	.00102	32.59456	.00000	.0
31	297.0277	.97655	30.55942	119.72773	-1418676.0

#					
1	10220.0000	277989.3	140.0	643770.2	30348319.0
2	25559.5070	24248.1220	21567950.0	21564420.0	83.1302
3	-18323509.0	4572595.1	-5907446.7	358.8	18548946.
4	-8771948.0	-83716.9	-330794.3	2.5	252.8827
5	-19539940.0	-4720860.8	-15474824.6	-27.2	-24.0886
6	23963.8190	5597.6530	18369.0740	.9297	.0162
7	-944.3466	139.2727	456.8135	.0125	.0000
8	3579.8050	5417.2117	17766.7360	.3238	.0000
9	139.8	140.0	-.2	.000	.000
10	.0	.0	-.0	.000	.000
11	.0	.0	-.0	.000	.000
12	-43.3947	-.0679	.0	150387.0	.0000
13	.9363	.0004	.0	9022969.1	.0000
14	.0000	.0000	.0	9020969.1	.0000
15	-43.3948	-.0679	-43.3948	-.0011	519.50
16	.9363	.0004	.9363	-.0679	-1.71
17	.0000	.0000	.0000	.0004	-1.11
18	.0513	.0487	.0198	.0000	.0000
19	56.5049	58.4293	58.4292	.0000	.0000
20	261.6822	23.6505	-.5350	-.0246	3.2
21	.0002	9.9184	.0000	2487.1641	.00
22	1.9561	.6740	-1.8365	-.240	24248.122
23	167.3915	8.6135	8.5584	-30.3038	-.0137
24	.0000	1.0000	-2.3689	.0	.00
25	310.8243	684.5038	.00000	.0	.00
26	.00000	.0000	.00000	.0	.00
27	10845.1508	.0000	.00000	-62345.5	.0000
28	6697172.4	.0000	.00000	-12611.0	.0000
29	3549.4035	3556.7127	25561.1740	25508.6440	88.53642
30	20.53242	.00103	32.59419	.00000	.0
31	302.3683	.97655	30.65942	119.72773	-1418676.0

SECOND S-IVB ENGINE START COMMAND

#					
1	10230.9999	277983.5	.0	644011.4	30090795.0
2	25559.4890	24247.9900	21568047.0	21564475.0	82.4250
3	-18060107.0	4633778.5	-5706568.0	369.3	18312847.
4	-8781637.8	-82177.6	-325745.5	2.7	252.8351
5	-19499081.0	-4660871.8	-15278079.7	-23.4	-23.7053
6	23926.5770	5526.4954	18135.7280	.9688	.0162
7	-817.3634	140.5960	461.1540	.0134	-.0000
8	3849.1337	5489.7661	18004.7300	.3613	-.0000
9	139.8	.0	-.2	.000	-.000
10	-.0	-.0	-.0	-.045	-.022
11	-.0	.0	-.0	.033	.034
12	-44.1419	-.0679	140.0	150386.9	-.0000
13	.9402	.0004	.0	9022881.8	.0000
14	.0000	.0000	.0	9020881.9	.0000
15	-44.1419	-.0679	-44.1419	-.0011	519.50
16	.9402	.0003	.9402	-.0679	-1.71
17	.0000	.0000	.0000	.0004	-1.11
18	.0522	.0496	.0195	.0000	.0000
19	56.6106	58.5276	58.5276	.0000	.0000
20	261.6958	23.9203	-.5350	-.0252	3.4
21	.0002	9.9170	.0000	2487.8257	.00
22	1.9436	.6736	-1.8233	-.239	24247.990
23	166.7933	9.0064	8.9489	-30.3033	-.0143
24	.0000	1.0000	-2.3689	.0	.00
25	310.8243	684.5038	.00000	.0	.00
26	310.82429	.0000	.00000	.0	.00
27	10845.1608	.0000	.00000	-62345.5	-.0000
28	6697172.4	.0000	.00000	-12611.0	-.0037
29	3549.4047	3556.7652	25561.2620	25508.3640	88.53743
30	21.10442	.00104	32.59391	.00000	.0
31	310.7916	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(FIRST OPPORTUNITY)

1	10235.0000	277969.2	469.3	644099.9	29997148.0
2	25559.6850	24248.1420	21568082.0	21564495.0	82.1686
3	-17964432.0	4655832.1	-5634295.1	373.3	18226822.
4	-8784814.8	-81614.3	-323897.7	2.7	252.8175
5	-19483489.0	-4638860.5	-15205889.0	-21.9	-23.5657
6	23912.3310	5500.4305	18050.2530	1.0250	.0705
7	-771.0964	141.0726	462.7177	.0147	-.0000
8	3946.9253	5515.9608	18090.6540	.4151	.0001
9	609.1	469.3	-.2	.075	-.000
10	-.0	-.0	-.0	61.129	-.022
11	.5	.5	-.0	-66.009	.034
12	-44.4109	-.0665	140.0	150386.6	-.0027
13	.9387	-.0012	.0	9022570.8	.0029
14	.0000	-.0000	.0	9020670.7	.0000
15	-44.4136	-.0679	-44.4136	-.0011	519.52
16	.9416	.0003	.9416	-.0665	-1.71
17	.0000	.0000	.0000	-.0012	-1.11
18	.0526	.0499	.0194	.0025	.0014
19	56.6503	58.5645	58.5645	.0632	-.0013
20	156.0157	23.9203	-3.9054	-.0252	3.4
21	.0002	9.9166	.0000	2488.0685	.00
22	1.9372	.6761	-1.8155	-.239	24248.142
23	166.5754	9.1490	9.0906	-30.3030	-.0146
24	.0000	1.0000	-2.3689	.0	.00
25	310.8243	684.5038	.00000	.0	.00
26	310.82429	.0000	.00000	.0	.00
27	10845.1638	.0000	.00000	-62345.5	-.0000
28	6697172.4	.0000	.00000	-12623.1	-3.3704
29	3549.4450	3556.8567	25561.2080	25507.9450	88.53989
30	19.48483	.00104	32.59380	.00000	.0
31	286.9429	.97655	30.55942	119.72773	-1418675.0

1	10239.9999	277934.3	37131.0	644211.9	29880089.0
2	25560.8620	24249.2630	21568125.0	21564519.0	81.8481
3	-17844916.0	4683252.3	-5544313.2	378.6	18119164.
4	-8788525.6	-80907.5	-321579.3	2.8	252.7952
5	-19463449.0	-4611199.3	-15115169.0	-19.6	-23.3911
6	23894.7700	5467.8769	17943.5020	1.2122	4.3145
7	-713.1994	141.6689	464.6735	.0189	-.0011
8	4069.1669	5548.7303	18198.1460	.6015	.0039
9	37270.7	37131.0	-.2	5.670	-.000
10	-9.4	-9.4	-.0	4597.212	-.022
11	33.7	33.7	-.0	-4953.176	.034
12	-44.7373	-.0584	140.0	150385.8	-.0159
13	.9261	-.0100	.0	9022186.1	.0172
14	.0000	-.0001	.0	9020186.1	.0000
15	-44.7533	-.0679	-44.7533	-.0009	519.55
16	.9433	.0003	.9433	-.0583	-1.71
17	.0000	.0000	.0000	-.0100	-1.11
18	.0530	.0503	.0193	.0146	.0051
19	56.7008	58.6114	58.6114	.0521	-.0047
20	499.9167	23.9203	-74.5543	-.0252	3.4
21	.0002	9.9165	.0000	2488.3758	.00
22	1.9225	.6891	-1.7950	-.239	24249.254
23	166.3028	9.3271	9.2675	-30.3028	-.0148
24	.0000	1.0000	-2.3689	.0	.00
25	310.8243	684.5038	.00000	.0	.00
26	310.82429	.0000	.00000	.0	.00
27	10845.1608	.0000	.00000	-62356.0	-41.8374
28	6697172.4	.0000	.00000	-12644.9	-32.1819
29	3549.4469	3557.5388	25562.4230	25504.2790	88.55267
30	18.87516	.00114	32.59367	.00000	.0
31	277.9519	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(FIRST OPPORTUNITY)

1	10245.0000	276190.6	193503.7	644329.1	29762830.0
2	25650.3970	24338.7270	21568172.0	21564547.0	81.5270
3	-17725293.0	4710552.7	-5454723.4	426.5	18011185.
4	-8791949.4	-80197.0	-319249.1	3.5	252.7727
5	-19442769.0	-4583332.0	-15023772.7	24.7	-23.2160
6	23963.9070	5454.3417	17899.1470	20.2035	22.5551
7	-656.5921	142.4493	467.2335	.2129	-.2098
8	4204.0094	5600.1902	18366.9580	19.2822	-.2038
9	193627.2	193487.4	-.2	-83.094	-.000
10	-1800.8	-1799.9	-.0	-43413.126	-.022
11	-1749.5	-1746.0	-.0	35449.398	.035
12	-45.1062	-.4099	140.0	150344.8	-1.3940
13	.5623	.1080	.0	8996274.5	1.0899
14	-.0000	.0013	.0	8994274.6	.0000
15	-46.5004	-1.0000	-46.5004	-.0040	521.27
16	1.6521	.7052	1.6521	-.4099	-1.72
17	.0000	.0000	.0000	.1080	-1.12
18	.0586	.0556	.0240	.5330	.3284
19	56.7571	58.6573	58.6572	-.5170	-.2799
20	429.6668	433.4778	-450.6456	-393.0920	170374.3
21	.0002	9.9524	.0000	2488.6974	.00
22	1.5623	.6549	-1.4185	-.241	24338.727
23	166.0295	9.5051	9.4445	-30.3025	-.0151
24	.0000	1.0000	-2.3273	.0	3135.65
25	331.1893	623.5358	.00000	.0	451.17
26	310.82429	-.9406	.00000	.0	328.39
27	10813.8388	.1429	-.14457	-63752.1	-374.5865
28	6735555.3	.1033	.12222	-12989.8	-75.5241
29	3549.6280	3607.7274	25650.7100	25237.6270	89.49574
30	3.17009	.00812	32.59561	.00000	.0
31	46.5223	.97655	30.55942	119.72773	-1418676.0

1	10249.9999	273902.2	200954.5	644456.9	29645052.0
2	25766.7300	24454.8980	21568229.0	21564584.0	81.2046
3	-17605239.0	4737802.3	-5365299.5	588.5	17902595.
4	-8795085.8	-79481.8	-316903.2	6.1	252.7497
5	-19421398.0	-4555187.4	-14931465.4	184.5	-23.0400
6	24058.2040	5454.2907	17869.5050	44.3452	23.6212
7	-595.9652	144.0528	472.4941	1.2206	.1057
8	4346.2297	5658.2827	18557.5310	-45.2318	.0831
9	201091.0	200951.2	-.2	18.222	-.000
10	899.8	893.2	-.0	43904.819	-.023
11	707.3	705.7	-.0	-60921.745	.035
12	-48.3862	.1757	140.0	150291.1	-.0070
13	1.9071	-.7396	.0	8962313.1	-.6873
14	.0000	-.0058	.0	8960313.1	.0000
15	-48.3932	-.0254	-48.3932	.0058	523.51
16	1.2198	-.3785	1.2198	.1756	-1.74
17	.0000	-.0000	.0000	-.7396	-1.13
18	.0575	.0545	.0225	-.2547	.5386
19	56.8218	58.7091	58.7090	.2012	-.5337
20	430.8797	434.5584	-466.6992	-431.0858	187351.5
21	.0002	9.9992	.0000	2489.0479	.00
22	3.5687	-2.2849	-2.7443	-.243	-24454.899
23	165.7545	9.6837	9.6220	-30.3022	-.0154
24	.0000	1.0000	-2.3552	.0	3097.92
25	306.7928	584.5286	.00000	.0	406.52
26	316.42105	-.1802	.00000	.0	328.72
27	10835.3655	.1305	-.12935	-65656.3	-389.0286
28	6709141.9	.1048	.15764	-13371.4	-77.1356
29	3549.6622	3674.4811	25766.8640	24891.5870	90.75134
30	1.43189	.01728	32.59293	.00000	.0
31	20.9187	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(FIRST OPPORTUNITY)

1	10259,9999	269168.3	201585,3	544704.7	29407780.0
2	26005,0870	24693,1990	21568330,0	21564647,0	80,5549
3	-17363705,0	4792163,0	-5186905,9	1274,3	17683411,
4	-8600463,2	-78035,9	-312160,5	18,0	252.7025
5	-19376481,0	-4498016,7	-14743962,9	906,3	-22.6849
6	24249,0040	5426.8947	17809,2560	92.9265	24.1240
7	-480,2431	144,8255	475,0284	.8562	-.1269
8	4637,8082	5776,0435	18943,8470	99,3728	-.0728
9	201821,4	201681,6	-,2	12,254	-,000
10	-1061.7	-1060.7	-,0	-2223.898	-,024
11	-609,4	-608,8	-,0	7936,862	.037
12	-48,3943	-,0605	140,0	150179,9	-.2514
13	-,2642	.1144	,0	8892058,0	.4538
14	-,0000	-,0000	,0	8890058,0	.0000
15	-48,6457	-,0316	-48.6457	,0003	528.17
16	,1896	.1021	.1896	-,0605	-1.78
17	,0000	.0000	,0000	.1144	-1.16
18	,0503	.0573	,0242	,3013.	-,0535
19	56,9351	58.7983	58.7983	-,1730	.0449
20	425,3327	429.7146	-474,5030	-453.9571	194985,9
21	,0002	10.0953	,0000	2489.7275	.00
22	1,6972	-1,6052	-,5516	-,247	24693,199
23	165,1997	10.0426	9.9787	-30.3016	-,0159
24	,0000	1,0000	-2,3629	,0	3026.46
25	290,8419	563.5226	,00000	,0	374.61
26	292,25500	,0025	,00000	,0	332.90
27	10840,9345	.1232	-,12825	-69602,3	-395.5750
28	6702333,0	.1087	,16302	-14154,0	-78,3930
29	3549,6873	3816.2474	26005,1590	24188,7320	93,43623
30	,73812	,03619	32,50457	,00000	,0
31	10,6841	,97655	30.55942	119.72773	-1418676,0

A077 CODE 76 FOR V, L, TABLE 125, I. V. = .60025000+03   T = .10261250+05

1	10280,0000	259659.4	202514,6	545418,4	28926199,0
2	26496,6620	25184,3950	21568730,0	21564973,0	79,2363
3	-16874871,0	4900329,5	-4831936,1	4119,6	17236944,
4	-8807691,5	-75110,1	-302563,9	41,9	252.6028
5	-19277881,0	-4380126.4	-14357312,9	4010,6	-21.9613
6	24635,8340	5389,6558	17687,2990	191,9357	25.1103
7	-239,1362	148.6562	487,5952	2,4476	-.1068
8	5222,2895	6013,5372	19722,9530	212.0777	-.0700
9	202651,8	202512,0	-,3	,021	-,000
10	-861,6	-860,9	-,0	19,339	-,026
11	-565,1	-564.7	-,0	-20,258	.040
12	-49,3367	-,0428	140,0	149956,6	-.2490
13	1,7478	.0698	,0	8750938,8	.3854
14	-,0000	.0000	,0	8748938,7	.0000
15	-49,5858	-,0415	-49.5858	-,0013	537.52
16	2,1332	.0686	2,1332	-,0428	-1.86
17	,0000	.0000	,0000	,0698	-1.22
18	,1134	.1077	,0726	,2436	,0008
19	57,1975	59.0083	59.0082	-,1598	-,0003
20	425,7350	427,5163	-476,0050	-465,1208	198782,7
21	,0002	10.2920	,0000	2491,6855	.00
22	2,7789	-1,2061	-2,5043	-,255	25184,396
23	164,0694	10.7674	10,6991	-30,2999	-,0170
24	,0000	1,0000	-2,3621	,0	2875,36
25	271,9701	545,7247	-,00513	,0	353.28
26	274,08239	-,0007	,00827	,0	339.85
27	10840,3420	.1223	-,11740	-77528,6	-395.5762
28	6703056,7	.1168	,14677	-15725,9	-78.8938
29	3549,7224	4131,6685	26496,9480	22764,8490	99,50235
30	1,04129	,07576	32,51210	,00000	,0
31	14,7933	,97655	30.55942	119.72773	-1418676,0

1	10300.0000	250138.9	202745.3	646891.5	28434921.0
2	27007.1410	25694.0180	21569866.0	21566035.0	77.8912
3	-16378234.5	5007741.8	-4479436.2	8965.9	16779555.
4	=8809920.5	-72062.3	-292567.2	143.8	252.4944
5	-19167586.0	-4257459.6	-13954992.9	9429.4	-21.2177
6	25029.1300	5351.5400	17562.4710	293.0840	26.0957
7	18.6955	156.7359	514.1027	8.3654	-.1131
8	5807.3105	6253.6054	20510.5100	330.7548	-.0747
9	202882.3	202742.5	-.3	-.075	-.030
10	-879.2	-878.5	-.0	42.336	-.028
11	-560.6	-580.3	-.0	-94.499	.043
12	-50.0504	-.0311	140.0	149733.0	-.2434
13	3.0695	.0654	.0	8609647.8	.3858
14	.0000	.0000	.0	8607647.9	.0000
15	-50.3011	-.0308	-50.3011	-.0017	546.87
16	3.4553	.0647	3.4553	-.0311	-1.94
17	.0000	.0000	.0000	.0654	-1.28
18	.2289	.2178	.1906	.2483	.0002
19	57.5114	59.2685	59.2583	-.1640	-.0002
20	426.4062	427.0278	-475.7964	-468.8486	200165.8
21	.0002	10.4918	.0000	2495.7265	.00
22	3.7874	-.6239	-3.7359	-.263	25694.019
23	162.9100	11.5009	11.4282	-30.2950	-.0181
24	.0000	1.0000	-2.3631	.0	2719.00
25	251.5898	525.0281	-.00704	.0	327.07
26	253.57500	.0000	.01141	.0	342.79
27	10841.0664	.1197	-.10885	-85455.1	-395.9027
28	6702171.8	.1245	.13492	-17309.2	-79.3587
29	3549.7824	4496.8734	27008.2840	21320.0430	106.63335
30	1.71786	.11770	32.59198	.00000	.0
31	23.9448	.97655	30.55942	119.72773	-1418676.0

1	10319.9999	240611.6	203477.1	649747.0	27933602.0
2	27536.7940	26222.4050	21572359.0	21568456.0	76.5186
3	-15873664.0	5114387.0	-4129448.0	15360.2	16311132.
4	-8806848.7	-68615.9	-281918.6	401.9	252.3752
5	=19045594.0	-4129968.8	+13536848.0	17279.4	-20.4538
6	25429.7380	5313.0949	17436.5700	396.8722	27.2268
7	290.6657	168.4492	552.5310	18.0005	-.1207
8	6392.0514	6496.0191	21305.7700	455.3223	-.0799
9	203613.9	203474.2	-.3	.148	-.000
10	-902.5	-901.9	-.0	45.383	-.030
11	-597.9	-597.6	-.0	-13.373	.045
12	-50.6615	-.0286	140.0	149509.3	-.2416
13	4.1400	.0555	.0	8468255.0	.3830
14	.0000	.0000	.0	8466255.0	.0000
15	-50.9038	-.0274	-50.9038	-.0021	556.24
16	4.5230	.0603	4.5230	-.0285	-2.32
17	.0000	.0000	.0000	.0555	-1.34
18	.4121	.3924	.3534	.2540	.0036
19	57.8726	59.5744	59.5740	-.1683	.0012
20	426.8269	426.9265	-477.0416	-470.7645	200947.3
21	.0002	10.6908	.0000	2503.5597	.00
22	4.6924	.0420	-4.6922	-.267	26222.406
23	161.7195	12.2423	12.1652	-30.2883	-.0192
24	.0000	1.0000	-2.3649	.0	2556.90
25	230.5994	502.9628	-.00774	.0	298.64
26	232.60588	-.0001	.01231	.0	342.39
27	10842.3327	.1163	-.10140	-93381.0	-396.8057
28	6700624.9	.1322	.12527	-18899.9	-79.7059
29	3549.8763	4924.1494	27540.0270	19853.9240	115.29439
30	2.53377	.16217	32.55019	.00000	.0
31	34.6384	.97655	30.65942	119.72773	-1418676.0

1	10339.9999	231088.6	202914.3	654679.7	27421899.0
2	28085.5810	26769.5200	21576904.0	21572928.0	75.1176
3	-15360996.6	5220263.2	-3781976.1	24859.9	15831571.
4	-8798205.0	-65300.9	-270389.0	387.9	252.2430
5	-18911912.0	-3997605.1	-13102717.0	27682.3	-19.6569
6	25838.2120	5274.5911	17310.4840	503.5190	28.2734
7	576.4075	183.7883	602.8553	31.3497	-.1259
8	6975.7981	6740.6931	22108.4510	585.8634	-.0853
9	203051.1	202911.3	-.3	-.858	-.000
10	-911.8	-911.2	-.0	-50.027	-.031
11	-612.6	-612.4	-.0	-200.905	.047
12	-51.1705	-.0252	140.0	149297.6	-.2444
13	5.4704	.0605	.0	8321537.2	.3892
14	.0000	.0000	.0	8319537.3	.0000
15	-51.4161	-.0263	-51.4161	-.0024	565.92
16	5.8595	.0555	5.8595	-.0251	-2.11
17	.0000	.0000	.0000	.0605	-1.40
18	.6554	.6342	.5934	.2573	-.0033
19	58.2806	59.9259	59.9251	-.1729	-.0012
20	427.3090	426.9589	-475.1862	-471.8582	201436.7
21	.0002	10.8845	.0000	2517.0911	.00
22	5.9341	.7606	-5.8859	-.268	26769.520
23	160.4960	12.9909	12.9094	-30.2747	-.0202
24	.0000	1.0000	-2.3541	.0	2388.34
25	211.4712	484.8576	-.00798	.0	274.16
26	213.46982	-.0000	.01327	.0	338.77
27	10841.7301	.1143	-.09478	-101298.3	-394.8643
28	6701361.0	.1400	.11095	-20495.0	-79.7859
29	3550.0079	5429.8495	28092.7820	18366.9180	125.77018
30	3.42933	.20934	32.48857	.00000	.0
31	45.9660	.97655	30.55942	119.72773	-1418676.0

1	10360.0000	221590.0	203431.3	562446.9	26899529.0
2	28652.8140	27334.6250	21584257.0	21580211.0	73.5874
3	-14840085.4	5325368.2	-3437028.8	36020.2	15340329.
4	-8783691.0	-51436.1	-257711.8	1684.8	252.0953
5	-18766582.0	-3850328.6	-12652469.0	40753.7	-18.8314
6	26254.5810	5236.1225	17184.5210	613.0352	29.5573
7	877.4800	203.3615	667.0712	49.0303	-.1347
8	7557.0310	6987.4334	22917.9200	722.3454	-.0898
9	203568.0	203428.3	-.3	.024	-.000
10	-927.8	-927.2	-.0	23.659	-.032
11	-618.3	-618.0	-.0	-19.439	.048
12	-51.6816	-.0251	140.0	149264.4	-.2453
13	6.5864	.0568	.0	8096840.9	.3911
14	.0000	.0000	.0	8094840.9	.0000
15	-51.9286	-.0341	-51.9286	-.0029	580.27
16	6.9775	.0186	6.9775	-.0250	-2.19
17	.0000	.0000	.0000	.0568	-1.46
18	.9904	.9448	.9023	.2612	.0001
19	56.7394	60.3269	60.3257	-.1741	-.0000
20	427.3574	427.0361	-476.3308	-472.3773	201699.7
21	.0002	11.0675	.0000	2538.3980	.00
22	6.9865	1.4365	-6.8401	-.252	27334.625
23	159.2376	13.7455	13.6597	-30.2533	-.0213
24	.0000	1.0000	-2.3547	.0	2213.81
25	191.2016	464.1501	-.00816	.0	245.94
26	193.56002	-.0022	.01326	.0	331.20
27	10842.2135	.1106	-.08883	-109190.1	-395.8276
28	6700770.7	.1476	.10052	-22091.2	-79.9682
29	3550.1787	6035.8623	28666.5330	16861.1060	138.71788
30	4.38417	.25930	32.40527	.00000	.0
31	57.6022	.97655	30.55942	119.72773	-1418676.0

1	10379.9999	212058.3	203530.0	673859.8	26366197.0
2	29242.7010	27921.9770	21595234.0	21591119.0	72.2272
3	-14310729.8	5429712.0	-3094573.6	49406.7	14838854.
4	-8763012.2	-57141.1	-243523.2	2275.2	251.9289
5	-18609637.0	-3718086.6	-12185930.6	56625.9	-17.9690
6	26683.2540	5198.5541	17061.5170	726.1956	30.9150
7	1192.8923	226.7948	743.9517	70.6804	-.1419
8	8137.3986	7237.3686	23737.8780	866.0815	-.0949
9	203766.6	203626.9	-.2	-.405	-.000
10	-935.4	-934.8	-.0	-18.096	-.032
11	-625.6	-625.3	-.0	-96.985	.047
12	-52.2247	-.0264	140.0	149230.8	-.2489
13	7.5483	.0570	.0	7871363.8	.3940
14	.0000	.0000	.0	7869363.7	.0000
15	-52.4758	-.0268	-52.4758	-.0035	594.67
16	7.9423	.0563	7.9423	-.0261	-2.28
17	.0000	.0000	.0000	.0570	-1.52
18	1.3872	1.3246	1.2805	.2630	.0003
19	59.2461	60.7747	60.7730	-.1759	-.0000
20	427.3413	427.0820	-476.8246	-472.9849	201984.2
21	.0002	11.2362	.0000	2569.7059	.00
22	7.8815	2.0399	-7.6193	-.250	27921.978
23	157.9425	14.5052	14.4150	-30.2215	-.0223
24	.0000	1.0000	-2.3655	.0	2031.54
25	170.7930	443.0523	-.00830	.0	216.29
26	172.79294	-.0000	.01340	.0	320.20
27	10842.7715	.1061	-.08367	-117109.4	-396.1374
28	6700989.1	.1555	.09055	-23692.9	-80.1521
29	3550.3966	6779.7029	29266.1030	15326.0800	155.17854
30	5.38006	.31261	32.30475	.00000	.0
31	69.2639	.97655	30.55942	119.72773	-1418676.0

1	10399.9999	202550.4	202910.1	689787.9	25821626.0
2	29852.9540	28529.2210	21610701.0	21606520.0	70.7342
3	-13772690.3	5533310.9	-2754556.9	65089.4	14325612.
4	-8735862.5	-52331.9	-227847.5	4545.3	251.7404
5	-18441112.0	-3570818.5	-11702903.5	75442.2	-17.0633
6	27122.7530	5161.6249	16940.6150	842.6254	32.2529
7	1525.2429	255.0325	836.5951	1016.7154	-.1497
8	8714.7201	7489.9529	24566.5340	-.054	-.0998
9	203045.7	202907.0	-.2	-5.913	-.000
10	-942.3	-941.7	-.0	-4.771	-.030
11	-628.4	-628.1	-.0	149197.4	.045
12	-52.7399	-.0285	140.0	149197.4	-.2530
13	8.8041	.0502	.0	7546448.0	.3893
14	.0000	.0000	.0	7544448.0	.0000
15	-52.9961	-.0287	-52.9961	-.0044	609.03
16	9.1934	.0513	9.1934	-.0282	-2.36
17	.0000	.0000	.0000	.0502	-1.58
18	1.8570	1.7746	1.7292	.2659	.0004
19	59.8066	61.2755	61.2730	-.1774	.0001
20	427.4575	427.1263	-475.0108	-473.2893	202137.8
21	.0002	11.3842	.0000	2613.4001	.00
22	9.0465	2.6328	-8.6671	-.230	28529.221
23	156.6085	15.2685	15.1741	-30.1774	-.0233
24	.0000	1.0000	-2.3647	.0	1841.72
25	151.5025	424.7422	-.00840	.0	188.32
26	153.50485	-.0000	.01372	.0	304.81
27	10842.1800	.1019	-.07903	-125003.4	-394.2759
28	6700811.5	.1632	.07702	-25296.1	-80.1990
29	3550.6622	7738.0891	29889.8560	13768.4943	176.56672
30	6.41677	.36926	32.18360	.00000	.0
31	80.9271	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(FIRST OPPORTUNITY)

1	10420.0000	193052.6	202809.3	711158.2	25265603.0
2	30485.9480	29158.7410	21631588.0	21627346.0	69.2138
3	-13225732.5	5636181.5	-2416925.3	83135.9	13801145.
4	-8701888.0	-46907.3	-210052.8	6798.9	251.5252
5	-18261067.0	-3418467.2	-11203199.2	97346.9	-16.1068
6	27575.7160	5125.7989	16823.3390	962.6471	33.8228
7	1875.2623	238.2710	945.6453	128.9758	-.1584
8	9289.5361	-7745.8847	25406.1830	1175.1339	-.1057
9	202945.9	202806.1	-.2	-.115	-.000
10	-950.5	-949.9	-.0	-3.332	-.028
11	-634.2	-633.8	-.0	-27.584	.042
12	-53.3271	-.0308	140.0	149163.9	-.2578
13	9.8680	.0539	.0	7364577.1	.3966
14	.0000	.0000	.0	7362577.0	.0000
15	-53.5890	-.0315	-53.5890	-.0053	626.70
16	10.2646	.0540	10.2646	-.0304	-2.47
17	.0000	.0000	.0000	.0539	-1.65
18	2.3994	2.2948	2.2483	.2684	.0001
19	60.4217	61.8301	61.8266	-.1791	-.0000
20	427.4659	427.1639	-474.7655	-473.4683	202234.0
21	.0002	11.5071	.0000	2672.0233	.00
22	9.9776	3.1125	-9.4981	-.204	29158.742
23	155.2337	16.0340	15.9355	-30.1181	-.0243
24	.0000	1.0000	-2.3646	.0	1643.52
25	131.6337	404.9307	-.00861	.0	158.39
26	133.61812	.0000	.01376	.0	284.86
27	10842.1412	.0961	-.07458	-132886.0	-393.9878
28	6700859.0	.1708	.06609	-26900.5	-80.2427
29	3550.9866	8901.5239	30540.7320	12183.2759	205.38036
30	7.48698	.42968	32.04329	.00000	.0
31	92.4746	.97655	30.55942	119.72773	-1418676.0

1	10440.0000	183559.8	202707.2	738954.1	24697912.0
2	31144.0630	29812.9240	21658879.0	21654578.0	67.6594
3	-12669559.1	5738349.6	-2081592.5	103620.6	13265509.
4	-8660727.0	-40765.6	-189905.3	9740.9	251.2781
5	-18069545.0	-3260957.4	-10686571.6	122505.6	-15.0901
6	28044.7000	5091.4413	16710.8860	1086.4614	35.5541
7	2244.1838	326.8283	1072.1464	166.1697	-.1682
8	9862.4992	8005.9113	26259.2760	1342.2739	-.1125
9	202843.8	202703.9	-.2	-.378	-.000
10	-959.9	-959.3	-.0	-64.304	-.025
11	-641.7	-641.3	-.0	-23.092	.037
12	-53.9894	-.0356	140.0	149130.5	-.2659
13	10.9353	.0529	.0	7042140.9	.3988
14	.0000	.0001	.0	7040140.9	.0000
15	-54.2604	-.0366	-54.2604	-.0068	646.73
16	11.3341	.0529	11.3341	-.0350	-2.59
17	.0000	.0000	.0000	.0529	-1.73
18	3.0137	2.8848	2.8374	.2711	.0001
19	61.0928	62.4400	62.4354	-.1813	-.0003
20	427.4708	427.1945	-474.5211	-473.5866	202300.6
21	.0002	11.6009	.0000	2748.2732	.00
22	10.8551	3.4776	-10.3079	-.173	29812.924
23	153.8161	16.7999	16.6974	-30.0412	-.0252
24	.0000	1.0000	-2.3645	.0	1435.84
25	111.7821	385.1710	-.00889	.0	128.10
26	113.76760	.0000	.01386	.0	260.07
27	10842.0593	.0890	-.07015	-140763.5	-393.7653
28	6700959.1	.1785	.05538	-28505.2	-80.2198
29	3551.3890	10494.0635	31221.5960	10565.9766	246.02380
30	8.58483	.49430	31.88483	.00000	.0
31	103.8135	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(FIRST OPPORTUNITY)

1	10459.9999	174037.0	203559.2	774211.9	24118345.0
2	31832.6250	30497.1130	21693512.0	21689256.0	66.0726
3	-12103805.2	5839850.7	-1748442.0	126623.4	12718791.
4	-8611986.0	-33797.1	-167045.3	13484.0	250.9927
5	-17866567.0	-3098193.7	-10152706.7	151108.4	-14.0022
6	28534.7410	5059.2309	16605.4820	1214.5537	37.6570
7	2633.3272	370.9066	1216.7608	209.0620	-.1797
8	10435.9013	8271.6267	27131.0440	1519.9304	-.1201
9	203695.7	203555.9	-.1	-.426	-.000
10	-971.8	-971.1	-.0	-35.623	-.021
11	-649.8	-649.3	-.0	-83.243	.032
12	-54.8037	-.0426	140.0	149094.8	-.2757
13	11.8259	.0575	.0	6708485.6	.4078
14	.0000	.0001	.0	6706485.5	.0000
15	-55.0855	-.0436	-55.0855	-.0087	667.38
16	12.2336	.0568	12.2335	-.0417	-2.71
17	.0000	.0000	.0000	.0575	-1.81
18	3.6986	3.5433	3.4951	.2733	.0009
19	61.8204	63.1057	63.0998	-.1828	.0002
20	427.3097	427.2090	-476.6938	-473.8203	202408.5
21	.0001	11.6858	.0000	2834.2281	.00
22	11.4835	3.6486	-10.9175	-.141	30497.114
23	152.3538	17.5644	17.4580	-29.9440	-.0260
24	.0000	1.0000	-2.3552	.0	1215.77
25	91.3905	363.5341	-.00932	.0	97.09
26	93.38055	.0000	.01385	.0	230.35
27	10842.5255	.0796	-.06519	-148669.7	-395.8477
28	6700389.4	.1865	.04790	-30111.1	-80.3110
29	3551.9060	12737.5442	31938.1070	8906.0454	307.27920
30	9.70149	.56390	31.71019	.00000	.0
31	114.8132	.97655	30.65942	119.72773	-1418676.0

1	10479.9999	164531.4	202865.2	818017.9	23526692.0
2	32551.2950	31210.9230	21736875.0	21732471.0	64.4526
3	-11528040.8	5940726.5	-1417339.0	152226.1	12161126.
4	-8555232.0	-25884.1	-141086.5	18150.0	250.6610
5	-17652116.0	-2930056.2	-9601211.8	183373.8	-12.8292
6	29045.3990	5028.7350	16505.7060	1346.2833	39.6959
7	3046.7252	421.6657	1383.2945	258.8395	-.1913
8	11009.2689	8543.2010	28022.0460	1708.4804	-.1280
9	203001.6	202861.7	-.1	-.435	-.000
10	-978.5	-977.9	-.0	-100.188	-.017
11	-654.4	-653.7	-.0	-5.637	.026
12	-55.7309	-.0541	140.0	149037.5	-.2910
13	13.0398	.0444	.0	6273227.6	.3949
14	.0000	.0002	.0	6271227.5	.0000
15	-56.0298	-.0552	-56.0298	-.0122	693.65
16	13.4347	.0459	13.4347	-.0527	-2.86
17	.0000	.0000	.0000	.0444	-1.91
18	4.4518	4.2682	4.2195	.2762	.0000
19	62.6109	63.8336	63.8262	-.1846	-.0001
20	427.4133	427.2248	-474.9542	-473.9429	202469.4
21	.0001	11.7615	.0000	2930.3630	.00
22	12.3495	3.6729	-11.8224	-.110	31210.924
23	150.8446	18.3255	18.2153	-29.8237	-.0267
24	.0000	1.0000	-2.3646	.0	986.08
25	71.8144	344.9273	-.00980	.0	68.19
26	73.81340	.0000	.01416	.0	194.52
27	10842.1113	.0690	-.06001	-156560.0	-394.2142
28	6700895.4	.1943	.03556	-31715.7	-80.2049
29	3552.5813	16114.7925	32690.1870	7206.7043	407.65530
30	10.83436	.63873	31.51673	.00000	.0
31	125.4454	.97655	30.65942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(FIRST OPPORTUNITY)

1	10500.0000	155033.6	202813.2	871497.6	22922812.0
2	33304.9820	31959.2840	21789797.0	21785348.0	62.7990
3	-10941828.2	6041009.5	-1088174.2	180498.0	11592794.
4	-8489942.7	-15884.6	-111562.8	23885.0	250.2730
5	-17426174.0	-2756416.0	-9031561.7	219533.6	-11.5545
6	29580.4200	5000.0060	16411.7280	1481.4463	42.1181
7	3487.0159	479.5060	1573.0512	315.9255	-.2045
8	11585.9960	8822.3498	28937.9080	1909.8200	-.1370
9	202949.7	202809.7	-.1	-.725	-.000
10	-985.5	-984.9	-.0	-139.429	-.014
11	-560.4	-659.5	-.0	-49.300	.020
12	-56.9386	-.0690	140.0	148980.3	-.3098
13	14.0159	.0497	.0	5826379.9	.4040
14	.0000	.0003	.0	5824379.8	.0000
15	-57.2582	-.0704	-57.2582	-.0167	720.52
16	14.4198	.0497	14.4198	-.0669	-3.02
17	.0000	.0000	.0000	.0497	-2.31
18	5.2589	5.0554	5.0066	.2782	.0002
19	63.4553	64.6248	64.6157	-.1863	-.0001
20	427.4090	427.2391	-474.8373	-474.0164	202508.5
21	.0001	11.8093	.0000	3047.7279	.00
22	12.8844	3.3757	-12.4625	-.081	31959.285
23	149.2854	19.0808	18.9669	-29.6778	-.0274
24	.0000	1.0000	-2.3545	.0	742.11
25	51.9027	325.0023	-.01053	.0	40.91
26	53.89323	.0000	.01421	.0	152.26
27	10842.0403	.0551	-.05356	-164443.4	-394.1214
28	6700982.1	.2021	.02636	-33319.5	-80.1809
29	3553.5021	21792.2780	33482.6970	5459.7705	596.39228
30	11.97253	.71960	31.30635	.00000	.0
31	135.5748	.97655	30.55942	119.72773	-1418676.0

1	10520.0000	145540.8	202501.2	935791.2	22306536.0
2	34098.8570	32747.3600	21853519.0	21849032.0	61.1115
3	-10344644.0	6140731.5	-760843.9	211501.3	11014155.
4	-8415542.4	-6651.7	-77392.8	30840.9	249.8150
5	-17188624.0	-2577099.4	-8443488.3	259867.1	-10.1572
6	30142.7570	4972.4741	16321.6792	1619.2009	44.7962
7	3958.7725	545.1659	1788.4830	381.0883	-.2189
8	12170.9439	9111.1305	29885.3850	2126.1970	-.1516
9	202637.6	202497.6	-.1	-6.613	-.000
10	-990.4	-989.8	-.0	-1138.153	-.010
11	-585.7	-684.5	-.0	-375.170	.015
12	-58.5227	-.0874	140.0	148923.1	-.3148
13	15.0534	.0375	.0	5260822.0	.3873
14	.0000	.0012	.0	5258822.1	.0000
15	-58.8490	-.0984	-58.8490	-.0227	753.41
16	15.4407	.0411	15.4407	-.0844	-3.22
17	.0000	.0000	.0000	.0375	-2.15
18	6.1422	5.8979	5.8493	.2801	.0092
19	64.3364	65.4820	65.4710	-.1937	-.0115
20	427.1384	427.2424	-474.4074	-474.0613	202530.0
21	.0001	11.8298	.0000	3188.8243	.00
22	13.3864	2.6682	-13.1363	-.057	32747.360
23	147.6773	19.8276	19.7104	-29.5037	-.0280
24	.0000	1.0000	-2.3543	.0	483.13
25	32.0554	305.6045	-.01128	.0	17.68
26	34.04817	-.0000	.01418	.0	102.91
27	10841.8866	.0366	-.04574	-172325.4	-394.0763
28	6701169.9	.2097	.01685	-34919.7	-79.7952
29	3554.8170	33355.8840	34320.3490	3657.6024	1048.09810
30	13.10077	.80738	31.07987	.00000	.0
31	145.0308	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(FIRST OPPORTUNITY)

CHI TILDE ($\tilde{\chi}$) INITIATION

1	10526.0000	142694.4	202491.0	957356.7	22119211.0
2	34345.6950	32992.3620	21874711.0	21870414.0	60.5986
3	-10163266.4	6170541.3	-662994.3	221341.3	10838626.
4	-8391345.9	-3317.0	-67053.0	33190.8	249.5631
5	-17115065.0	-2522166.7	-8263303.6	272828.2	-9.7104
6	30317.1130	4964.2693	16294.8446	1660.8091	45.6875
7	4107.3250	566.5199	1858.5430	402.3476	-.2231
8	12349.0319	9200.0078	30176.9900	2194.4323	-.1473
9	202627.5	202487.5	-.1	2.027	-.000
10	-989.7	-989.0	-.0	753.081	-.009
11	-653.5	-651.9	-.0	-606.542	.014
12	-59.1370	-.1121	140.0	148906.0	-.3195
13	15.3047	.0450	.0	5091245.3	.3824
14	.0000	-.0006	.0	5089245.3	.0000
15	-59.4686	-1.0000	-59.4686	-.0296	763.53
16	15.6871	.5971	15.6871	-.1081	-3.28
17	.0000	.0000	.0000	.0450	-2.19
18	6.4136	5.1599	6.1113	.2799	-.0075
19	64.6761	55.7524	65.7409	-.1845	.0077
20	427.1492	427.2403	-474.3718	-474.0682	202532.2
21	.0000	11.8308	.0000	3236.1510	.00
22	13.4584	2.3091	-13.2728	-.051	32992.363
23	147.1343	20.0496	19.9314	-29.4457	-.0281
24	.0000	1.0000	-2.3643	.0	402.25
25	26.5723	299.5714	-.01445	.0	11.84
26	28.06639	.0003	.01508	.0	86.61
27	10841.8761	.0294	.00000	-174689.7	-394.0320
28	6701182.6	.2120	.00000	-35398.5	-79.8048
29	3555.3204	39595.0820	34581.1570	3105.0318	1324.84750
30	13.43449	.83522	31.00890	.00000	.0
31	147.7065	.97655	30.55942	119.72773	-1418675.0

1	10539.9999	136053.8	202466.7	1011906.9	21677677.0
2	34938.7330	33580.7970	21929055.0	21924536.0	59.3895
3	-9735960.2	6239874.0	-435410.0	245242.0	10425687.
4	-8331265.1	4990.8	-39798.2	39199.2	249.2735
5	-16939159.0	-2391875.7	-7835934.0	304714.8	-8.6121
6	30727.8990	4940.3144	16216.4478	1753.4227	47.9124
7	4478.7279	620.8825	2036.9000	456.5841	.0021
8	12783.0827	9414.3688	30880.3070	2362.6060	-.0955
9	202505.2	202466.3	-.0	-115.590	-.000
10	9.1	11.4	-.0	15324.087	-.007
11	-403.7	-398.5	-.0	-58141.875	.011
12	-61.7367	-.3640	140.0	146211.3	-.1373
13	16.2835	.1600	.0	4682859.6	.1179
14	.0000	.0069	.0	4681627.8	.0000
15	-61.8798	-.0197	-61.8798	-.1021	786.44
16	16.4014	.0040	16.4014	-.3494	-3.42
17	.0000	.0000	.0000	.1600	-2.28
18	7.0322	5.7576	6.7094	-.0032	-.4837
19	65.3845	66.4152	66.4022	-.1128	.5422
20	427.1806	427.2360	-474.2871	-474.0804	202535.8
21	.0000	11.8439	.0000	3345.2433	.00
22	13.9594	.2985	-13.9664	-.039	33580.798
23	146.0150	20.5632	20.4428	-29.2996	-.0284
24	.0000	1.0000	-2.3642	.0	214.48
25	13.1302	286.3233	-.01122	.0	5.98
26	14.62501	.0003	.01303	.0	45.94
27	10841.8761	.0279	.00000	-180205.4	-393.9273
28	6701182.6	.2109	.00000	-36515.9	-79.8248
29	3557.1565	69861.6090	35205.8230	1792.5815	2940.24910
30	14.14254	.90310	30.83287	.00000	.0
31	153.0140	.97655	30.55942	119.72773	-1418676.0

SECOND S-IVB GUIDANCE CUTOFF COMMAND

1	10553.8872	129468.1	208000.0	1072162.2	21233468.0
2	35555.3630	34192.8300	21988904.0	21984363.0	58.1731
3	-9306281.5	6308333.7	-210584.5	270251.4	10011596.
4	-8266458.4	14000.5	-10240.3	45927.5	248.8355
5	-16758623.9	-2259624.7	-7402132.8	338734.2	-7.4360
6	31159.0270	4920.2906	16150.9462	1849.3970	51.6900
7	4855.2825	676.8905	2220.6559	512.6496	.0000
8	13217.0582	9632.9454	31597.4610	2538.1513	.0000
9	208000.0	208000.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-61.4582	-.0144	.0	143075.3	.0000
13	15.8637	-.0096	.0	4275616.1	.0000
14	.0000	-.0002	.0	4275280.3	.0000
15	-61.4582	.0000	-61.4582	.0000	809.10
16	15.8637	.0000	15.8637	.0000	-3.55
17	.0000	.0000	.0000	.0000	-2.37
18	7.6886	7.3923	7.3446	.0000	.0000
19	66.1375	67.0933	67.0787	.0000	.0000
20	428.8660	427.2335	-485.0000	-474.0870	202537.9
21	.0000	11.8678	.0000	3454.3364	.00
22	13.3127	1.2091	-13.2615	-.029	34192.830
23	144.8282	21.0658	20.9433	-29.1394	-.0287
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5.	.0000
29	3559.0214	283398.8000	35857.0790	450.3058	22719.59600
30	14.87715	.97519	30.56191	119.73471	-1500059.0
31	158.3672	.97655	30.55942	119.72773	-1418676.0
1	10559.9999	129264.1	57.1	1100648.2	21036761.0
2	35543.9800	34180.4650	22017211.0	22012653.0	57.6344
3	-9116005.0	6338263.2	-112438.2	281571.1	9828717.
4	-8236557.8	18143.9	3352.9	49070.0	248.6255
5	-16677478.4	-2200667.6	-7208744.9	354276.5	-6.8896
6	31086.6710	4870.8282	15988.7521	1851.9287	.0142
7	4923.8740	677.8198	2223.7059	514.1484	.0000
8	13329.6140	9654.0904	31666.8540	2542.7998	.0000
9	57.0	57.1	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-61.4582	.0000	.0	142978.1	.0000
13	15.8637	.0000	.0	4263004.7	.0000
14	.0000	-.0000	.0	4262696.7	.0000
15	-61.4582	.0000	-61.4582	.0000	809.81
16	15.8637	.0000	15.8637	.0000	-3.55
17	.0000	.0000	.0000	.0000	-2.37
18	7.9775	7.6696	7.6220	.0000	.0000
19	66.3193	67.2975	67.2822	.0000	.0000
20	335.6592	425.1044	-.1700	-465.6286	198804.0
21	.0000	11.7759	.0000	3505.9109	.00
22	13.3247	1.4885	-13.2471	-.025	34180.456
23	144.2995	21.2843	21.1609	-29.0641	-.0288
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.0578	299084.3000	35868.5610	426.8304	24607.65500
30	15.42875	.97648	30.55873	119.72857	-1422313.0
31	164.3497	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN ·
(FIRST OPPORTUNITY)

TRANSLUNAR ORBIT INSERTION (TLI)

1	10563.8872	129263.4	55.7	1119294.2	20911945.0
2	35528.8470	34164.7190	22035743.0	22031191.0	57.2926
3	-8995266.0	6357134.0	-50492.5	288770.1	9712816.
4	-8217338.0	20778.7	11996.7	51058.6	248.4895
5	-16625528.0	-2163117.5	-7085575.1	364161.1	-6.5341
6	31033.1870	4838.2787	15882.0161	1851.9363	.0139
7	4964.6716	677.7552	2223.4948	514.1530	.0000
8	13398.5612	9665.2790	31703.5750	2542.8137	.0000
9	55.7	55.7	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.654	.008
12	-61.4582	.0000	.0	142977.8	.0000
13	15.8637	.0000	.0	4262964.1	.0000
14	.0000	-.0000	.0	4262656.1	.0000
15	-61.4582	.0000	-61.4582	.0000	809.81
16	15.8637	.0000	15.8637	.0000	-3.55
17	.0000	.0000	.0000	.0000	-2.37
18	8.1507	7.8453	7.7978	.0000	.0000
19	66.4520	67.4258	67.4101	.0000	.0000
20	327.8114	423.9785	-.1700	-460.0152	196407.5
21	.0000	11.7142	.0000	3537.6697	.00
22	13.3380	1.6660	-13.2409	-.022	34164.719
23	143.9632	21.4220	21.2981	-29.0150	-.0238
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.0603	299078.7700	35868.5450	426.8384	24606.98200
30	15.78454	.97648	30.55860	119.72831	-1422336.0
31	168.1696	.97655	30.55742	119.72773	-1418676.0

1	TIME	WEIGHT	F SB T	ALTITUDE	RANGE
2	V SB I	V SB E	R SB C	R SUB PF	RANGE ANGLE
3	X SB E	X SB P (M)	X SB S	XI	D* SB 1
4	Y SB E	Y SB P (M)	Y SB S	ETA	A* SB 1
5	Z SB E	Z SB P (M)	Z SB S	ZETA	E* SB 1
6	D-X SB E	D-X SB P (M)	D-X SB S	D-XI	A SB XM
7	D-Y SB E	D-Y SB P (M)	D-Y SB S	D-ETA	A SB YM
8	D-Z SB E	D-Z SB P (M)	D-Z SB S	D-ZETA	A SB ZM
9	F SB X	F SB TX	F SB AX	M SB X	M SB AX
10	F SB Y	F SB TY	F SB AY	M SB Y	M SB AY
11	F SB Z	F SB TZ	F SB AZ	M SB Z	M SB AZ
12	THETA(M) QRP	DTHETA(M)QRP	F AUX SB X	I SB XX	EPS(THETA)
13	PSI(M) QRP	D-PSI(M)QRP	F AUX SB Y	I SB YY	EPS(PSI)
14	PHI(M) QRP	D-PHI(M)QRP	F AUX SB Z	I SB ZZ	EPS(PHI)
15	CHI SB P	D-CHI SB P	THETA SB C	P SB M	X SB CG
16	CHI SB Y	D-CHI SB Y	PSI SB C	Q SB M	Y SB CG
17	CHI SB R	D-CHI SB R	PHI SB C	R SB M	Z SB CG
18	GAMMA SB 1	GAMMA SB 1I	GAMMA(1I)PR.	DELTA(A)	D-DELTA(A)
19	GAMMA SB 2	GAMMA SB 2I	GAMMA(2I)PR.	DELTA(B)	D-DELTA(B)
20	I SB SP	AVG I SB SP	WEIGHT FLOW	AVG D-W	AVG F SB L
21	Q	MACH NO.	PRESSURE	TEMPERATURE	X SB Cp
22	ALPHA*	ALPHA	BETA	CHORD FORCE	V SB RM
23	MU	RHO	RHO PRIME	G(RHO)	G(PSI)
24	T(2)	TAU(2)	PHI(T)	D-W(LOX3J)	DELTA-D-X(V)
25	T(3)	TAU(3)	SMCP	D-W(LH2BJ)	DELTA-D-Y(V)
26	DELTA-T(CO)	DELTA-T(3)	SMCY	D-W(LH2PR)	DELTA-D-Z(V)
27	V(T)	CHI(P)-TILDE	K(1)	W(LOX)RES	WDOTSUBO
28	Y(Y,T)	CHI(Y)-TILDE	K(3)	W(LH2)RES	WDOTSUBF
29	R(PER)	R(AP)	V(PER)	V(AP)	PERIOD
30	BETA	ECCENTRICITY	INCLINATION	THETA SUB NS	C SUB 3G
31	TAU	E SUB T	I SUB T	THETA SUB N	C3 SUB T

INITIATION OF RESTART PREPARATION (TB6)

1	14951.9999	277097.7	15.0	649945.5	50676627.0
2	25357.6530	24244.9540	21572765.0	21573025.0	138.8190
3	-37135039.0	624909.3	-18862133.0	-2850861.8	34045957.
4	-7944577.6	-165174.4	-508018.8	31303.8	266.9207
5	-11809425.8	-6543611.1	-21450330.0	13968460.7	-52.6058
6	15953.1306	7755.1500	25443.9260	-198.8306	.0017
7	-10876.6223	34.2383	112.2253	2.1750	.0000
8	-14663.3732	734.5929	2405.7712	973.3979	.0000
9	14.8	15.0	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.039
12	-0.3732	-.0679	.0	150356.1	.0000
13	.5499	.0010	.0	9009736.1	.0000
14	-.0000	.0000	.0	9007736.1	.0000
15	-5.3734	-.0068	-5.3734	-.0001	520.37
16	.5499	.0001	.5499	-.0068	-1.71
17	.0000	.0000	.0000	.0001	-1.11
18	.0025	.0024	.0404	.0000	.0000
19	57.5239	59.3782	59.3782	.0000	.0000
20	300.0000	72.2516	-.0500	-5.4172	2224.7
21	.0002	9.8835	.0000	2504.1042	.00
22	2.1533	.0726	-2.1521	-.228	24244.955
23	-139.7867	-11.8196	-11.7450	-30.2877	.0184
24	.0000	1.0000	-2.4371	.0	63.58
25	308.6354	677.6353	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	10850.8079	.2519	.00000	-62345.5	.0000
28	6687844.2	-.0127	.00000	-12510.9	.0000
29	3549.6417	3553.6172	25563.3060	25498.8300	88.57647
30	34.46322	.00126	32.59161	123.19019	-60736761.0
31	507.6375	.97939	34.19085	123.85528	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(SECOND OPPORTUNITY)

1	15000.0000	277095.3	17.5	650033.5	43550171.0
2	25557.1470	24244.9770	21573520.0	21573822.0	135.7268
3	-36346053.0	995949.1	-17644782.0	-2860405.0	33349422.
4	-8455610.1	-163290.1	-571775.7	31408.2	266.9458
5	-12495249.1	-6497789.1	-21300201.0	14015183.3	-51.02.9
6	15913.2770	7700.5726	25265.3840	-198.8057	.0020
7	-10410.5337	-45.0946	147.8444	2.1752	.0000
8	-13906.1402	1174.1422	3847.9167	973.4005	.0000
9	17.3	17.6	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.024
12	-8.0204	-.0679	.0	150366.0	.0000
13	.5871	.0009	.0	9009700.5	.0000
14	-.0000	.0000	.0	9007700.5	.0010
15	-8.0205	-.0679	-8.0206	-.0007	520.48
16	.5871	.0009	.5871	-.0679	-1.71
17	.0000	.0000	.0000	.0009	-1.11
18	.0055	.0060	.0393	.0000	.0000
19	56.9431	58.8376	58.8375	.0000	.0000
20	351.5069	73.0282	-.0500	-5.3994	2217.3
21	.0002	9.8530	.0000	2504.3458	.00
22	2.2558	.5843	-2.1497	-.228	24244.978
23	-142.4334	-10.1363	-10.0718	-30.2868	.019
24	.0000	1.0000	-2.4371	.0	63.68
25	308.6354	677.6353	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	10850.8079	.2519	.00000	-62345.5	.0000
28	6689844.2	-.0127	.00000	-12610.9	.0000
29	3549.8038	3558.7376	25562.6460	25498.4740	88.58175
30	34.05759	.00126	32.59309	123.19019	-60736761.0
31	501.6251	.97639	34.19085	123.85628	-1426555.0

1	15500.0000	276990.3	140.0	656272.1	37808133.0
2	25551.6590	24239.6600	21580546.0	21580230.0	103.5636
3	-25953497.0	4455567.2	-6293323.6	-2959688.0	24757297.
4	-12125599.5	-114415.9	-431472.8	32497.5	257.3375
5	-17145927.0	-4837392.0	-15854584.9	14501927.5	-34.3618
6	23557.2610	5730.9131	18805.5500	-198.1352	.0152
7	-3801.7355	145.2679	476.5273	2.1857	.0000
8	-4251.8543	5271.5390	17291.9500	973.7570	.0000
9	139.8	140.0	-.2	.138	-.000
10	.0	.0	-.0	30.103	-.025
11	.0	.0	-.0	5.634	.024
12	-41.9522	-.0679	.0	150363.5	.0000
13	.9284	.0004	.0	9008143.0	.0000
14	-.0000	.0000	.0	9006143.0	.0000
15	-41.9524	-.0679	-41.9524	-.0011	520.48
16	.9284	.0004	.9284	-.0678	-1.72
17	.0000	.0000	.0000	.0004	-1.11
18	.0525	.0498	.0227	.0000	.0000
19	56.3525	58.2985	58.2985	.0000	.0000
20	261.6322	81.9611	-.5350	-5.2251	2144.7
21	.0002	9.8473	.0000	2521.4534	.00
22	1.9137	.5794	-1.7955	-.217	24239.660
23	-169.1799	8.0583	8.0067	-30.2685	-.0179
24	.0000	1.0000	-2.4371	.0	63.68
25	308.0854	677.6353	.00000	.0	16.39
26	.00001	.0000	.00000	.0	-.84
27	10850.8079	.2519	.00000	-62345.5	.0000
28	6689844.2	-.0127	.00000	-12610.9	.0000
29	3551.4010	3558.7143	25553.9850	25501.4700	88.61117
30	24.31099	.00103	32.59454	123.19019	-60736761.0
31	358.3214	.97639	34.19085	123.85628	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(SECOND OPPORTUNITY)

SECOND S-IVB ENGINE START COMMAND

1	15521.9999	275978.6	140.0	656770.4	37291244.0
2	25551.6020	24239.3800	21580866.0	21580417.0	102.1484
3	-25433749.0	4590120.4	-5884508.9	-2964046.4	24329181.
4	-12205535.5	-111180.8	-420360.3	32545.6	267.3554
5	-17234510.0	-4719789.9	-15468819.3	14523350.0	-33.6267
6	23690.3730	5591.5414	18348.3720	-198.1052	.0325
7	-3455.7480	148.8266	488.2036	2.1875	-.0030
8	-3790.8645	5419.0415	17775.9190	973.8306	-.0030
9	279.8	140.0	-.2	.000	-.000
10	-.0	-.0	-.0	12.925	-.020
11	-.0	.0	-.0	-19.983	.031
12	-43.4449	-.0679	140.0	150363.3	-.0002
13	.9365	.0004	.0	9007968.6	-.0000
14	-.0000	.0000	.0	9005968.6	.0000
15	-43.4452	-.0679	-43.4452	-.0011	520.49
16	.9365	.0004	.9365	-.0678	-1.72
17	.0000	.0000	.0000	.0004	-1.11
18	.0543	.0515	.0420	.0000	.0000
19	56.5649	58.4868	58.4867	.0000	.0000
20	523.3645	82.2247	-.5350	-5.2192	2141.7
21	.0002	9.8445	.0000	2522.8263	.00
22	1.8894	.6787	-1.7635	-.216	24239.381
23	-170.3728	8.8454	8.7889	-30.2673	-.0141
24	.0000	1.0000	-2.4371	.0	63.58
25	308.6854	677.6353	.00000	.0	16.39
26	308.68539	.0000	.00000	.0	-.84
27	10850.8079	.2519	.00000	-62345.5	.0000
28	6689844.2	-.0127	.00000	-12510.9	.0000
29	3551.4320	3558.7967	25553.9560	25501.0830	88.61329
30	24.42178	.00104	32.59400	123.19019	-60736761.0
31	359.9581	.97639	34.19085	123.85626	-1426555.0

1	15524.9999	275968.2	483.3	656839.5	37220758.0
2	25551.7410	24239.4860	21580896.0	21580441.0	101.9555
3	-25362653.0	4596866.1	-5829558.8	-2964640.6	24270514.
4	-12215832.9	-110733.6	-419393.3	32552.1	267.3578
5	-17245787.0	-4703503.1	-15415394.2	14526271.2	-33.5254
6	23707.5700	5572.2728	18285.1650	-198.0636	.0724
7	-3408.3497	149.3054	489.7744	2.1884	-.0020
8	-3726.5312	5438.9030	17841.0870	973.8702	.0001
9	623.0	483.3	-.2	.078	-.000
10	-.0	-.0	-.0	63.532	-.020
11	.5	.5	-.0	-68.684	.031
12	-43.6470	-.0668	140.0	150363.1	-.0017
13	.9361	-.0008	.0	9007814.0	.0016
14	.0000	-.0000	.0	9005814.0	.0000
15	-43.6487	-.0679	-43.6487	-.0011	520.50
16	.9377	.0004	.9377	-.0658	-1.72
17	.0000	.0000	.0000	-.0008	-1.11
18	.0545	.0517	.0219	.0013	.0010
19	56.5940	58.5138	58.5138	.0641	-.0009
20	167.6882	82.2247	-3.7168	-5.2192	2141.7
21	.0002	9.8442	.0000	2523.0157	.00
22	1.8843	.6801	-1.7574	-.216	24239.488
23	-170.5358	8.9524	8.6953	-30.2672	-.0142
24	.0000	1.0000	-2.4371	.0	63.68
25	308.6854	677.6353	.00000	.0	16.39
26	308.68539	.0000	.00000	.0	-.84
27	10850.8079	.2519	.00000	-62345.5	-.0000
28	6689844.2	-.0127	.00000	-12519.7	-3.1618
29	3551.4550	3558.8707	25553.9740	25500.7260	88.61510
30	23.64800	.00104	32.59392	123.19019	-60736761.0
31	348.5542	.97639	34.19085	123.85628	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(SECOND OPPORTUNITY)

1	15530.0000	276947.1	346.9	656955.1	37103280.0
2	25551.9730	24239.6650	21580944.0	21580482.0	101.6338
3	-25244045.0	4624646.6	-5738407.7	-2965630.5	24172579.
4	-12232675.9	-109985.1	-416937.9	32553.1	267.3618
5	-17264151.0	-4676226.2	-15325018.6	14531140.0	-33.3566
6	23735.6000	5540.0020	18179.3070	-197.9913	.0555
7	-3329.2302	150.0974	492.3795	2.1900	-.0000
8	-3619.2422	5471.8527	17949.1980	973.9396	.0000
9	485.7	346.9	-.2	.354	-.000
10	-.1	-.1	-.0	43.646	-.020
11	.3	.3	-.0	-47.279	.031
12	-43.9764	-.0651	140.0	150362.6	-.0116
13	.9271	-.0027	.0	9007501.2	.0123
14	.0000	-.0000	.0	9005501.3	.0000
15	-43.9880	-.0679	-43.9880	-.0011	520.52
16	.9394	.0004	.9394	-.0651	-1.72
17	.0000	.0000	.0000	-.0027	-1.11
18	.0549	.0521	.0247	.0108	.0025
19	56.6433	58.5597	58.5597	.0553	-.0023
20	101.3639	82.2247	-4.8037	-5.2192	2141.7
21	.0002	9.3436	.0000	2523.3330	.00
22	1.8708	.6898	-1.7391	-.215	24239.666
23	-170.8079	9.1306	9.0723	-30.2669	-.0145
24	.0000	1.0000	-2.4371	.0	63.68
25	308.6854	677.6353	.00000	.0	16.39
26	306.68539	.0000	.00000	.0	-.84
27	10850.8079	.2519	.00000	-62345.5	-.0000
28	6689844.2	-.0127	.00000	-12638.1	-4.2687
29	3551.5103	3558.9769	25553.8660	25500.2540	88.61813
30	21.56964	.00105	32.59379	123.19019	-60736761.0
31	319.3981	.97639	34.19085	123.85628	-1426555.0

SECOND S-IVB IGM INITIATION

1	15535.0000	275615.2	167930.7	657074.8	36935678.0
2	25621.1400	24308.7630	21580995.0	21580525.0	101.3119
3	-25125176.0	4652293.1	-5647775.4	-2966594.1	24074354.
4	-12249140.4	-109232.2	-414468.1	32574.4	267.3658
5	-17282001.0	-4648758.4	-15235815.7	14536034.6	-33.1875
6	23830.2090	5522.7004	18122.5920	-183.2680	19.6188
7	-3258.6985	151.0774	495.5723	2.3704	-.1320
8	-3523.9118	5519.1615	18104.4190	988.0740	-.1459
9	168062.0	167922.2	-.2	-74.082	-.000
10	-1130.6	-1130.9	-.0	-28257.465	-.020
11	-1249.8	-1248.3	-.0	15577.413	.031
12	-44.1104	-.2076	140.0	150331.3	-.6918
13	.5325	-.0306	.0	8987735.0	.4111
14	.0000	.0008	.0	8985735.0	.0000
15	-44.8022	-1.0000	-44.8022	-.0019	521.83
16	.9435	-.0827	.9435	-.2076	-1.73
17	.0000	-.0000	.0000	-.0306	-1.12
18	.0590	.0560	.0251	.3854	.0189
19	56.6975	58.6050	58.6050	-.4259	.0115
20	438.3173	433.6994	-383.4259	-378.5418	164178.6
21	.0002	9.8711	.0000	2523.6614	.00
22	1.6022	.8914	-1.3315	-.216	24308.763
23	-171.0805	9.3087	9.2493	-30.2666	-.0148
24	.0000	1.0000	-2.3997	.0	3145.53
25	330.8519	623.5358	.00000	.0	369.49
26	308.68539	-1.0957	.00000	.0	-265.99
27	10824.5513	.1169	-.13995	-63397.2	-311.4373
28	6721947.0	-.0838	-.11068	-12915.6	-71.4536
29	3551.7237	3597.6308	25621.5590	25294.6180	89.34572
30	4.11685	.00642	32.59517	123.19019	-60736751.0
31	60.5209	.97639	34.19085	123.85628	-1426555.0

1	15539.9999	273361.3	200859.9	657206.7	36867589.0
2	25735.9750	24423.5340	21581057.0	21580580.0	100.9886
3	-25005683.0	4679886.1	-5557230.4	-2967449.3	23975538.
4	-12265270.4	-108474.4	-411962.4	32586.7	267.3697
5	-17299397.0	-4621021.0	-15144929.9	14541034.4	-33.0176
6	23959.3040	5514.5516	13095.8+50	-158.7817	23.6561
7	-3192.3795	152.0314	498.7187	2.5486	-.2060
8	-3433.6667	5576.6241	18292.9530	1012.9331	.0982
9	200990.3	200850.5	-.2	288.135	-.000
10	-1750.4	-1748.1	-.0	48466.302	-.021
11	634.1	844.2	-.0	32625.652	.032
12	-48.5713	-1.1378	140.0	150278.4	-.8293
13	.7504	.2495	.0	8954285.8	.8703
14	-.0000	.0005	.0	8952285.7	.0000
15	-49.4012	-.5990	-49.4012	-.0149	524.35
16	1.6208	.3442	1.6208	-1.1377	-1.75
17	.0000	.0000	.0000	.2495	-1.13
18	.0615	.0584	.0270	.4987	.0325
19	56.7541	58.6493	58.6493	.2408	.4132
20	435.3214	434.7471	-461.7061	-426.6930	185534.6
21	.0002	9.9169	.0000	2524.0233	.00
22	3.5776	-3.2325	-1.5363	-.218	24423.534
23	-171.3545	9.4872	9.4267	-30.2663	-.0150
24	.0000	1.0000	-2.4191	.0	3118.95
25	315.2646	599.3206	.00000	.0	347.69
26	328.90437	-.3798	.00000	.0	-265.92
27	10838.6585	.1111	-.12385	-65269.7	-384.4517
28	6704657.8	-.0845	-.13235	-13294.3	-76.7194
29	3551.7543	3563.2888	25736.1750	24952.6670	90.58010
30	1.84460	.01546	32.59856	123.19019	-60736761.0
31	26.9965	.97639	34.19085	123.85628	-1426555.0

A077 CODE 76 FOR V. L. TABLE 125, I. V. = .60025000+03   Γ = .15552250+05

1	15559.9999	263885.0	202149.5	657573.2	36389457.0
2	26217.8380	24904.6510	21561127.0	21580622.0	99.6735
3	-24520442.0	4789797.4	-5196557.5	-2969680.2	23573408.
4	-12326158.9	-105350.3	-401734.3	32690.1	267.3847
5	-17364283.0	-450/088.3	-14771095.7	14562406.2	-32.3294
6	24546.3240	5476.7257	17971.5150	-63.7892	24.6634
7	-2895.4799	160.6504	526.9970	8.081/	-.1041
8	-3055.4668	5817.0237	19081.6980	1125.3119	-.0563
9	202785.7	202146.9	-.2	2.358	-.000
10	-853.6	-854.0	-.0	486.454	-.023
11	-543.9	-543.2	-.0	57.250	.034
12	-50.3174	-.0789	140.0	150055.9	-.2755
13	2.1504	-.0413	.0	8813694.0	.2490
14	.0000	-.0000	.0	8811694.0	.0000
15	-50.5932	-.0654	-50.5932	-.0030	533.36
16	2.3995	-.0409	2.3995	-.0788	-1.83
17	.0000	-.0000	.0000	-.0413	-1.19
18	.0359	.0341	.0006	.2421	-.0042
19	57.0284	50.8712	58.5712	-.1540	.0157
20	425.4414	428.2986	-475.4764	-460.8605	197307.9
21	.0002	10.1103	.0000	2525.0284	.00
22	4.5638	-3.5764	-2.8425	-.226	24904.652
23	-172.4575	10.2069	10.1421	-30.2655	-.0161
24	.0000	1.0000	-2.4359	.0	2972.70
25	282.7245	555.4203	-.00245	.0	287.47
26	284.55474	.0009	.00170	.0	-272.31
27	10850.0460	.0964	-.12109	-73166.9	-396.3919
28	6690772.5	-.0909	-.14417	-14859.9	-78.5485
29	3551.6041	3955.9790	26217.6380	23539.2110	96.14819
30	.00000	.05383	32.58097	123.19019	-60736761.0
31	-.0000	.97639	34.19085	123.85628	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(SECOND OPPORTUNITY)

1	15580.0000	254369.7	202718.3	558003.3	35901769.0
2	26719.8710	25405.1110	21581240.0	21580703.0	98.3444
3	-24023780.0	4398944.8	-4838389.4	-2969988.4	23160115.
4	-12381092.9	-102063.1	-390950.7	32895.9	267.3984
5	-17421555.0	-4398319.8	-14381495.6	14586085.5	-31.6261
6	25131.4540	5437.8389	17844.4590	33.2693	25.6582
7	-2597.8670	167.7827	550.3977	12.2178	-.1102
8	-2670.4928	6050.4084	19880.2413	1243.9413	-.0724
9	202855.4	202715.7	-.2	.190	-.000
10	-871.0	-871.4	-.0	79.728	-.025
11	-572.8	-572.4	-.0	-90.885	.037
12	-51.3290	-.0412	140.0	149832.4	-.2495
13	1.4235	-.0423	.0	6672435.2	.2539
14	.0000	-.0000	.0	8670435.2	.0000
15	-51.5735	-.0406	-51.5785	-.0010	542.72
16	1.6774	-.0427	1.6774	-.0412	-1.91
17	.0000	-.0000	.0000	-.0420	-1.26
18	.0719	.0683	.0328	.245_	.0003
19	57.3113	59.1014	59.1014	-.1618	-.0000
20	426.0642	427.2127	-476.1153	-467.2000	199539.2
21	.0002	10.3115	.0000	2526.2065	.00
22	3.8029	-3.2158	-2.0341	-.235	25406.111
23	-173.6090	10.9355	10.8562	-30.2646	-.0172
24	.0000	1.0000	-2.4377	.0	2817.65
25	261.9046	535.0136	-.00538	.0	264.44
26	263.97154	-.0004	.00528	.0	-278.20
27	10851.1998	.0936	-.11029	-81097.3	-395.4176
28	6689365.7	-.0980	-.13495	-16437.1	-79.1627
29	3551.8152	4293.9233	26719.9295	22101.9890	102.71273
30	.38866	.09459	32.57449	123.19019	-50736761.0
31	5.4773	.97639	34.19085	123.85628	-1426555.0

1	15600.0000	244893.2	202715.3	659047.7	35404151.0
2	27241.3540	25927.2010	21581040.0	21581373.0	96.9821
3	-23515239.0	5007305.1	-4482302.7	-2968336.2	22735518.
4	-12430085.1	-98654.2	-379763.2	33164.3	267.4109
5	-17471051.0	-4254654.9	-13975830.7	14612199.8	-30.9061
6	25724.1730	5398.0642	17713.8840	132.3824	25.6551
7	-2301.9151	172.6432	566.3452	14.1711	-.1172
8	-2277.6294	6305.5706	20687.8950	1368.7536	-.0774
9	202852.3	202712.5	-.2	.299	-.000
10	-891.6	-892.1	-.0	43.461	-.027
11	-589.1	-588.7	-.0	-.513	.040
12	-52.0560	-.0336	140.0	149608.9	-.2460
13	.4502	-.0517	.0	8531203.3	.2500
14	.0000	-.0000	.0	8529203.4	.0000
15	-52.3121	-.0334	-52.3121	-.0003	552.07
16	.7001	-.0514	.7001	-.0335	-1.99
17	.0000	-.0000	.0000	-.0517	-1.32
18	.1719	.1536	.1260	.2521	.0003
19	57.5087	59.3365	59.3363	-.1654	-.0001
20	426.6730	426.9644	-475.4285	-469.7556	200529.1
21	.0002	10.5170	.0000	2529.0733	.00
22	2.8011	-2.6182	-.9971	-.242	25927.201
23	-174.7802	11.6730	11.5993	-30.2619	-.0183
24	.0000	1.0000	-2.4383	.0	2657.27
25	241.8372	515.0379	-.00764	.0	243.49
26	243.83026	.0000	.00533	.0	-282.01
27	10851.6145	.0914	-.10089	-89016.4	-395.4153
28	6688861.5	-.1053	-.12391	-18023.8	-79.4781
29	3551.8564	4687.0327	27241.8340	20644.0530	110.52927
30	1.04227	.13778	32.58335	123.19019	-60736761.0
31	14.4112	.97639	34.19085	123.85628	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(SECOND OPPORTUNITY)

1	15619.9999	235312.7	203569.2	661338.9	34896237.0
2	27784.2590	26467.9240	21583560.0	21583266.0	95.5916
3	-22994749.0	5114865.4	-4129838.3	-2964574.3	22299489.
4	-12473194.5	-95175.1	-368355.3	33445.6	267.4228
5	-17512516.0	-4136036.8	-13553913.8	14640875.8	-30.1670
6	26326.6580	5356.0106	17582.5480	234.2638	27.8552
7	-2009.6556	174.8105	573.4565	13.5231	-.1249
8	-1877.5681	6555.7960	21505.6010	1500.1970	-.0830
9	203725.0	203586.2	-.2	.257	-.000
10	-913.5	-914.0	-.0	21.573	-.028
11	-607.0	-606.6	-.0	19.094	.043
12	-52.6971	-.0305	140.0	149384.8	-.2478
13	-.4527	-.0536	.0	8389615.6	.2542
14	.0000	-.0000	.0	8387615.6	.0000
15	-52.9449	-.0306	-52.9449	.0002	561.45
16	-.2084	-.0529	-.2084	-.0305	-2.07
17	-.0000	-.0000	-.0000	-.0536	-1.38
18	.3400	.3239	.2844	.2572	.0005
19	57.8898	59.5755	59.5751	-.1737	-.0002
20	427.0213	426.9277	-477.0868	-471.4172	201230.1
21	.0002	10.7238	.0000	2535.3566	.00
22	1.9559	-1.9554	-.0406	-.248	26459.924
23	-175.9826	12.4197	12.3415	-30.2558	-.0194
24	.0000	1.0000	-2.4403	.0	2499.52
25	220.7499	492.8338	-.0080P	.0	219.41
26	222.76251	-.0001	.00690	.0	-283.23
27	10852.8824	.0979	-.09299	-96952.4	-395.7606
28	6687317.5	-.1128	-.11492	-19617.5	-79.7912
29	3551.9715	5151.0358	27786.1330	19160.3320	119.99898
30	1.83273	.18374	32.50910	123.19019	-60736761.0
31	24.8465	.97639	34.19085	123.85628	-1426555.0

1	15640.0000	225807.8	202843.3	665577.3	34377680.0
2	28346.0230	27031.7040	21587702.0	21587078.0	94.1720
3	-22462133.0	5221619.0	-3779514.3	-2958951.3	21851926.
4	-12510515.2	-91686.1	-356909.6	33681.5	267.4344
5	-17546097.0	-4204409.7	-13115563.1	14672241.8	-29.4064
6	26936.6730	5317.4730	17449.6230	338.6100	28.9214
7	-1725.5597	173.4557	569.0127	9.4468	-.1312
8	-1469.0175	6807.4373	22331.2340	1637.7822	-.0875
9	202980.0	202849.2	-.2	.112	-.000
10	-920.9	-921.4	-.0	21.120	-.030
11	-613.9	-613.6	-.0	-32.110	.045
12	-53.2823	-.0281	140.0	149279.3	-.2480
13	-1.6374	-.0514	.0	8196616.4	.2601
14	-.0000	-.0000	.0	8194616.4	.0000
15	-53.5304	-.0281	-53.5304	.0008	573.90
16	-1.3773	-.0517	-1.3773	-.0281	-2.15
17	-.0000	-.0000	-.0000	-.0514	-1.44
18	.5787	.5518	.5103	.2603	-.0002
19	58.1812	59.8155	59.8148	-.1733	-.0000
20	427.4207	426.9938	-474.8957	-472.1299	201571.6
21	.0002	10.9264	.0000	2546.9867	.00
22	1.7288	-1.2885	1.1530	-.250	27031.704
23	-177.2175	13.1758	13.0933	-30.2442	-.0205
24	.0000	1.0000	-2.4395	.0	2317.59
25	201.5733	474.7126	-.00625	.0	199.80
26	203.57041	-.0000	.00693	.0	-281.21
27	10852.3881	.0860	-.08544	-104851.3	-394.5761
28	6687919.2	-.1203	-.10188	-21212.9	-79.7845
29	3552.1383	5703.0518	28350.8640	17658.2980	131.59858
30	2.70701	.23240	32.55524	123.19019	-60736761.0
31	35.9730	.97639	34.19085	123.85628	-1426555.0

1	15663.0000	216296.3	203528.5	572525.0	33848168.0
2	28929.5540	27615.4410	21594225.0	21593572.0	92.7225
3	-21917215.0	5327552.5	-3431350.6	-2951111.3	21392760.
4	-12542181.7	-88260.5	-345972.3	33800.5	267.4465
5	-17571325.0	-3863720.4	-12650503.1	14706428.3	-28.6216
6	27557.5650	5277.1748	17317.4850	446.0619	30.2952
7	-1444.0772	168.5593	552.9492	1.9231	-.1386
8	-1052.5448	7062.2253	23167.1910	1782.4049	-.0926
9	203665.2	203525.4	-.2	-.091	-.000
10	-931.7	-932.2	-.0	3.279	-.031
11	-622.3	-622.0	-.0	-73.257	.046
12	-53.8370	-.0279	140.0	149245.8	-.2495
13	-2.5429	-.0480	.0	7971616.4	.2642
14	-.0000	-.0000	.0	7969616.4	.0000
15	-54.0868	-.0276	-54.0860	.0012	588.27
16	-2.2787	-.0519	-2.2787	-.0279	-2.24
17	-.0000	-.0000	-.0000	-.0430	-1.49
18	.8890	.8486	.8052	.2564	-.0032
19	58.4754	60.0590	60.0579	-.1731	.0009
20	427.3548	427.0595	-476.5722	-472.6705	201837.6
21	.0002	11.1208	.0000	2566.0444	.00
22	2.1492	-.5325	2.0543	-.2+7	27615.441
23	-178.4865	13.9416	13.8546	-30.2251	-.0215
24	.0000	1.0000	-2.4409	.0	2137.89
25	180.8262	452.7097	-.00832	.0	175.71
26	182.14346	-.0001	.00739	.0	-275.73
27	10853.2701	.0820	-.07931	-112753.7	-395.9471
28	6656545.4	-.1278	-.09319	-22811.3	-80.0901
29	3552.3729	6373.2795	28939.6260	16130.5247	145.15448
30	3.63931	.28420	32.72023	123.19019	-60736761.0
31	47.3954	.97639	34.19085	123.85628	-1426555.0

1	15679.9999	205770.4	202967.9	683002.8	33307362.0
2	29536.4650	28224.6670	21604251.0	21603571.0	91.2420
3	-21359748.0	5432707.8	-3086302.9	-2941085.9	20921889.
4	-12568325.1	-84967.4	-334369.5	33735.4	267.4596
5	-17588149.0	-3713897.9	-12188800.6	14743584.7	-27.8091
6	28191.3350	5237.5409	17187.5260	556.9608	31.6036
7	-1171.6670	160.0343	524.9800	-9.1369	-.1558
8	-628.3120	7320.5994	24014.9170	1934.6994	-.0985
9	203104.2	202964.5	-.2	6.898	-.000
10	-1001.5	-1002.4	-.0	-286.209	-.031
11	-632.9	-632.6	-.0	2612.934	.046
12	-54.3835	-.0283	140.0	149212.2	-.2533
13	-3.7421	-.0738	.0	7746276.2	.2574
14	-.0000	-.0001	.0	7744276.2	.0000
15	-54.6373	-.0282	-54.6373	.0018	602.66
16	-3.4847	-.0647	-3.4847	-.0232	-2.33
17	-.0000	-.0000	-.0000	-.0738	-1.55
18	1.2723	1.2157	1.1704	.2830	.0022
19	58.7748	60.3083	60.3065	-.1735	.0009
20	427.4478	427.1022	-475.1540	-473.1619	202070.7
21	.0002	11.3022	.0000	2594.7871	.00
22	3.2268	-.0095	3.2268	-.237	28222.667
23	-179.7910	14.7170	14.6257	-30.1961	-.0226
24	.0000	1.0000	-2.4402	.0	1950.17
25	161.4857	434.5629	-.00838	.0	154.13
26	163.36980	.0004	.00693	.0	-265.92
27	10852.8151	.0789	-.07349	-120666.2	-394.4607
28	6687399.5	-.1356	-.08000	-24414.0	-80.1583
29	3552.6314	7204.5906	27554.6410	14573.7945	164.90231
30	4.52011	.33948	32.30283	123.19019	-60736761.0
31	58.9282	.77639	34.19085	123.85628	-1426555.0

1	15699.9999	197269.8	202867.8	697897.2	32754985.0
2	30165.5540	28852.2470	21618565.0	21617958.0	89.7298
3	-20789488.0	5537064.7	-2744339.1	-2928813.0	20439259.
4	-12589118.8	-81891.4	-324778.8	33403.4	257.4746
5	-17596393.0	-3570875.7	-11699938.3	14783861.6	-26.9653
6	28837.2650	5198.4808	17059.4510	671.0957	33.1093
7	-909.1192	146.8634	481.7705	-24.7544	-.1544
8	-194.5502	7582.3607	24873.7560	2094.6492	-.1030
9	203004.3	202864.6	-.2	.103	-.000
10	-946.8	-947.4	-.0	-6.028	-.030
11	-631.4	-631.1	-.0	-2.838	.045
12	-54.9470	-.0285	140.0	149178.8	-.2546
13	-4.7755	-.0515	.0	7507819.8	.2692
14	-.0000	-.0000	.0	7505819.7	.0000
15	-55.2025	-.0289	-55.2025	.0024	617.81
16	-4.5063	-.0515	-4.5063	-.0284	-2.42
17	-.0000	-.0000	-.0000	-.0515	-1.61
18	1.7292	1.6539	1.6069	.2676	.0002
19	59.0755	60.5598	60.5574	-.1782	-.0003
20	427.4616	427.1443	-474.9071	-473.3849	202188.1
21	.0002	11.4644	.0000	2635.6456	.00
22	4.2423	.5559	4.2060	-.221	28852.248
23	178.8677	15.5021	15.4064	-30.1549	-.0236
24	.0000	1.0000	-2.4403	.0	1754.75
25	141.5510	414.6525	-.00847	.0	130.78
26	143.53901	.0000	.00724	.0	-253.62
27	10852.8784	.0744	-.06842	-128552.2	-394.1539
28	6687322.3	-.1431	-.06954	-26017.8	-80.2182
29	3553.0689	8257.9112	30195.3840	12991.9392	189.71533
30	5.64359	.39834	32.90680	123.19019	-60736761.0
31	70.4891	.97639	34.19085	123.85628	-1426555.0

1	15720.0000	187774.2	202766.5	718155.8	32190781.0
2	30819.9320	29507.2290	21638414.0	21637683.0	88.1853
3	-20206158.0	5640651.7	-2404400.5	-2914219.6	19944826.
4	-12604754.9	-79123.1	-315597.6	32715.7	267.4925
5	-17595871.0	-3416576.6	-11193762.7	14827423.4	-26.0859
6	29498.8870	5160.5941	16935.2230	788.9334	34.7663
7	-656.1462	129.1769	423.7446	-44.8042	-.1639
8	248.4327	7848.3877	25746.5910	2263.3290	-.1092
9	202903.1	202763.3	-.2	.113	-.000
10	-956.8	-957.4	-.0	-20.734	-.028
11	-638.1	-637.7	-.0	16.477	.042
12	-55.5423	-.0313	140.0	149145.3	-.2601
13	-5.8070	-.0511	.0	7185287.6	.2733
14	-.0000	-.0000	.0	7183287.5	.0000
15	-55.8037	-.0315	-55.8037	.0032	637.84
16	-5.5337	-.0509	-5.5337	-.0312	-2.54
17	-.0000	-.0000	-.0000	-.0511	-1.69
18	2.2599	2.1636	2.1149	.2705	.0001
19	59.3818	60.8177	60.8144	-.1802	.0001
20	427.4670	427.1784	-474.6643	-473.5342	202269.8
21	.0002	11.6030	.0000	2691.2191	.00
22	5.2633	1.0495	5.1587	-.198	29507.229
23	177.4881	15.2969	16.1969	-30.0988	-.0245
24	.0000	1.0000	-2.4402	.0	1550.27
25	121.6832	394.9075	-.00862	.0	107.17
26	123.67048	.0000	.00736	.0	-236.02
27	10852.8455	.0690	-.06376	-136432.5	-393.8930
28	6687362.3	-.1507	-.05899	-27622.5	-80.2364
29	3553.5465	9639.5106	30865.5490	11378.3954	223.97095
30	6.70350	.46130	33.02924	123.19019	-60736761.0
31	81.9631	.97639	34.19085	123.85628	-1426555.0

1	15740.0000	178272.7	203444.0	744788.9	31614498.0
2	31502.5970	30190.5970	21664509.0	21663752.0	86.6077
3	-19609414.0	5743495.8	-2066897.2	-2897230.6	19438540.
4	-12615436.8	-76757.5	-307938.1	31578.6	267.5144
5	-17586388.0	-3256907.8	-10669969.6	14874454.4	-25.1660
6	30179.6040	5124.3487	16816.3810	910.7741	36.7415
7	-413.7561	106.5329	349.4545	-69.7360	-.1689
8	701.7374	8119.6053	26636.4570	2441.8631	-.1162
9	203580.7	203440.8	-.2	-4.225	-.000
10	-935.1	-936.5	-.0	101.076	-.025
11	-643.8	-643.4	-.0	-1530.198	.038
12	-56.2141	-.0356	140.0	149111.9	-.2677
13	-6.6912	-.0332	.0	6862558.5	.2931
14	-.0000	.0001	.0	6860558.5	.0000
15	-56.4835	-.0365	-56.4835	.0041	657.86
16	-6.3981	-.0364	-6.3981	-.0353	-2.66
17	-.0000	-.0000	-.0000	-.0332	-1.77
18	2.8642	2.7449	2.6945	.2638	.0082
19	59.6943	61.0826	61.0782	-.1812	-.0017
20	427.3385	427.2029	-476.3925	-473.6877	202346.2
21	.0002	11.7138	.0000	2764.2792	.00
22	6.1051	1.4268	5.9384	-.170	30190.597
23	176.0587	17.1012	16.9971	-30.0252	-.0255
24	.0000	1.0000	-2.4408	.0	1335.58
25	101.3595	373.5665	-.00888	.0	82.77
26	103.43237	-.0003	.00783	.0	-213.67
27	10853.2269	.0619	-.05928	-144318.3	-395.5520
28	6686897.9	-.1593	-.05127	-29227.5	-80.3055
29	3554.1324	11534.0787	31568.6510	9727.6224	273.92404
30	7.79405	.52889	33.17029	123.19019	-60735761.0
31	93.2547	.97639	34.19085	123.85628	-1426555.0

1	15759.9999	168749.8	202996.1	778870.4	31025868.0
2	32217.8510	30906.6240	21698023.0	21697243.0	84.9963
3	-18998415.0	5845637.5	-1731596.7	-2877760.1	18920323.
4	-12621370.0	-74893.6	-301924.1	29894.8	267.5415
5	-17567731.0	-3091748.8	-10128161.9	14925170.5	-24.1998
6	30884.0740	5090.2407	16704.5520	1036.9319	38.7104
7	-181.6155	78.8456	258.6180	-99.6471	-.1892
8	1166.3589	8397.3702	27547.8070	2631.8224	-.1242
9	203032.5	202892.6	-.1	2.616	-.000
10	-992.1	-992.9	-.0	-57.139	-.022
11	-651.3	-650.7	-.0	823.975	.033
12	-56.9366	-.0424	140.0	149053.0	-.2770
13	-7.8381	-.0662	.0	6466385.6	.2623
14	-.0000	-.0001	.0	6464385.6	.0000
15	-57.2561	-.0427	-57.2561	.0058	681.99
16	-7.5757	-.0631	-7.5757	-.0420	-2.80
17	-.0000	-.0000	-.0000	-.0662	-1.86
18	3.5409	3.3966	3.3447	.2804	-.0116
19	60.0161	61.3574	61.3518	-.1838	.0012
20	427.4145	427.2154	-475.0251	-473.8992	202445.8
21	.0001	11.8214	.0000	2844.4514	.00
22	7.1500	1.5663	6.9570	-.140	30706.623
23	174.6079	17.9151	17.8068	-29.9313	-.0254
24	.0000	1.0000	-2.4403	.0	1108.91
25	81.7338	354.8142	-.00920	.0	59.82
26	83.56509	.0001	.10723	.0	-186.56
27	10852.9113	.0539	-.05460	-152224.8	-394.2722
28	6687282.1	-.1664	-.03872	-30833.2	-80.2179
29	3554.8591	14300.0117	32309.4000	8031.8368	352.62134
30	8.90815	.60181	33.32807	123.19019	-60736761.0
31	104.2561	.97639	34.19085	123.85628	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY SECOND BURN
(SECOND OPPORTUNITY)

1	15779.9999	157250.5	202844.4	821528.3	30424685.0
2	32965.5771	31655.2290	21740063.0	21739283.0	83.3506
3	-18373899.0	5947113.3	-1398579.4	-2855730.4	18390143.
4	-12622795.5	-73648.9	-297741.5	27547.9	267.5753
5	-17539530.0	-292.0969.4	-9567914.4	14979801.0	-23.1805
6	31612.3620	5057.8362	15598.3100	1166.7474	41.0091
7	37.2930	44.6262	146.3834	-136.0257	-.1985
8	1646.4207	8631.9847	28481.6430	2833.7069	-.1327
9	202980.9	202841.0	-.1	-.178	-.000
10	-782.5	-983.1	-.0	-81.739	-.013
11	-656.8	-656.2	-.0	-15.030	.027
12	-57.9287	-.0520	140.0	149005.7	-.2914
13	-8.7938	-.0475	.0	6031417.5	.2854
14	-.0000	-.0001	.0	6029417.5	.0000
15	-58.2234	-.0533	-58.2234	.0080	708.24
16	-8.5074	-.0477	-8.5074	-.0514	-2.95
17	-.0000	-.0000	-.0000	-.0475	-1.96
18	4.2877	4.1169	4.0536	.2777	.0001
19	60.3421	61.6376	61.6305	-.1353	-.0011
20	427.4103	427.2313	-474.9090	-473.9655	202491.1
21	.0001	11.9133	.0000	2938.0659	.00
22	7.9334	1.6994	7.7538	-.110	31655.229
23	173.1041	18.7381	18.6258	-29.8143	-.0272
24	.0000	1.0000	-2.4403	.0	870.16
25	61.7908	334.7971	-.00969	.0	37.78
26	63.78214	.0000	.00763	.0	-153.10
27	10652.8851	.0434	-.04940	-160109.3	-394.1802
28	5687314.1	-.1740	-.02979	-32437.3	-80.1938
29	3555.7707	18692.9610	33037.9450	6293.9813	490.49141
30	10.04207	.68036	33.50717	123.19019	-60735761.0
31	114.9194	.97639	34.19085	123.85628	-1426555.0

1	15800.0000	149753.5	202794.7	873934.9	29810756.0
2	33752.1581	32442.7630	21791362.0	21791043.0	81.6699
3	-17734124.0	6047960.4	-1067723.2	-2831067.4	17847963.
4	-12619953.9	-73151.0	-296109.5	24411.1	267.6177
5	-17501757.0	-2744410.6	-8986704.4	15038609.1	-22.1004
6	32370.8800	5027.3072	16498.2240	1300.1455	43.5991
7	245.1141	3.9914	13.0355	-178.8097	-.2135
8	2144.5178	8975.6494	29445.1480	3049.9030	-.1425
9	202931.1	202791.2	-.1	.177	-.000
10	-993.6	-994.3	-.0	-47.579	-.014
11	-663.2	-652.2	-.0	13.276	.022
12	-59.1515	-.0723	140.0	148948.5	-.2921
13	-9.7558	-.0472	.0	5511807.0	.3072
14	-.0000	-.0001	.0	5509806.9	.0000
15	-59.4478	-.0697	-59.4478	.0123	738.93
16	-9.4485	-.0448	-9.4485	-.0713	-3.13
17	-.0000	-.0000	-.0000	-.0472	-2.09
18	5.0997	4.9014	4.8467	.2819	.0005
19	60.6774	61.9277	61.9189	-.1871	.0010
20	427.4055	427.2444	-474.7979	-474.0502	202525.8
21	.0001	11.9775	.0000	3053.3765	.00
22	8.6434	1.4183	8.5297	-.082	32442.763
23	171.5557	19.5701	19.4538	-29.6715	-.0280
24	.0000	1.0000	-2.4402	.0	617.14
25	41.8804	314.9261	-.01035	.0	18.34
26	43.87200	.0000	.00780	.0	-113.43
27	10852.8151	.0297	-.04313	-167992.0	-394.0928
28	6687399.5	-.1817	-.02077	-34040.9	-80.1701
29	3556.9590	26786.4440	33910.6570	4502.9797	781.21387
30	11.18300	.76555	33.70421	123.19019	-60736761.0
31	125.0848	.97639	34.19085	123.85628	-1426555.0

CHI TILDE ($\tilde{\chi}$) INITIATION

1	15812.9999	143525.1	202501.1	913789.7	29404770.0
2	34280.2433	32977.5000	21831293.0	21830463.0	80.5584
3	-17309998.0	6113189.0	-853557.5	-2813594.2	17489079.
4	-12615921.1	-73292.5	-296574.5	21884.2	267.6509
5	-17471704.0	-2625455.0	-8501743.2	15079218.1	-21.3614
6	32881.9110	5008.0615	16435.1280	1388.2399	45.4053
7	374.6449	-26.3096	-86.3773	-210.4873	-.2234
8	2483.9540	9172.2786	30090.2920	3199.1113	-.1492
9	202637.5	202497.6	-.1	.069	-.000
10	-997.0	-997.6	-.0	20.435	-.012
11	-666.0	-664.8	-.0	-142.551	.018
12	-50.1463	-.0874	140.0	148911.4	-.3052
13	-10.3815	-.0414	.0	5144307.8	.3168
14	-.0000	-.0001	.0	5142307.9	.0000
15	-60.4564	-1.0000	-50.4564	.0157	760.43
16	-10.0649	-.5470	-10.0649	-.0859	-3.26
17	-.0000	-.0000	-.0000	-.0414	-2.17
18	5.6588	5.4422	5.3865	.2823	.0031
19	60.8999	62.1213	52.1114	-.1881	.0017
20	427.1408	427.2413	-474.4747	-474.0708	202533.6
21	.0001	12.0042	.0000	3140.5464	.00
22	9.0745	1.0204	9.0190	-.066	32977.500
23	170.5246	20.1155	19.9967	-29.5635	-.0234
24	.0000	1.0000	-2.4400	.0	430.77
25	26.4968	301.4707	-.01337	.0	7.37
26	29.79105	.0003	.00709	.0	-81.46
27	10852.7099	.0171	.00000	-173115.3	-394.0709
28	6687527.4	-.1869	.00000	-35079.0	-79.7988
29	3557.9475	37076.2240	34470.8920	3307.9319	1210.62780
30	11.92135	.82488	33.84241	123.19019	-60736761.0
31	131.3453	.97639	34.19085	123.85628	-1426555.0

1	15820.0000	140254.4	202489.2	937258.3	29183877.0
2	34581.6720	33273.3190	21854528.0	21853692.0	79.9537
3	-17078845.0	6148203.7	-738745.7	-2803714.9	17293707.
4	-12613055.0	-73540.2	-297387.5	20344.7	267.6710
5	-17453669.0	-2551869.5	-8369866.2	15101904.4	-20.9504
6	33162.6650	4995.7506	16394.7620	1433.9617	45.4755
7	444.8852	-44.7810	-146.9778	-225.6860	-.5799
8	2674.6057	9281.3107	30448.0270	3283.5764	.1392
9	202612.4	202472.4	-.1	637.846	-.000
10	-2528.0	-2529.5	-.0	71435.796	-.011
11	607.0	612.7	-.0	85379.012	.016
12	-62.7474	-.4056	140.0	148215.4	.0432
13	-11.5057	-.1092	.0	4943227.2	.6705
14	-.0000	.0515	.0	4941422.6	.0000
15	-62.7034	-.0492	-62.7034	.0809	771.94
16	-10.8352	-.0288	-10.8352	-.3974	-3.33
17	-.0000	-.0000	-.0000	-.1092	-2.22
18	5.9563	5.7302	5.6742	.7158	.5091
19	61.0165	62.2228	62.2121	.1734	.7991
20	427.1254	427.2386	-474.3029	-474.0734	202535.8
21	.0001	12.0137	.0000	3192.0438	.00
22	10.1372	-1.2793	10.0595	-.053	33273.320
23	169.9511	20.4107	20.2905	-29.5002	-.0285
24	.0000	1.0000	-2.4400	.0	348.42
25	22.5065	295.3602	-.01219	.0	5.33
26	23.99255	.0008	.00801	.0	-66.00
27	10852.7099	.0153	.00000	-175873.0	-394.0191
28	6687527.4	-.1872	.00000	-35637.7	-79.8068
29	3558.7315	46634.8780	34780.9410	2654.1058	1662.05790
30	12.28983	.85220	33.92367	123.19019	-60736761.0
31	134.3077	.97639	34.19085	123.85628	-1426555.0

#					
1	15839.9999	130778.4	202447.0	1012395.7	28543798.0
2	35463.6010	34136.4250	21928979.0	21928129.0	73.2014
3	-16407340.5	6247778.6	-411962.0	-2773712.0	16727130.
4	-12602161.5	-74985.7	-302134.2	15178.6	257.7380
5	-17394543.0	-2373057.5	-7770453.1	15170086.6	-19.7211
6	33996.6300	4763.5428	16269.4925	1568.3174	43.8391
7	642.6139	-100.2312	-328.6999	-287.2774	-.2068
8	3236.9068	9601.8165	31499.6129	3537.7444	-.2872
9	202581.9	202441.9	7.0	-176.272	-.000
10	-940.5	-844.4	-.0	-26927.730	-.008
11	-1167.5	-1163.4	-.0	-10080.585	.012
12	-62.1183	-.2748	140.0	143699.3	-.2536
13	-10.8880	-.2598	.0	4356646.2	.4032
14	-.0000	-.0467	.0	4356132.2	.0000
15	-62.3764	-.0744	-62.3764	.0519	804.59
16	-10.4848	-.0371	-10.4849	-.2699	-3.52
17	-.0000	-.0000	-.0000	-.2598	-2.35
18	6.8556	6.5017	6.5446	.2370	.3079
19	61.3736	62.5359	62.5232	-.3293	.2124
20	427.1850	427.2337	-474.2452	-474.0927	202540.2
21	.0000	12.0453	.0000	3346.1301	.00
22	9.2043	.2991	9.1996	-.040	34156.425
23	168.3183	21.2597	21.1360	-29.2987	-.0292
24	.0000	1.0000	-2.4398	.0	46.52
25	1.5900	274.7308	-.00891	.0	.76
26	3.08574	.0002	.01016	.0	-8.55
27	10852.7079	.0163	.00000	-183752.4	-393.3559
28	6637527.4	-.1839	.00000	-37234.1	-73.8343
29	3561.1863	173638.4300	35706.2550	732.3072	11024.72290
30	13.36465	.95981	34.15584	123.19019	-60736761.0
31	142.6332	.97639	34.19085	123.35628	-1426555.0

SECOND S-IVB GUIDANCE CUTOFF COMMAND

#					
1	15842.8173	129442.4	208000.0	1024017.9	28452552.0
2	35592.9700	34235.7120	21940901.0	21939648.0	77.9515
3	-16311387.9	6251757.0	-356065.7	-2769265.9	16646325.
4	-12500313.3	-75280.5	-303098.3	14357.4	267.7486
5	-17385313.0	-2345940.6	-7681493.6	15180105.0	-19.5408
6	34118.4120	4959.8943	16277.2043	1588.1044	51.7002
7	669.6264	-108.2699	-355.2737	-295.5147	.0000
8	3315.9743	9647.9578	31651.0020	3575.0056	.0000
9	208000.0	208000.0	-.0	-42.375	-.000
10	.0	.0	-.0	-7046.503	-.007
11	.0	.0	-.0	-2397.350	.011
12	-67.1400	-.1029	.0	143063.1	.0000
13	-10.8000	-.1485	.0	4274030.3	.0000
14	-.0000	-.0001	.0	4273698.1	.0000
15	.0000	.0000	.0000	.0000	809.19
16	.0000	.0000	.0000	.0000	-3.55
17	.0000	.0000	.0000	.0000	-2.37
18	6.9704	6.7325	6.6753	.0000	.0000
19	61.4274	62.5834	62.5705	.0000	.0000
20	428.8660	427.2333	-485.0000	-474.0937	202540.5
21	.0000	12.0530	.0000	3367.1705	.10
22	9.0863	.4039	9.0775	-.038	34285.712
23	168.0829	21.3300	21.2558	-29.2677	-.0293
24	.0000	1.0000	-2.4399	.0	46.52
25	1.3900	274.7308	-.00391	.0	.76
26	-.00007	.0002	.01015	.0	-8.55
27	10848.7484	.0163	.00000	-184862.0	.0000
28	6687527.4	-.1839	.00000	-37459.0	.0000
29	3561.5302	280775.7200	35842.2150	454.6445	22409.08700
30	13.52290	.97495	34.18809	123.85096	-1513890.0
31	143.8425	.97639	34.19085	123.85623	-1426555.0

TRANSLUNAR ORBIT INSERTION (TLI)

1	15852.8173	129237.8	55.7	1067143.2	28123748.0
2	35569.7230	34261.1060	21983273.0	21982414.0	77.0651
3	-15970375.4	6310954.0	-204530.3	-2753360.3	16359524.
4	-12592852.0	-76364.5	-306555.5	11391.1	267.7873
5	-17351190.0	-2247275.7	-7364375.5	15215901.3	-13.8899
6	34071.2730	4877.9633	16008.4365	1590.641	.0139
7	823.8161	-107.8779	-353.4868	-296.6545	.0000
8	3506.1535	9681.7122	31761.7740	3579.7966	.0000
9	55.7	55.7	-.0	-42.375	-.000
10	- .0	.0	-.0	-7046.503	-.007
11	.0	.0	-.0	-2397.350	.011
12	-62.1400	.0000	.0	142965.6	.0000
13	-10.8000	.0000	.0	4261375.	.0000
14	-.0000	-.0000	.0	4261072.0	.0000
15	.0000	.0000	.0000	.0000	809.90
16	.0000	.0000	.0000	.0000	-3.55
17	.0000	.0000	.0000	.0000	-2.37
18	7.4538	7.1878	7.1304	.0000	.0000
19	51.7592	52.9037	52.8896	.0000	.0000
20	327.3114	423.9338	-.1700	-459.9318	196370.5
21	.0000	11.9971	.0000	3445.2496	.00
22	9.1306	.8579	9.0916	-.030	34261.106
23	167.2443	21.8041	21.6781	-29.1537	-.0295
24	.0000	1.0000	-2.4398	.0	46.52
25	1.3900	274.7308	-.00891	.0	.76
26	-.00007	.0002	.01016	.0	-8.55
27	1.0848.7434	.0163	.00000	-184862.0	.0000
28	5687527.4	-.1839	.00000	-37459.0	.0000
29	3561.5555	296281.1100	35853.7880	430.9948	24265.86700
30	14.43521	.97524	34.19044	123.85449	-1435599.0
31	153.7145	.97539	34.19085	123.85628	-1426555.0

PREDICTED S-IVB-503N STAGE TRAJECTORY TRANSLUNAR COAST

#					
1	TIME	WEIGHT	F SB T	ALTITUDE	RANGE
2	V SB I	V SB E	R SB C	R SUB PF	RANGE ANGLE
3	X SB E	X SB P (M)	X SB S	XI	D* SB I
4	Y SB E	Y SB P (M)	Y SB S	ETA	A* SB I
5	Z SB E	Z SB P (M)	Z SB S	ZETA	E* SB I
6	D-X SB E	D-X SB P (M)	D-X SB S	D-XI	A SB XN
7	D-Y SB E	D-Y SB P (M)	D-Y SB S	D-ETA	A SB YN
8	D-Z SB E	D-Z SB P (M)	D-Z SB S	D-ZETA	A SB ZN
9	F SB X	F SB TX	F SB AX	M SB X	M SB AX
10	F SB Y	F SB TY	F SB AY	M SB Y	M SB AY
11	F SB Z	F SB TZ	F SB AZ	M SB Z	M SB AZ
12	THETA(M)QRP	DTHETA(M)QRP	F AUX SB X	I SB XX	EPS(THETA)
13	PSI(M) QRP	D-PSI(M)QRP	F AUX SB Y	I SB YY	EPS(PSI)
14	PHI(M) QRP	D-PHI(M)QRP	F AUX SB Z	I SB ZZ	EPS(PHI)
15	CHI SB P	D-CHI SB P	THETA SB C	P SB M	X SB CG
16	CHI SB Y	D-CHI SB Y	PSI SB C	Q SB M	Y SB CG
17	CHI SB R	D-CHI SB R	PHI SB C	R SB M	Z SB CG
18	GAMMA SB 1	GAMMA SB 1I	GAMMA(1I)PR.	DELTA(A)	D-DELTA(A)
19	GAMMA SB 2	GAMMA SB 2I	GAMMA(2I)PR.	DELTA(B)	D-DELTA(B)
20	I SB SP	AVG I SB SP	WEIGHT FLOW	AVG D-I	AVG F SB L
21	Q	MACH NO.	PRESSURE	TEMPERATURE	X SB CP
22	ALPHA*	ALPHA	BETA	CHORD FORCE	V SB R
23	MU	RHO	RHO PRIME	G(RHO)	G(PSI)
24	T(2)	TAU(2)	PHI(T)	D-W(LOX)BO	DELTA-D-X(V)
25	T(3)	TAU(3)	SMCP	D-W(LH2BO)	DELTA-D-Y(V)
26	DELTA-T(C3)	DELTA-T(3)	SMCY	D-W(LH2PR)	DELTA-D-Z(V)
27	V(T)	CHI(P)-TILDE	K(1)	W(LOX)RES	WDOTSUB
28	Y(V,T)	CHI(Y)-TILDE	K(3)	W(LH2)RES	WDOTSUBF
29	R(PER)	R(AP)	V(PER)	V(AP)	PERIOD
30	BETA	ECCENTRICITY	INCLINATION	THETA SUB NS	C SUB 3S
31	TAU	E SUB T	I SUB T	THETA SUB N	C3 SUB T

BEGIN MANEUVER TO LOCAL HORIZONTAL

#					
1	10573.8871	129261.8	52.3	1169147.2	20591885.0
2	35488.4610	34122.7050	22085304.0	22080743.0	56.4151
3	-8685629.9	6405097.5	106954.0	307289.5	9416186.
4	-8167169.8	27555.2	34228.1	56210.2	248.1221
5	-16490664.2	-2066324.8	-6758080.2	389589.4	-5.5893
6	30893.6780	4754.4920	15607.2636	1851.9551	.0130
7	5068.8015	677.5284	2222.7527	514.1641	.0000
8	13573.7565	9693.0469	31794.7110	2542.8482	.0000
9	52.3	52.3	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-61.4582	.0000	.0	142977.0	.0000
13	15.8637	.0000	.0	4262859.5	.0000
14	.0000	-.0000	.0	4262551.8	.0000
15	-61.4582	.0000	-61.4582	.0000	809.81
16	15.8637	.0000	15.8637	.0000	-3.55
17	.0000	.0000	.0000	.0000	-2.37
18	8.6304	8.2959	8.2484	.0000	.0000
19	66.7972	57.7595	67.7425	.0000	.0000
20	307.6233	420.7816	-.1700	-446.1815	190500.1
21	.0000	11.5534	.0000	3529.9294	.00
22	13.3822	2.1211	-13.2248	-.017	34122.705
23	143.0979	21.7717	21.6464	-28.8843	-.0289
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37524.5	.0000
29	3559.0569	299059.1500	35868.4970	426.8657	24604.58900
30	16.59702	.97648	30.55826	119.72787	-1422391.0
31	178.2065	.97655	30.55942	119.72773	-1418676.0

1	10599.9949	129257.3	43.3	1311966.8	19763549.0
2	35373.4170	34003.0390	22227372.0	22222791.0	54.1477
3	-7883792.2	6526391.7	505130.1	355549.7	8653314.
4	-8031317.3	45235.3	92231.2	69536.6	247.0465
5	-16130392.7	-1812334.6	-5934950.5	455991.1	-2.8910
6	30517.0890	4535.6171	14889.5252	1851.9958	.0108
7	5334.8556	676.5171	2219.4411	514.1749	.0000
8	14016.1809	9758.7043	32010.2300	2542.9330	.0000
9	43.3	43.3	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-74.0804	-.8973	.0	142974.9	.0000
13	2.7945	-.0098	.0	4262585.3	.0000
14	.6262	.0437	.0	4262278.2	.0000
15	-74.0804	.0000	-74.0804	.0000	809.83
16	2.7945	.0000	2.7945	-.8963	-3.55
17	.6262	.0000	.6262	.0000	-2.37
18	9.8471	9.4621	9.4153	.0000	.0000
19	67.7225	68.6545	68.6345	.0000	.0000
20	254.9066	410.6193	-.1700	-413.6945	176627.8
21	.0000	11.1235	.0000	3888.5066	.00
22	9.3972	-9.3954	-.1850	-.008	34003.039
23	140.8380	22.6535	22.5251	-28.5146	-.0291
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.0846	298967.0500	35868.3420	426.9985	24593.35900
30	19.05900	.97647	30.65746	119.72787	-1422391.0
31	204.2806	.97655	30.65942	119.72773	-1418676.0

1	10699.9999	129240.3	7.5	2019675.1	16708442.7
2	34817.5800	33424.9850	22932414.0	22927801.0	45.7803
3	-4909245.4	6938354.1	1857569.3	540850.5	5983658.
4	-7450011.0	112507.4	312931.4	121054.4	240.3560
5	-14651861.5	-827180.6	-2703442.4	710289.9	12.1682
6	28944.7420	3708.1740	12176.0823	1852.0152	.0019
7	6267.5054	667.6976	2190.5400	514.1791	.0000
8	15496.7721	9921.6698	32545.4850	2543.0194	.0000
9	7.5	7.5	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-82.4512	-.0801	.0	142966.8	.0000
13	2.6737	-.0014	.0	4261535.0	.0000
14	1.0263	.0037	.0	4261230.2	.0000
15	-82.4512	.0000	-82.4512	.0000	809.89
16	2.6737	.0000	2.6737	-.0800	-3.55
17	1.0263	.0000	1.0263	.0000	-2.37
18	14.3524	13.7668	13.7254	.0000	.0000
19	71.5315	72.3419	72.3101	.0000	.0000
20	44.0021	335.5653	-.1700	-323.5038	138107.3
21	.0000	9.9521	.0000	4694.0545	.00
22	13.5352	-13.5352	-.0190	-.000	33424.985
23	132.2447	25.5877	25.4513	-26.7828	-.0281
24	.0000	1.0000	-2.3541	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10637.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.1480	297510.9000	35866.9860	429.0798	24416.01900
30	27.78998	.97636	30.55475	119.72787	-1422391.0
31	304.2631	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY TRANSLUNAR COAST

1	10800.0000	129223.3	5.7	2957582.3	13874011.2
2	34118.4930	32697.6090	23868156.0	23863564.0	38.0151
3	-2098708.4	7259485.8	2945131.0	726052.2	4238494.
4	-6782790.0	178561.3	529538.9	172472.4	221.9874
5	-13042691.9	167801.2	560380.3	964594.3	40.2206
6	27255.8610	2924.0941	9604.6945	1852.0183	.0014
7	7051.6114	652.4777	2140.6508	514.1814	.0000
8	16629.0860	9958.9556	32668.6320	2543.0693	.0000
9	5.7	5.7	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-90.4576	-.0801	.0	142958.7	.0000
13	2.5049	-.0019	.0	4260484.3	.0000
14	1.3885	.0035	.0	4260181.8	.0000
15	-90.4576	.0000	-90.4576	.0000	809.95
16	2.5049	.0000	2.5049	-.0800	-3.55
17	1.3885	.0000	1.3885	.0000	-2.37
18	18.5694	17.7696	17.7366	.0000	.0000
19	75.6011	76.2771	76.2339	.0000	.0000
20	33.6215	282.4313	-.1700	-265.6105	113380.2
21	.0000	9.5667	.0000	4861.1699	.00
22	17.6308	-17.6301	.1584	-.000	32697.610
23	123.9110	27.7991	27.6502	-24.7200	-.0254
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37524.5	.0000
29	3559.1995	296297.7200	35865.8550	430.8293	24268.59500
30	35.91943	.97626	30.55263	119.72787	-1422391.0
31	404.2705	.97655	30.55942	119.72773	-1418676.0

1	10899.9999	129206.3	4.0	4090167.5	11286332.0
2	33326.6320	31872.9070	24999177.0	24994644.0	30.9267
3	541489.2	7525426.2	3785994.0	911254.0	4505072.
4	-6044665.6	242855.2	740577.1	223890.6	158.2724
5	-11337081.6	1161250.7	3819265.1	1218903.2	62.7388
6	25552.9170	2207.2008	7253.4838	1852.0156	.0010
7	7686.8625	632.8203	2076.2083	514.1829	.0000
8	17431.0860	9895.4947	32461.3740	2543.1067	.0000
9	4.0	4.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-98.4617	-.0800	.0	142950.6	.0000
13	2.2872	-.0024	.0	4259433.2	.0000
14	1.7237	.0032	.0	4259133.0	.0000
15	-98.4617	.0000	-98.4617	.0000	810.01
16	2.2872	.0000	2.2872	-.0800	-3.55
17	1.7237	.0000	1.7237	.0000	-2.37
18	22.4662	21.4365	21.4132	.0000	.0000
19	79.7239	80.2483	80.1953	.0000	.0000
20	23.2409	243.8587	-.1700	-225.3006	96163.0
21	.0000	9.3254	.0000	4861.1699	.00
22	22.0829	-22.0806	.3527	-.000	31872.908
23	116.0272	29.3235	29.1863	-22.5312	-.0218
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.2379	295463.1700	35865.0590	432.0412	24167.35500
30	43.37532	.97619	30.55116	119.72787	-1422391.0
31	504.2452	.97655	30.55942	119.72773	-1418676.0

1	10999.9999	129189.3	3.0	5382181.2	8950581.6
2	32485.9140	30995.2760	26290212.0	26285757.0	24.5269
3	3013943.1	7713552.0	4404436.1	1096455.2	6436398.
4	-5249951.3	305037.8	944593.5	275309.0	111.3203
5	-9566095.8	2144432.4	7044560.5	1473215.1	52.1825
6	23911.0690	1568.7795	5159.4801	1852.0104	.0007
7	8186.3143	610.5254	2003.1127	514.1839	.0000
8	17944.7550	9757.9384	32010.9670	2543.1311	.0000
9	3.0	3.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-105.5447	-.0500	.0	142942.5	.0000
13	2.0573	-.0017	.0	4258382.0	.0000
14	1.9925	.0018	.0	4258084.1	.0000
15	-105.5447	.0000	-105.5447	.0000	810.06
16	2.0573	.0000	2.0573	-.0500	-3.56
17	1.9925	.0000	1.9925	.0000	-2.37
18	26.0384	24.7616	24.7479	.0000	.0000
19	83.7297	84.0815	84.0205	.0000	.0000
20	17.6471	214.2339	-.1700	-195.6176	83485.4
21	.0000	9.0689	.0000	4861.1699	.00
22	25.9813	-25.9767	.5675	-.000	30996.277
23	108.7296	30.2501	30.1172	-20.3711	-.0182
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.2586	294934.9800	35864.5200	432.8122	24103.35400
30	50.14268	.97615	30.55028	119.72787	-1422391.0
31	604.2601	.97655	30.55942	119.72773	-1418676.0

1	11100.0000	129172.3	3.0	6801423.4	6857502.9
2	31630.5080	30103.1630	27708980.0	27704610.0	18.7915
3	5327331.5	7841861.2	4826574.2	1281655.9	8936587.
4	-4411277.5	364920.9	1141070.2	326727.4	98.3843
5	-7756030.6	3111164.7	10215985.2	1727529.2	42.1676
6	22377.3110	1010.5511	3328.3615	1852.0034	.0007
7	8569.5597	587.0346	1926.0909	514.1846	.0000
8	16221.3880	9570.1347	31395.8810	2543.1526	.0000
9	3.0	3.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-110.5443	-.0500	.0	142034.5	.0000
13	1.8759	-.0019	.0	4257331.0	.0000
14	2.1642	.0016	.0	4257035.4	.0000
15	-110.5443	.0000	-110.5443	.0000	810.12
16	1.8759	.0000	1.8759	-.0500	-3.56
17	2.1642	.0000	2.1642	.0000	-2.37
18	29.2998	27.7587	27.7534	.0000	.0000
19	87.5030	87.6582	87.5913	.0000	.0000
20	17.6471	191.3350	-.1700	-172.8532	73761.2
21	.0000	8.8076	.0000	4861.1699	.00
22	28.1505	-28.1425	.7960	-.000	30103.153
23	102.0918	30.6915	30.5643	-18.3375	-.0149
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.2990	294645.6900	35864.1550	433.2364	24068.32600
30	56.24669	.97613	30.54987	119.72787	-1422391.0
31	704.2483	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY TRANSLUNAR COAST

1	11199.9999	129155.3	3.0	8320059.2	4989666.7
2	30784.6210	29218.8230	29227538.0	29223251.0	13.6732
3	7493821.2	7918194.7	5078412.4	1466855.8	11580379.
4	-3539210.7	422440.0	1329795.0	378145.9	93.1294
5	-5928029.5	4057435.4	13320375.1	1981845.4	35.7826
6	20975.5130	528.2104	1746.0459	1851.9945	.0007
7	8857.6148	563.3906	1848.5618	514.1853	.0000
8	18311.4750	9351.4814	30679.4250	2543.1735	.0000
9	3.0	3.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-115.5429	-.0500	.0	142926.4	.0000
13	1.6802	-.0020	.0	4256279.8	.0000
14	2.3194	.0015	.0	4255986.6	.0000
15	-115.5429	.0000	-115.5429	.0000	810.18
16	1.6802	.0000	1.6802	-.0500	-3.56
17	2.3194	.0000	2.3194	.0000	-2.37
18	32.2748	30.4523	30.4541	.0000	.0000
19	90.9827	90.9148	90.8438	.0000	.0000
20	17.6471	173.2142	-.1700	-154.8372	66066.0
21	.0000	8.5489	.0000	4861.1699	.00
22	30.6471	-30.6351	1.0489	-.000	29218.823
23	96.1308	30.7601	30.6393	-16.4812	-.0120
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.3237	294510.5600	35863.8800	433.4361	24051.97200
30	61.73500	.97612	30.64981	119.72787	-1422391.0
31	804.2458	.97655	30.55942	119.72773	-1418676.0
1	11300.0000	129138.4	3.0	9914904.5	3326641.6
2	29964.0290	28359.8620	30822500.0	30818384.0	9.1159
3	9527093.8	7949787.2	5183372.6	1652054.6	14238593.
4	-2642274.4	477617.2	1510842.2	429564.4	90.3797
5	-4098463.7	4980918.2	16350087.7	2236163.8	31.4165
6	19713.1860	114.3623	388.3119	1851.9838	.0007
7	9069.9778	540.2852	1772.7946	514.1860	.0000
8	18259.4520	9116.4087	29909.0210	2543.1935	.0000
9	3.0	3.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-120.5404	-.0500	.0	142918.3	.0000
13	1.4717	-.0021	.0	4255228.7	.0000
14	2.4569	.0013	.0	4254937.8	.0000
15	-120.5404	.0000	-120.5404	.0000	810.24
16	1.4717	.0000	1.4717	-.0500	-3.56
17	2.4569	.0000	2.4569	.0000	-2.37
18	34.9921	32.8719	32.8794	.0000	.0000
19	94.1503	93.8310	93.7574	.0000	.0000
20	17.6471	158.5172	-.1700	-140.2253	59824.8
21	.0000	8.2976	.0000	4861.1699	.00
22	33.4405	-33.4241	1.3324	-.000	28359.863
23	90.8229	30.5551	30.4410	-14.8194	-.0097
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.3738	294461.3600	35863.6400	433.5105	24046.02200
30	66.66988	.97611	30.64997	119.72787	-1422391.0
31	904.2304	.97655	30.65942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY TRANSLUNAR COAST

1	11400.0000	129121.4	3.0	11567114.4	1850757.4
2	27178.0950	27536.2760	32475230.0	32471073.0	5.0715
3	11441021.0	7943067.3	5162533.8	1837252.4	16865975.
4	-1727176.4	530529.2	1684460.2	480983.0	88.7294
5	-2279648.4	5880514.7	19301512.0	2490484.0	28.2021
6	18587.5560	-239.4745	-772.6296	1851.9714	.0007
7	9223.3428	518.1384	1700.1678	514.1865	.0000
8	18101.9110	8875.1611	29118.2730	2543.2126	.0000
9	3.0	3.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-125.5370	-.0500	.0	142910.2	.0000
13	1.2520	-.0022	.0	4254177.7	.0000
14	2.5757	.0011	.0	4253889.0	.0000
15	-125.5370	.0000	-125.5370	.0000	810.30
16	1.2520	.0000	1.2520	-.0500	-3.56
17	2.5757	.0000	2.5757	.0000	-2.37
18	37.4812	35.0479	35.0598	.0000	.0000
19	97.0158	96.4152	96.3403	.0000	.0000
20	17.6471	146.3575	-.1700	-128.1359	54661.1
21	.0000	8.0566	.0000	4861.1699	.00
22	36.4991	-36.4782	1.6548	-.000	27536.277
23	86.1195	30.1574	30.0499	-13.3494	-.0078
24	.0000	1.0000	-2.3541	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.4191	294455.3400	35863.4040	433.5221	24045.30000
30	71.10968	.97611	30.55027	119.72787	-1422391.0
31	1004.2320	.97655	30.55942	119.72773	-1418676.0

1	11499.9999	129104.4	.0	13261610.1	585930.5
2	28431.6140	26753.3280	34170280.0	34166166.0	1.6056
3	13248879.8	7903612.7	5034488.3	2022448.9	19445069.
4	-799115.2	581284.5	1851005.6	532401.7	87.6573
5	-480630.1	6755977.4	22173829.0	2744806.0	25.7043
6	17590.1040	-541.6803	-1764.2446	1851.9633	-.0000
7	9331.3181	497.1767	1631.4238	514.1867	.0000
8	17867.7180	8634.6598	28329.8900	2543.2236	.0000
9	-.0	.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-82.6424	1.0009	.0	142902.1	.0000
13	2.6702	.0181	.0	4253126.5	.0000
14	1.0352	-.0466	.0	4252840.2	.0000
15	-82.6424	.0000	-82.6424	.0000	810.36
16	2.6702	.0000	2.6702	1.0000	-3.56
17	1.0352	.0000	1.0352	.0000	-2.37
18	39.7699	37.0094	37.0246	.0000	.0000
19	99.6046	98.6918	98.6165	.0000	.0000
20	-.0000	135.5537	-.1700	-117.9677	50317.9
21	.0000	7.8275	.0000	4861.1699	.00
22	8.2707	8.1236	1.5739	-.000	26753.329
23	81.9610	29.6293	29.5283	-12.0578	-.0063
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.4629	294441.9400	35863.1720	433.5443	24043.68200
30	75.11425	.97611	30.55065	119.72787	-1422391.0
31	1104.2322	.97655	30.55942	119.72773	-1418676.0

1	11600.0000	129087.4	.0	14986448.3	762540.4
2	27726.3430	26013.1210	35895753.0	35891566.0	2.0895
3	14962940.2	7836195.2	4814585.8	2207645.1	21969362.
4	137933.5	630007.3	2010885.2	583820.3	85.9269
5	1292084.2	7607621.9	24968063.0	2999128.2	23.6875
6	16709.6140	-799.9453	-2611.7415	1851.9633	-.0000
7	9404.6830	477.4961	1566.8792	514.1857	.0000
8	17579.0560	8399.3781	27558.5540	2543.2236	.0000
9	-.0	.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.564	.008
12	-8.2041	.0000	.0	142894.0	.0000
13	1.7155	.0000	.0	4252075.4	.0000
14	23.3161	1.0000	.0	4251791.4	.0000
15	-8.2041	.0000	-8.2041	1.0000	810.41
16	1.7155	.0000	1.7155	.0000	-3.56
17	23.3161	.0000	23.3161	.0000	-2.37
18	41.8837	38.7827	38.8002	.0000	.0000
19	101.9502	100.6925	100.6176	.0000	.0000
20	-.0000	125.5755	-.1700	-109.2956	46613.9
21	.0000	7.6109	.0000	4861.1699	.00
22	84.0106	83.2595	77.1628	-.000	26013.122
23	78.2848	29.0175	28.9225	-10.9265	-.0051
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.5	.2080	.00000	-37624.5	.0000
29	3559.5003	294398.3600	35862.9490	433.6104	24038.4130
30	78.73718	.97611	30.55106	119.72787	-1422391.0
31	1204.2174	.97655	30.55942	119.72773	-1418676.0

1	11700.0000	129070.4	.0	16732222.3	1790737.4
2	27062.1430	25315.7590	37642205.0	37638126.0	4.9069
3	16594298.9	7744861.8	4516200.6	2392841.4	24437207.
4	1080948.3	676826.9	2164523.0	635239.0	85.4155
5	3033929.0	8436119.5	27686411.0	3253450.5	22.0139
6	15934.0529	-1021.0421	-3337.3249	1851.9633	-.0000
7	9451.8420	459.1106	1506.5799	514.1857	.0000
8	17252.7170	8172.0623	26813.2840	2543.2236	.0000
9	-.0	.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-8.2041	.0000	.0	142985.9	.0000
13	1.7155	.0000	.0	4251024.4	.0000
14	123.3055	1.0000	.0	4250742.6	.0000
15	-8.2041	.0000	-8.2041	1.0000	810.47
16	1.7155	.0000	1.7155	.0000	-3.56
17	123.3055	.0000	123.3055	.0000	-2.37
18	43.8446	40.3912	40.4104	.0000	.0000
19	104.0863	102.4505	102.3763	.0000	.0000
20	-.0000	116.9656	-.1700	-101.8145	43417.9
21	.0000	7.4069	.0000	4861.1699	.00
22	85.3326	-82.3861	84.1132	-.000	25315.759
23	75.0315	28.3559	28.2668	-9.9361	-.0042
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.5	.2080	.00005	-37624.5	.0000
29	3559.5375	294359.3800	35862.7310	433.6697	24033.70000
30	82.02581	.97610	30.55148	119.72787	-1422391.0
31	1304.2297	.97655	30.55942	119.72773	-1418676.0

1	11999.9999	62631.5	.0	22028998.0	4388808.1
2	25299.4650	23465.7050	42941042.0	42936894.0	12.0253
3	21085540.0	7358970.7	3253818.2	2948430.0	31513684.
4	3925633.7	807118.7	2592090.2	789494.9	85.6213
5	8048219.0	10792034.0	35416599.0	4016417.2	18.3200
6	14123.4051	-1514.9244	-4958.3454	1851.9633	-.0000
7	9493.2505	411.2339	1349.5490	514.1857	.0000
8	16156.9472	7549.5376	24772.0910	2543.2236	.0000
9	-.0	.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-8.2041	.0000	.0	107144.7	.0000
13	1.7155	.0000	.0	1073540.7	.0000
14	177.6874	-.0000	.0	1071540.6	.0000
15	-8.2041	.0000	-8.2041	.0000	490.51
16	1.7155	.0000	1.7155	.0000	-3.33
17	177.6874	.0000	177.6874	.0000	1.32
18	48.9906	44.4195	44.4407	.0000	.0000
19	109.5517	106.5692	106.4994	.0000	.0000
20	-.0000	97.0113	-.1700	-122.2264	36010.8
21	.0000	5.8656	.0000	4861.1699	.00
22	88.4075	-88.4057	-60.3269	-.000	23465.706
23	67.2978	26.2794	26.2051	-7.6352	-.0023
24	.000J	1.0000	-2.3541	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.9	.2080	.00000	-37624.5	.0000
29	3559.6415	294247.8300	35862.1200	433.8394	24020.21700
30	90.27420	.97609	30.55265	119.72787	-1422391.0
31	1604.2436	.97655	30.55942	119.72773	-1418676.0
1	13000.0000	62461.6	.0	39415487.0	9314304.5
2	21238.0770	19255.2170	60332772.0	60327596.0	25.5179
3	33521431.0	5410628.3	-3127570.0	4800392.5	52256232.
4	13330542.0	1160941.3	3753320.5	1303681.4	85.8128
5	22336244.0	17535404.0	57544977.0	6559639.6	12.4990
6	11329.3208	-2227.9172	-7299.5773	1851.9633	.0000
7	9282.5614	397.6883	1009.8960	514.1857	.0000
8	12499.7428	6069.5837	19918.6410	2543.2236	.0000
9	.0	.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-8.2041	.0000	.0	107130.7	.0000
13	1.7155	.0000	.0	1070526.7	.0000
14	177.6874	-.0000	.0	1068526.7	.0000
15	-8.2041	.0000	-8.2041	.0000	491.53
16	1.7155	.0000	1.7155	.0000	-3.33
17	177.6574	.0000	177.6874	.0000	1.83
18	61.3585	52.7284	52.7457	.0000	.0000
19	123.8022	113.5215	113.4592	.0000	.0000
20	-.0000	51.8432	-.1700	-77.9790	22956.3
21	.0000	5.6337	.0000	4861.1699	.00
22	92.7915	-92.7956	-115.8887	.000	19255.218
23	53.9733	20.3522	20.3088	-3.8676	-.0005
24	.0000	1.0000	-2.3541	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.9	.2080	.00000	-37624.5	.0000
29	3559.8618	293953.6700	35860.7820	434.2842	23984.66200
30	107.37962	.97607	30.55503	119.72787	-1422391.0
31	2604.2764	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY TRANSLUNAR COAST

1	13499.9999	62376.6	.0	47723901.0	10619657.2
2	19863.5270	17885.1920	68642868.0	68636867.0	29.0930
3	39049172.0	4261075.2	-6894335.3	5726374.0	61424953.
4	17938522.0	1306301.1	4230435.1	1560774.7	86.4633
5	28178030.0	20440275.0	67078181.0	7831251.1	11.2798
6	10840.2351	-2356.9415	-7723.6465	1851.9633	.0000
7	9149.6532	275.2049	903.3350	514.1867	-.0000
8	10892.8077	5569.3956	18278.1030	2543.2236	.0000
9	.0	.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-8.2041	.0000	.0	107123.6	.0000
13	1.7155	.0000	.0	1069169.6	.0000
14	177.6874	-.0000	.0	1067169.6	.0000
15	-8.2041	.0000	-8.2041	.0000	491.89
16	1.7155	.0000	1.7155	.0000	-3.33
17	177.6874	.0000	177.6874	.0000	1.83
18	65.9542	55.3124	55.3271	.0000	.0000
19	131.3691	115.2183	115.1731	.0000	.0000
20	-.0000	52.3537	-.1700	-66.0396	19433.8
21	.0000	5.2329	.0000	4861.1699	.00
22	93.0930	-93.1186	-112.8969	.000	17885.193
23	50.8887	18.1336	18.0990	-2.9878	-.0003
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.94
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.9197	293863.1800	35860.4210	434.4205	23973.72700
30	112.74098	.97606	30.55563	119.72787	-1422391.0
31	3104.3042	.97655	30.55942	119.72773	-1418676.0

1	13999.9999	62291.6	.0	55752158.0	11512387.4
2	18751.1230	16825.4460	76672395.0	76665431.0	31.5377
3	44406708.0	3063681.4	-10818404.9	6652355.5	70012282.
4	22481207.0	1437346.3	4660592.4	1817868.1	87.2621
5	33252209.0	23121282.0	75877132.0	9102862.5	10.6385
6	10624.2555	-2425.1939	-7948.2044	1851.9633	.0000
7	9021.9411	249.9683	820.5450	514.1867	.0000
8	9424.7223	5168.5719	16963.4130	2543.2236	.0000
9	.0	.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-8.2041	.0000	.0	107116.6	.0000
13	1.7155	.0000	.0	1067712.5	.0000
14	177.6874	-.0000	.0	1065712.5	.0000
15	-8.2041	.0000	-8.2041	.0000	492.25
16	1.7155	.0000	1.7155	.0000	-3.34
17	177.6874	.0000	177.6874	.0000	1.83
18	69.7510	57.3358	57.3483	.0000	.0000
19	140.5716	116.3886	116.3491	.0000	.0000
20	-.0000	45.3890	-.1700	-57.2769	16848.5
21	.0000	4.9228	.0000	4861.1699	.00
22	92.7093	-92.7430	-106.8424	.000	16825.446
23	49.0001	16.2925	16.2543	-2.3947	-.0002
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.9587	293799.6600	35860.1760	434.5163	23966.05200
30	116.96036	.97606	30.55603	119.72787	-1422391.0
31	3604.3225	.97655	30.55942	119.72773	-1418676.0

1	14499.9999	62206.6	.0	63516079.0	12121701.1
2	17827.9440	15999.4833	84437291.0	84429249.0	33.2061
3	49700110.0	1841596.0	-14823774.7	7578337.0	78124103.
4	26961045.0	1557104.4	5053719.9	2074961.4	88.1541
5	37621284.0	25620782.0	84080738.0	10374473.6	10.4000
6	10569.8584	-2458.7831	-8058.9398	1851.9633	.0000
7	8897.6873	229.7679	754.2750	514.1867	.0000
8	8068.0062	4839.6578	15884.5893	2543.2236	.0000
9	.0	.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-8.2041	.0000	.0	107109.6	.0000
13	1.7155	.0000	.0	1066255.3	.0000
14	177.6874	-.0000	.0	1064255.4	.0000
15	-8.2041	.0000	-8.2041	.0000	492.60
16	1.7155	.0000	1.7155	.0000	-3.34
17	177.6874	.0000	177.6874	.0000	1.83
18	72.7176	58.9727	58.9834	.0000	.0000
19	152.2175	117.2332	117.1986	.0000	.0000
20	-.0000	40.0597	-.1700	-50.5718	14870.3
21	.0000	4.6811	.0000	4861.1699	.00
22	91.8450	-91.8773	-99.8910	.000	15999.484
23	47.9110	14.7419	14.7185	-1.9745	-.0001
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3559.9857	293754.4800	35860.0060	434.5844	23960.59400
30	120.39091	.97605	30.55631	119.72787	-1422391.0
31	4104.3468	.97655	30.55942	119.72773	-1418676.0

1	15000.0000	62121.6	.0	71036421.0	12527921.3
2	17045.9400	15355.7828	91958397.0	91949183.0	34.3183
3	54992475.0	608316.6	-18866117.0	8504318.5	85838013.
4	31378824.0	1667716.8	5416844.2	2332054.6	89.1098
5	41334784.0	27969833.0	91790855.0	11646084.9	10.4573
6	10611.7398	-2471.6736	-8101.6899	1851.9633	.0000
7	8773.0295	213.1989	699.9178	514.1867	.0000
8	6798.8974	4564.2590	14981.2160	2543.2236	.0000
9	.0	.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-8.2041	.0000	.0	107102.5	.0000
13	1.7155	.0000	.0	1064798.3	.0000
14	177.6874	-.0000	.0	1062798.3	.0000
15	-8.2041	.0000	-8.2041	.0000	492.96
16	1.7155	.0000	1.7155	.0000	-3.34
17	177.6874	.0000	177.6874	.0000	1.84
18	74.6955	60.3310	60.3402	.0000	.0000
19	166.6484	117.8648	117.8343	.0000	.0000
20	-.0000	35.8505	-.1700	-45.2758	13307.8
21	.0000	4.4928	.0000	4861.1699	.00
22	90.6441	-90.6592	-93.0237	.000	15355.784
23	47.3847	13.4164	13.3967	-1.6647	-.0001
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3560.0051	293721.2300	35859.8820	434.6344	23956.57700
30	123.25150	.97605	30.55651	119.72787	-1422391.0
31	4604.3534	.97655	30.55942	119.72773	-1418676.0

1	15500,0000	62035.6	.0	78334028,0	12783778,0
2	16372,2919	14858,1183	99256512,0	99246147,0	35,0187
3	60321102,0	-627965.2	-22918524,0	9430299,8	93212658.
4	35733370,0	1770752.1	5755110,2	2589147,9	90,1122
5	44431650,0	30191824,0	99084199,0	12917596,2	10,7406
6	10709,6036	-2471.7887	-8102,4674	1851,9633	-,0000
7	8644,1797	199,3331	654,4285	514,1857	,0000
8	5598,7704	4329,6762	14211,7459	2543,2236.	,0000
9	-,0	,0	-,0	22,054	-,000
10	,0	,0	-,0	10103,388	-,006
11	,0	,0	-,0	-8573,664	,008
12	-8,2041	,0000	,0	107095,5	,0000
13	1,7155	,0000	,0	1063341,2	,0000
14	177,6874	-,0000	,0	1061341,2	,0000
15	-8,2041	,0000	-8,2041	,0000	493.32
16	1,7155	,0000	1,7155	,0000	-3.35
17	177,6874	,0000	177,6874	,0000	1.84
18	75,5125	61.4810	61,4890	,0000	,0000
19	-177,0128	118,3505	118,3233	,0000	,0000
20	-,0000	32,4416	-,1700	-40,9870	12042,4
21	,0000	4,3472	,0000	4861,1699	,00
22	89,2096	-89,1858	-86,7141	-,000	14858,119
23	47,2716	12,2678	12,2510	-1,4289	-,0000
24	,0000	1,0000	-2,3641	,0	62,14
25	2,4580	275,8643	-,00940	,0	1.84
26	-,00081	,0002	,01205	,0	13.12
27	10837,9349	,0296	,00000.	-185675,1	,0000
28	6701182,6	,2080	,00000	-37624,5	,0000
29	3560,0198	293696,8300	35859,7900	434,6712	23953,62900
30	125,68517	,97605	30,55666	119.72787	-1422391,0
31	5104,3610	,97655	30,55942	119.72773	-1418676,0

1	15999,9999	61951,6	,0	85428177,0	12925496,0
2	15783,8374	14479,9586	106351250,0	106339470,0	35.4065
3	65707025,0	-1862138,1	-26964200,0	10356281,0	100203560.
4	40021769,0	1367393,3	6072399',2	2846241,1	91,1507
5	46942669,0	32394807,0	106019975,0	14189307,4	11,2015
6	10837,4542	-2463.8437	-8076,7542	1851,9633	-,0000
7	8507,9506	187.5346	615,7210	514,1857	,0000
8	4453,4704	4126,9686	13546,8259	2543,2236	,0000
9	-,0	,0	-,0	22,054	-,000
10	,0	,0	-,0	10103,388	-,0 6
11	,0	,0	-,0	-8573,664	,008
12	-8,2041	,0000	,0	107088,5	,0000
13	1,7155	,0000	,0	1061884,1	,0000
14	177,6874	-,0000	,0	1059884,1	,0000
15	-8,2041	,0000	-8,2041	,0000	493.68
16	1,7155	,0000	1,7155	,0000	-3.35
17	177,6874	,0000	177,6874	,0000	1.84
18	75,1559	52,4707	62,4777	,0000	,0000
19	-160,9751	118,7323	118,7080	,0000	,0000
20	-,0000	29,6248	-,1700	-37,4429	10996.8
21	,0000	4,2366	,0000	4861,1699	,00
22	87,6189	-87,5294	-81,1444	-,000	14479,959
23	47,4719	11,2607	11,2463	-1,2446	-,0000
24	,0000	1,0000	-2,3641	,0	62,14
25	2,4580	275,8643	-,00940	,0	1.84
26	-,00081	,0002	,01205	,0	13.12
27	10837,9349	,0296	,00000	-185675,1	,0000
28	6701182,6	,2080	,00000	-37624,5	,0000
29	3560,0302	293677,9100	35859,7230	434,6997	23951,34400
30	127.78963	,97605	30,55675	119.72787	-1422391,0
31	5604,3650	,97655	30,55942	119.72773	-1418676,0

1	16500.0000	61866.6	.0	92336146.0	12978940.3
2	15263.7504	14201.1471	113259522.0	113246457.0	35.5525
3	71160616.0	-3090957.0	-30992476.0	11282262.2	107116912.
4	44239677.0	1958555.4	6371713.1	3103334.4	92.2186
5	48892465.0	34323013.0	112644866.0	15460918.7	11.8051
6	10977.8744	-2450.7542	-8034.1250	1851.9633	-.0000
7	8361.8540	177.3537	582.3202	514.1867	.0000
8	3352.3509	3949.6490	12965.1783	2543.2236	.0000
9	-.0	.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-8.2041	.0000	.0	107081.4	.0000
13	1.7155	.0000	.0	1060427.0	.0000
14	177.6874	-.0000	.0	1058426.9	.0000
15	-8.2041	.0000	-8.2041	.0000	494.04
16	1.7155	.0000	1.7155	.0000	-3.35
17	177.6874	.0000	177.6874	.0000	1.84
18	73.8434	63.3340	63.3401	.0000	.0000
19	-147.2908	119.0381	119.0163	.0000	.0000
20	-.0000	27.2580	-.1700	-34.4651	10118.2
21	.0000	4.1550	.0000	4861.1699	.00
22	85.9317	-85.7464	-76.3320	-.000	14201.148
23	47.9166	10.3685	10.3559	-1.0974	-.0000
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.34
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185575.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3560.0385	293663.5100	35859.6590	434.7214	23949.60400
30	129.63399	.97604	30.55685	119.72737	-1422391.0
31	6104.3765	.97655	30.55942	119.72773	-1418676.0

1	17000.0000	61781.6	.0	99073219.0	12963216.0
2	14799.4968	14005.8780	119997025.0	119982420.0	35.5092
3	76684365.0	-4312348.1	-34996532.0	12208243.5	113712057.
4	48381645.0	2044961.5	6655423.3	3360427.6	93.3118
5	50301039.0	36257876.0	118996374.0	16732530.0	12.5254
6	11118.8120	-2434.3798	-7980.6877	1851.9633	-.0000
7	8203.9180	168.4636	553.1542	514.1867	.0000
8	2287.4380	3792.9033	12451.0153	2543.2236	.0000
9	-.0	.0	-.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	-8.2041	.0000	.0	107074.4	.0000
13	1.7155	.0000	.0	1058969.9	.0000
14	177.6874	-.0000	.0	1056969.8	.0000
15	-8.2041	.0000	-8.2041	.0000	494.39
16	1.7155	.0000	1.7155	.0000	-3.36
17	177.6874	.0000	177.6874	.0000	1.85
18	71.8961	64.0956	64.1010	.0000	.0000
19	-136.6110	119.2868	119.2571	.0000	.0000
20	-.0000	25.2415	-.1700	-31.9279	9369.7
21	.0000	4.0979	.0000	4861.1699	.00
22	84.1947	-83.8815	-72.2145	-.000	14005.879
23	48.5560	9.5708	9.5598	-.9776	-.0000
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.34
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37524.5	.0000
29	3560.0455	293652.1400	35859.6250	434.7385	23948.23100
30	131.26867	.97604	30.55692	119.72787	-1422391.0
31	6604.3772	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY TRANSLUNAR COAST

1	17500.0000	61696.6	.0	105652355.0	12892864.8
2	14381.5343	13881.4314	126576941.0	126560844.0	35.3162
3	82278068.0	-5524993.8	-38972031.0	13134224.6	120103213.
4	52441371.0	2127193.2	6925438.5	3617520.9	94.4277
5	51184931.0	38118730.0	125105113.0	18004140.0	13.3426
6	11251.6974	-2415.9366	-7920.4366	1851.9633	.0000
7	8032.6827	160.6212	527.4251	514.1867	.0000
8	1252.7789	3653.0847	11992.8753	-2543.2236	.0000
9	.0	.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	27.7473	.0000	.0	107067.4	.0000
13	.0301	.0000	.0	1057512.8	.0000
14	177.1210	-.0000	.0	1055512.7	.0000
15	27.7473	.0000	27.7473	.0000	494.75
16	.0301	.0000	.0301	.0000	-3.36
17	177.1210	.0000	177.1210	.0000	1.85
18	69.5906	64.7740	64.7787	.0000	.0000
19	-128.5593	119.4914	119.4735	.0000	.0000
20	-.0000	23.5027	-.1700	-29.7403	8724.3
21	.0000	4.0614	.0000	4861.1699	.00
22	116.1890	-117.9564	-142.6134	.000	13881.432
23	49.3537	8.8520	8.8424	-.8786	-.0000
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3560.0505	293642.9500	35859.5935	434.7524	23947.12000
30	132.73142	.97604	30.55697	119.72787	-1422391.0
31	7104.4113	.97655	30.55942	119.72773	-1418676.0

1	18000.0000	61611.6	.0	112086944.0	12779265.4
2	14002.4571	13817.3571	133011261.0	132993624.0	35.0049
3	87934263.0	-6728075.8	-42916279.0	14060205.8	126310675.
4	56411923.0	2205726.1	7183318.9	3374514.1	95.5648
5	51558115.0	39913307.0	130996445.0	19275752.0	14.2410
6	11370.2915	-2396.2350	-7856.0359	1851.9633	.0000
7	7847.0578	153.6416	504.5265	514.1867	.0000
8	243.9579	3527.3782	11580.0254	2543.2236	.0000
9	.0	.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	27.7473	.0000	.0	107060.4	.0000
13	.0301	.0000	.0	1056055.7	.0000
14	177.1210	-.0000	.0	1054055.6	.0000
15	27.7473	.0000	27.7473	.0000	495.11
16	.0301	.0000	.0301	.0000	-3.36
17	177.1210	.0000	177.1210	.0000	1.85
18	67.1158	65.3832	65.3974	.0000	.0000
19	-122.4934	119.6617	119.6456	.0000	.0000
20	-.0000	21.9881	-.1700	-27.8346	8162.0
21	.0000	4.0427	.0000	4861.1699	.00
22	114.1945	-116.0300	-138.9004	.000	13817.358
23	50.2921	8.1999	8.1914	-.7957	-.0000
24	.0000	1.0000	-2.3541	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185575.1	.0000
28	6701182.6	.2080	.00000	-37524.5	.0000
29	3560.0547	293635.5200	35859.5670	434.7535	23946.22300
30	134.05107	.97604	30.55701	119.72787	-1422391.0
31	7604.4149	.97655	30.55942	119.72773	-1418676.0

INITIATE LOX DUMP

1	18473,8870	61531.0	.0	118060187.0	12639994.9
2	13673,7554	13804.4290	138984700.0	138365550.0	34.6232
3	93345740.0	-7859057.5	-46624230.0	14937827.1	132040049.
4	60086086.0	2277101.8	7417706.0	4118280.5	96.6616
5	51451366.0	41558875.0	136398750.0	20480952.0	15.1558
6	11465,2877	-2376.9011	-7792.8115	1851.9633	.0000
7	7657,1262	147.6927	485.0096	514.1857	.0000
8	-691.2764	3419.2540	11225.3495	2543.2235	.0000
9	.0	.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	27.7473	.0000	.0	107053.7	.0000
13	.0301	.0000	.0	1054674.6	.0000
14	177.1210	-.0000	.0	1052074.7	.0000
15	27.7473	.0000	27.7473	.0000	495.45
16	.0301	.0000	.0301	.0000	-3.37
17	177.1210	.0000	177.1210	.0000	1.85
18	64.7213	65.9068	65.9105	.0000	.0000
19	-118.0710	119.7978	119.7830	.0000	.0000
20	-.0000	20.7223	-.1700	-26.2422	7692.2
21	.0000	4.0389	.0000	4861.1699	.00
22	112.3430	-114.2113	-135.3794	.000	13804.430
23	51.2632	7.6343	7.6267	-.7287	-.0000
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00061	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3560.0577	293629.7400	35859.5470	434.7722	23945.52500
30	135.19020	.97604	30.55704	119.72787	-1422391.0
31	8078.2991	.97655	30.55942	119.72773	-1418676.0

1	18500.0000	60867.6	490.0	118385915.0	12631553.7
2	13650.5710	13802.4339	139310430.0	139291200.0	34.6001
3	93645185.0	-7921088.2	-46827501.0	14986209.3	132351606.
4	60285838.0	2280954.4	7430357.5	4131707.3	96.7226
5	51432583.0	41648074.0	136691590.0	20547350.0	15.2078
6	11469.4683	-2374.0443	-7783.4500	1853.7211	.2590
7	7641.9952	147.3827	483.9927	514.1878	.0000
8	-747.2769	3412.6391	11203.6501	2542.2989	.0000
9	490.0	490.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	27.7473	.0000	.0	106998.8	.0000
13	.0301	.0000	.0	1043301.1	.0000
14	177.1210	-.0000	.0	1041301.1	.0000
15	27.7473	.0000	27.7473	.0000	498.24
16	.0301	.0000	.0301	.0000	-3.39
17	177.1210	.0000	177.1210	.0000	1.87
18	64.5715	65.9471	65.9508	.0000	.0000
19	-117.8153	119.8052	119.7905	.0000	.0000
20	18.9169	20.7163	-25.9000	-26.2395	7669.4
21	.0000	4.0383	.0000	4861.1699	.00
22	112.2170	-114.0846	-135.1498	.000	13802.435
23	51.3199	7.6045	7.5970	-.7253	-.0000
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00061	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3553.8208	290619.5100	35889.1540	438.8631	23581.88200
30	135.30965	.97584	30.55755	119.72787	-1422391.0
31	8104.7865	.97655	30.55942	119.72773	-1418676.0

PREDICTED S-IVB-503N STAGE TRAJECTORY TRANSLUNAR COAST

1	18750.0000	54392.6	490.0	121481411.0	12546196.3
2	13427.5873	13788.0121	142406010.0	142385970.0	34.3652
3	96517099.0	-8511041.6	-48761804.0	15451883.1	135307030.
4	62177650.0	2317436.4	7550162.4	4260255.5	97.3094
5	51178670.0	42493365.0	139466590.0	21181744.0	15.7166
6	11504.2810	-2345.2283	-7689.0122	1872.0049	.2898
7	7490.8192	144.4974	474.5265	514.1986	.0000
8	-1283.9105	3349.9204	10997.9106	2532.6805	.0000
9	490.0	490.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	27.7473	.0000	.0	106463.3	.0000
13	.0301	.0000	.0	932301.1	.0000
14	177.1210	-.0000	.0	930301.1	.0000
15	27.7473	.0000	27.7473	.0000	525.50
16	.0301	.0000	.0301	.0000	-3.63
17	177.1210	.0000	177.1210	.0000	2.07
18	63.1205	56.3341	66.3375	.0000	.0000
19	-115.5093	119.8735	119.8594	.0000	.0000
20	18.9167	20.6634	-25.9000	-26.2295	7458.4
21	.0000	4.0341	.0000	4861.1699	.00
22	110.9980	-112.8518	-132.9102	.000	13788.013
23	51.8771	7.3271	7.3200	-.6942	-.0000
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3488.7165	262865.7500	36203.8220	480.4919	20317.18300
30	136.48441	.97380	30.66296	119.72787	-1422391.0
31	8358.6398	.97655	30.55942	119.72773	-1418676.0

TERMINATE LOX DUMP

1	18773.8870	53773.9	490.0	121774989.0	12537626.3
2	13406.2448	13787.0969	142699500.0	142679480.0	34.3427
3	96791935.0	-8567028.3	-48945360.0	15496622.3	135586820.
4	62356405.0	2320884.8	7561485.9	4272538.2	97.3658
5	51147390.0	42573314.0	139729160.0	21242231.0	15.7661
6	11507.1020	-2342.3583	-7679.6062	1873.8779	.2932
7	7475.8260	144.2292	473.6467	514.1997	.0000
8	-1335.1683	3343.9931	10978.4667	2531.6951	.0000
9	490.0	490.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	27.7473	.0000	.0	106412.1	.0000
13	.0301	.0000	.0	921695.2	.0000
14	177.1210	-.0000	.0	919695.2	.0000
15	27.7473	.0000	27.7473	.0000	528.11
16	.0301	.0000	.0301	.0000	-3.66
17	177.1210	.0000	177.1210	.0000	2.09
18	62.9806	66.3711	66.3746	.0000	.0000
19	-115.3022	119.8797	119.8657	.0000	.0000
20	18.9189	20.6586	-25.9000	-26.2286	7438.9
21	.0000	4.0338	.0000	4861.1699	.00
22	110.8807	-112.7324	-132.6927	.000	13787.097
23	51.9318	7.3014	7.2943	-.6913	-.0000
24	.0000	1.0000	-2.3641	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185675.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3482.0586	260355.2300	36236.5860	484.6375	20029.85500
30	136.59891	.97360	30.66352	119.72787	-1422391.0
31	8382.9258	.97655	30.55942	119.72773	-1418676.0

1	18800.0000	53760.9	.0	122095543.0	12528188.8
2	13389.6112.	13788.8695	143020160.0	142999960.0	34.3169
3	97092465.0	-8628178.5	-49145846.0	15545555.9	135892230.
4	62551467.0	2324647.2	7573842.6	4285965.3	97.4275
5	51111364.0	42660563.0	140015510.0	21308340.0	15.8205
6	11510.7828	-2341.2345	-7675.9293	1873.9372	.0000
7	7464.2568	143.9363	472.6858	514.1998	.0000
8	-1385.5251	3338.5970	10960.7664	2531.6640	.0000
9	.0	.0	.0	22.054	-.000
10	.0	.0	-.0	10103.388	-.006
11	.0	.0	-.0	-8573.664	.008
12	27.7473	.0000	.0	106411.1	.0000
13	.0301	.0000	.0	921473.2	.0000
14	177.1210	-.0000	.0	919473.2	.0000
15	27.7473	.0000	27.7473	.0000	528.16
16	.0301	.0000	.0301	.0000	-3.66
17	177.1210	.0000	177.1210	.0000	2.09
18	62.8490	66.3968	66.4003	.0000	.0000
19	-115.1215	119.8859	119.8719	.0000	.0000
20	.0000	20.5974	.0000	-26.1501	7416.3
21	.0000	4.0344	.0000	4861.1699	.00
22	110.7915	-112.6330	-132.4983	.000	13788.870
23	51.9917	7.2733	7.2563	-.6882	-.0000
24	.0000	1.0000	-2.3541	.0	62.14
25	2.4580	275.8643	-.00940	.0	1.84
26	-.00081	.0002	.01205	.0	13.12
27	10837.9349	.0296	.00000	-185075.1	.0000
28	6701182.6	.2080	.00000	-37624.5	.0000
29	3481.9185	260302.6500	30237.2760	484.7252	20023.85100
30	136.55643	.97360	30.56354	119.72787	-1422391.0
31	8409.0586	.97655	30.55942	119.72773	-1418676.0

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITION
A SB XM A SB YM A SB ZM	a_{xm}, a_{ym}, a_{zm}	Vehicle accelerations in the vehicle coordinate system (ft/sec^2). See figure AP 3-1
C3	C_3	Total energy of the vehicle times two. Derived for potential energy equal to zero at an infinite distance from the earth's center (m^2/sec^2)
C3 SB T	C_{3T}	Twice the total energy of the target conic ("Cutoff Energy") (m^2/sec^2)
CHORD FORCE	C	Aerodynamic chord force (lbf)
CHI (P) - TILDE CHI (Y) - TILDE	$\tilde{X}_p$ $\tilde{X}_y$	Commanded pitch and yaw attitude angles, in the X^V, Y^V, Z^V coordinate system, uncorrected for altitude constraint.
ECC ANOMALY	E	Eccentric anomaly: angle between semi-major axis and vehicle, measured about the center of the conic (deg)
ECCENTRICITY	e	Eccentricity of the instantaneous vehicle conic (dimensionless)
E SB T	e_t	Eccentricity of the target conic section (dimensionless)
E*	E*	Elevation angle measured positively up from a plane tangent to the earth's surface at the telemetry site. Angle between the plane and the vector drawn between the missile and telemetry station (ft)

COMPUTER PROGRAMS AE77 AND AB21 PRINTOUT SYMBOLS AND DEFINITIONS

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITION
E/M	E/m	Energy per unit mass of the vehicle based on a zero potential energy at the average surface of the earth (ft^2/sec^2)
F SB OB i	F_{OB_i}	Individual engine thrust at altitude; for S-IC stage engines 1 through 4 are the outboard engines (lb)
F SB AX F SB AY F SB AZ	F_{A_x}, F_{A_y}, F_{A_z}	Aerodynamic forces in the vehicle coordinate system (lbf)
AVG F SB L	$\bar{F}_L$	Average longitudinal thrust (lbf)
F SB T	F_T	Total effective engine thrust (lbf)
F SB TX F SB TY F SB TZ	F_{T_x}, F_{T_y}, F_{T_z}	Propulsive forces in the vehicle system (lbf)
F SB X F SB Y F SB Z	F_x, F_y, F_z	Total forces in the vehicle coordinate system (lbf)
FAUX SB X FAUX SB Y FAUX SB Z	$FAUX_x$ $FAUX_y$ $FAUX_z$	Auxiliary forces in the vehicle (m) coordinate system (lbf)
G (RHO)	g_ρ	Component of gravity due to the attractive force of the earth measured along r_c positive down (ft/sec^2)
G (PSI)	g_ψ	Component of gravity due to attractive force of the earth measured along the perpendicular to r_c positive down (ft/sec^2)

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITION
ALTITUDE	h	Vehicle altitude. Distance between the spheroid's surface and vehicle measured along the normal to the earth's surface positive up (ft)
I SB T	i_t	Inclination of the target conic section relative to the earth's equatorial plane (deg)
INCLINATION	i	Equatorial orbital inclination (deg)
I SB SP	I_{sp}	Instantaneous specific impulse (sec)
AVG I SB SP	$\bar{I}_{sp}$	Average specific impulse from 90% thrust to engine cutoff (sec)
I SB XX I SB YY I SB ZZ	I_{xx}, I_{yy}, I_{zz}	Principal vehicle moments of inertia about vehicle body fixed axis (slug-ft^2)
K (1) K (3)	K_1 K_3	Altitude constraint corrections to $\tilde{X}_p$ and $\tilde{X}_y$, respectively (radians)
MACH NO.	M	Vehicle mach number
M SB X M SB Y M SB Z	M_x, M_y, M_z	Total moments about the axis of the vehicle coordinate system (ft-lbf)
M SB AX M SB AY M SB AZ	M_{A_x}, M_{A_y}, M_{A_z}	Aerodynamic moments in the vehicle coordinate system (ft-lbf)
NORMAL FORCE	N	Aerodynamic normal force (lbf)
PERIOD	P	Period of instantaneous vehicle conic (min)

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITION
P SB M	P_M	Total vehicle roll rate; positive roll clockwise looking forward along the X_m axis (deg/sec)
PRESSURE	P_a	Atmospheric pressure at the vehicle (lbf/ft^2)
Q	q	Vehicle dynamic pressure (lbf/ft^2)
Q SB M	Q_M	Total vehicle pitch rate, positive nose up (deg/sec)
R (AP)	r_a	Radius of apogee (nmi)
R (PER)	r_{PER}	Radius of perigee (nmi)
R SB C	r_c	Instantaneous distance between the center of the earth and the vehicle (ft)
R SB L	r_L	Earth radius at the launcher (ft)
R SB M	R_M	Total vehicle yaw rate; positive yaw nose right (deg/sec)
S SB F	S_f	Downrange distance at terminal altitude (nmi)
SEMIMAJ AXIS	a	Semi-major axis of conic (ft)
RANGE	s	Spherical earth ground range (ft). Based on the spherical earth range angle and the average earth radius
TIME	t	Current simulation time, measured from vehicle first motion (sec)

COMPUTER PROGRAMS AE77 AND AB21 PRINTOUT SYMBOLS AND DEFINITIONS

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITION
T SB F	t_f	Time since launch at the terminal altitude (sec)
T (2)	T_2	First guidance stage time to go to guidance staging (sec)
T (3)	T_3	Second guidance stage time to go to guidance cutoff (sec)
DELTA-T (3)	ΔT_3	Correction to T_3 (sec)
DELTA-T (CO)	ΔT_{co}	Time to go until guidance cutoff command after introduction of high speed cutoff logic (sec)
TEMPERATURE	T_R	The temperature specified at a certain altitude (deg R)
V (AP)	V_{ap}	Apogee velocity of the glide phase orbit (ft/sec)
V SB E	V_e	Magnitude of the vehicle's earth fixed velocity (ft/sec)
V (F)	V_f	Magnitude of inertial velocity at terminal altitude (ft/sec)
V SB I	V_I	Magnitude of the vehicle's inertial velocity (ft/sec)
V (PER)	V_{per}	Perigee velocity of the glide phase orbit (ft/sec)
V SB RM	V_{RM}	Magnitude of the vehicle's velocity relative to the earth's atmosphere (ft/sec)
V (T)	V_t	Cutoff velocity (m/sec)
V SB W	V_W	Wind velocity relative to the earth (ft/sec)

COMPUTER PROGRAMS AE77 AND AB21 PRINTOUT SYMBOLS AND DEFINITIONS

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITIONS
WEIGHT	W	Total vehicle weight (lbm)
WEIGHT FLOW	$\dot{W}$	Time rate of change of total vehicle weight (lbm/sec)
AVG D-W	$\bar{\dot{W}}$	Average time rate of change of total vehicle weight measured from first engine start (lbm/sec)
X, Y, Z D-X, D-Y, D-Z DD-X, DD-Y, DD-Z	X, Y, Z	Components of vehicle position, velocity, and accelerations. A subscript on these quantities indicates the coordinate system in which these quantities are measured (ft, ft/sec, ft/sec^2, unless followed by [M], then m, m/sec, m/sec^2, respectively)
ALPHA* (S-IVB) ALPHA	α' α	Total angle of attack. Angle between the centerline of the vehicle and the vehicle air velocity vector (deg)
ALPHA (S-IVB) ALPHA SB P	α α_p	Pitch angle of attack. Angle between the projection of the vehicle's air velocity vector onto the pitch plane and the centerline of the vehicle, positive for relative velocity below (Position I) the centerline (deg)
BETA (S-IVB) ALPHA SB Y	β α_y	Yaw angle of attack. Angle between projection of the vehicle's air velocity vector onto the yaw plane and the centerline of the vehicle (deg). Positive if relative velocity is from the right (Position IV) of the centerline (deg)

COMPUTER PROGRAMS AE77 AND AB21 PRINTOUT SYMBOLS AND DEFINITIONS

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITIONS
ALPHA Q PROD	αq	Aerodynamic load: product of total angle of attack and dynamic pressure ($lb\text{-}deg/ft^2$)
BETA	β	True anomaly at start of glide (deg)
BETA (F)	β_f	True anomaly at terminal altitude (deg)
GAMMA (1)	γ_1	Elevation flight path angle. Angle between the earth fixed vehicle velocity and the local tangent plane positive for an ascending vehicle (deg)
GAMMA (2)	γ_2	Azimuthal flight path angle. Angle between the local north positive clockwise to the projection of the earth fixed vehicle velocity on the local tangent plane (deg)
X SB CG Y SB CG Z SB CG	X_{CG}, Y_{CG}, Z_{CG}	Components of vehicle center of gravity, with X_{CG} measured positive forward from the vehicle reference plane, Y_{CG} measured positive right from the vehicle centerline, and Z_{CG} measured positive down from the vehicle centerline (in.)
X SB CP Y SB CP Z SB CP	X_{CP}, Y_{CP}, Z_{CP}	Components of vehicle center of pressure, with X_{CP} measured positive forward from the vehicle reference plane, Y_{CP} measured positive right from the vehicle centerline, and Z_{CP} measured positive down from the vehicle centerline (in.)

COMPUTER PROGRAMS AE77 AND AB21 PRINTOUT SYMBOLS AND DEFINITIONS

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITIONS
X (V) Y (V) Z (V)	X^V, Y^V, Z^V	Position coordinates in the terminal radius coordinate system. Origin is at the earth's center, Y^V along the desired terminal radius, X^V in the orbit plane in the direction of orbital motion, Z^V forming a right handed coordinate system (m)
D-X (V) D-Y (V) D-Z (V)	$\dot{X}^V$, $\dot{Y}^V$, $\dot{Z}^V$	Velocity coordinates in terminal radius
DELTA D-X (V) DELTA D-Y (V) DELTA D-Z (V)	$\Delta\dot{X}^V$ $\Delta\dot{Y}^V$ $\Delta\dot{Z}^V$	Iterative guidance velocity to – go components in terminal coordinate system located at the earth's center with Y^V along the desired terminal radius, X^V measured downrange in the orbit plane, and Z^V completing a right handed coordinate system (m/sec)
Y (V, T)	Y_t^V	Desired terminal radius in the X^V, Y^V, Z^V coordinate system (meters)
W (LH2) RES W (LOX) RES	W_t W_o	Instantaneous fuel and oxidizer consumption from main engine start (lbm)
GAMMA (1I)	γ_{1_I}	Inertial elevation flight path angle. Same as γ_1 except measured to inertial vehicle velocity (deg)
GAMMA (2I)	γ_{2_I}	Inertial elevation and azimuthal flight path angle. Same as γ_2 except measured to inertial vehicle velocity (deg)

COMPUTER PROGRAMS AE77 AND AB21 PRINTOUT SYMBOLS AND DEFINITIONS

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITIONS
GAMMA (1I) PR	γ_{1_I}'	Inertial elevation flight path angle. Angle between the inertial velocity vector and the X_{L_I}', Z_{L_I}' plane. Angle is positive for an ascending vehicle (deg)
GAMMA (2I) PR	γ_{2_I}'	Inertial azimuthal flight path angle measured in the X_{L_I}', Z_{L_I}' plane. Angle between Z_{L_I}, clockwise to the projection of the inertial velocity vector (deg)
GAMMA SB 1F	γ_{1_f}	Inertial flight path elevation angle at the terminal altitude (deg)
GAMMA SB 2F	γ_{2_f}	Inertial flight path azimuth angle at the terminal altitude (deg)
DELTA (A) DELTA (B)	δ_A, δ_B	Vehicle actuator A (yaw) and actuator B (pitch). A positive δ_A produces a nose left positive moment about ym axis. A positive δ_B produces a nose down negative moment about zm axis
D-DELTA (A) D-DELTA (B)	$\dot{\delta}_A$ $\dot{\delta}_B$	Vehicle actuator A (yaw) and actuator B (pitch) gimbal angle rates, respectively (deg/sec)
SMCP	SδMCP	Pitch thrust misalignment correction (radians)
SMCY	SδMCY	Yaw thrust misalignment correction (radians)

COMPUTER PROGRAMS AE77 AND AB21 PRINTOUT SYMBOLS AND DEFINITIONS

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITIONS
E SB W	ε_W	Tabular wind azimuth angle, positive clockwise from north, as a function of altitude (at ε_W = zero wind is coming from the north) (deg) '
EPS (THETA) EPS (PSI) EPS (PHI)	$\varepsilon\theta$, $\varepsilon\psi$, $\varepsilon\phi$	Autopilot error signals (deg)
RANGE ANGLE	η'	Spherical earth range angle. The angle is measured between lines connecting the following three points: the vehicle, the center of the earth, and the launcher with the earth's center as the vertex (deg)
D-THETA (M) QRP D-PSI (M) QRP D-PHI (M) QRP	$\dot{\theta}_M$, $\dot{\psi}_M$, $\dot{\phi}_M$	Vehicle pitch, yaw, and roll attitude Euler angle rates (deg/sec)
THETA SB C	θ_C	Commanded vehicle pitch Euler angle (deg)
THETA (M) QRP PSI (M) QRP PHI (M) QRP	θ_M, ψ_M, ϕ_M	Vehicle pitch, yaw, and roll attitude Euler angles (deg)
THETA (P) THETA (Y) THETA (R)	θ_P, θ_Y, θ_R	For the three-gimbal stable platform, pitch, yaw, and roll angles, respectively (deg)
MU	μ	Instantaneous vehicle longitude where Greenwich, England, is longitude zero. West of Greenwich is positive (AE77) and negative (AB21) (deg)

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITIONS
MU SB F	μ_f	Longitude of terminal altitude (deg)
XI ETA ZETA	ξ, η, ζ	Vehicle position obtained by integrating $\dot{\xi}\ \dot{\eta}\ \dot{\zeta}$. The ξ, η, ζ system coincides with the P system at t = 0, and is falling with an acceleration equal to gravity at the vehicle position. Position and velocity in this system correspond to the position and velocity the vehicle would have if gravity were zero (m)
D-XI D-ETA D-ZETA	$\dot{\xi}, \dot{\eta}, \dot{\zeta}$	Vehicle velocity obtained by integrating $\ddot{\xi}, \ddot{\eta}, \ddot{\zeta}$ (m/sec)
RHO	ρ	Instantaneous geodetic latitude, positive in the northern hemisphere (deg)
RHO PRIME	ρ'	Instantaneous geocentric latitude, positive in the northern hemisphere (deg)
RHO SB F	ρ_f	Longitude of terminal altitude (deg)
TAU (2)	τ_2	Ratio of W/Ẇ during first burn and prior to second burn guidance stagings (sec)
TAU (3)	τ_3	Ratio of W/Ẇ following second burn guidance staging (sec)
TAU SB F	τ_f	Time since/to perigee at terminal altitude (sec)

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITIONS
PHI SB C	ϕ_C	Command vehicle roll Euler angle (deg)
PHI (T)	ϕ_T	Estimate of terminal range angle measured in the orbit plane from the descending node to the terminal radius vector, positive in the flight direction (radians)
PSI SB C	ψ_C	Command vehicle yaw Euler angle (deg)
CHI SB P	χ_P	Guidance-commanded body attitude angle
CHI SB R	χ_R	in the vehicle pitch, roll, and yaw
CHI SB Y	χ_Y	planes (deg)
D-CHI SB P	$\dot{\chi}_P$	Guidance-commanded body attitude rates
D-CHI SB R	$\dot{\chi}_R$	in the vehicle pitch, roll, and yaw
D-CHI SB Y	$\dot{\chi}_Y$	planes (deg/sec)
TAU P i	τ_i	Radar polarization look angle for radar station i: angle between the projection of the vehicle centerline on a plane perpendicular to the radar line of sight and the line of intersection of the plane containing the radar line of sight perpendicular to the earth's surface, and the plane perpendicular to the radar line of sight, measured positive counter clockwise from this line of intersection looking along the radar line of sight toward the vehicle (deg)

COMPUTER PROGRAMS AE77 AND AB21 PRINTOUT SYMBOLS AND DEFINITIONS

PRINTOUT SYMBOL	COMMON SYMBOL	DEFINITIONS
TAU PHI i	$\tau_{\phi i}$	Radar roll look angle: measured from the Y_m axis clockwise looking forward to the perpendicular projection of the line of sight of radar i onto the roll plane (deg)
TAU THETA i	$\tau_{\theta i}$	Total radar look angle: measured from the nose of the vehicle about the center of gravity to the line of sight of radar site i (deg).

TABLE AP 3-7
LIST OF COORDINATE SUBSCRIPT DEFINITIONS

E   Coordinate system on the surface of the spheroid representing the earth and whose origin is at the same latitude and longitude as the launcher. X_E is perpendicular to the surface of the spheroid, positive up; Y_E is crossrange, positive in the right-handed coordinate system (English); and Z_E is positive downrange.

m   Vehicle coordinates fixed at the center of gravity of the vehicle. X_m is parallel to the longitudinal axis of the vehicle positive, forward; Y_m is at the 90 deg bank angle position (English); and Z_m is at the 180 deg look angle position.

P   Inertial coordinate system with its origin at the center of the earth and with its X_P axis along the line of parallel to the local gravity vector at launch through the earth's center, positive up. The Z_P axis is parallel to the plane defined by the X_S and Z_S axes at launch, and Y_P forms a right-hand coordinate system (Metric).

S   Coordinates initially coincident with the E system, but remaining fixed in space (English).

SFE   Space Fixed Ephemeris System. The origin of the system is at the center of the earth: Z_{SFE} is positive north, X_{SFE} passes through the vernal equinox, and Y_{SFE} completes the right-handed system with the $X_{SFE} - Y_{SFE}$ plane coincident with the equatorial plane. The directions of the axes remain fixed in space and the origin moves with the center of the earth. The reference equinox and equator are the true vernal equinox and the equator for the epoch of midnight of the day of the launch (English).
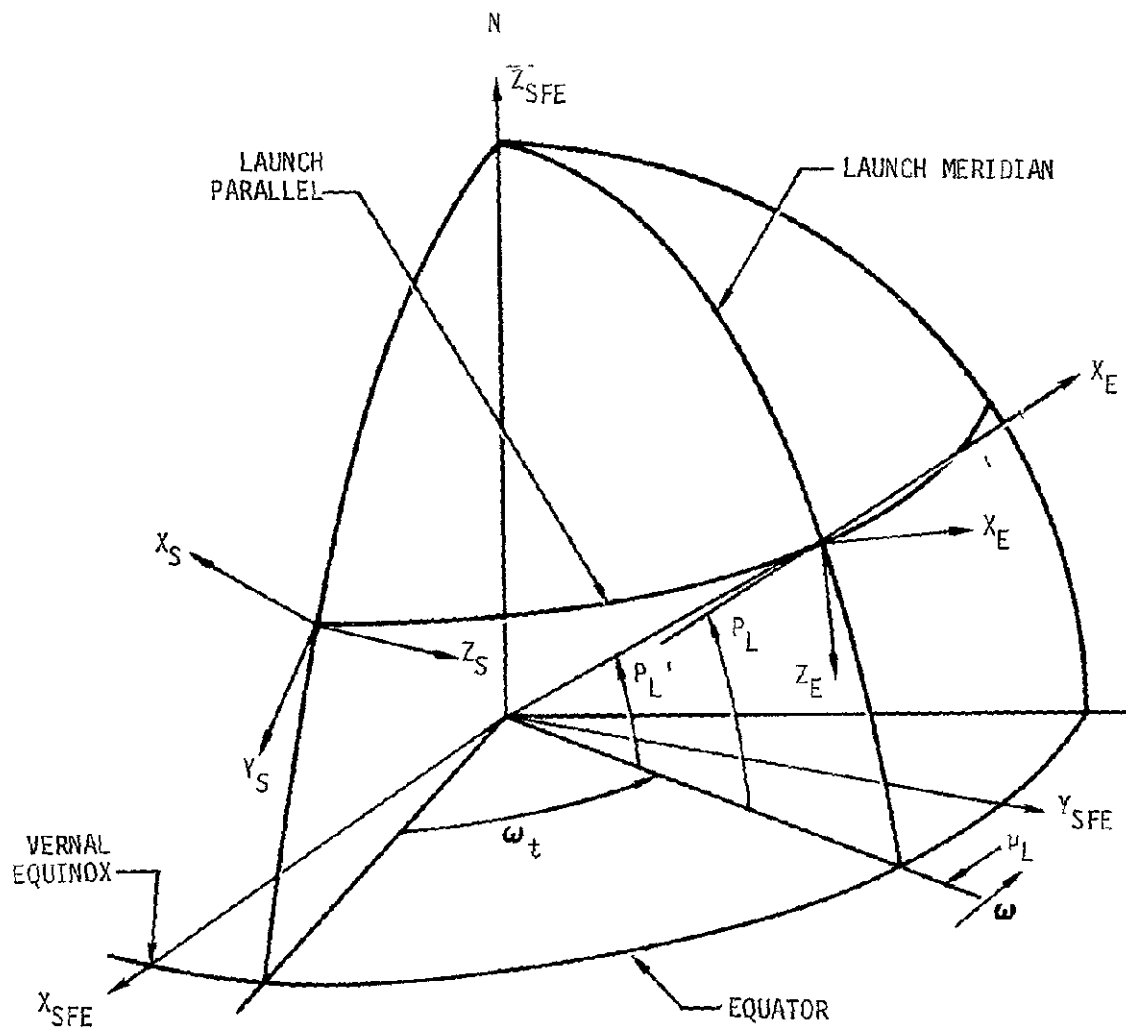
NOTE: THE Y AXES ARE PERPENDICULAR TO THE
EARTH'S SURFACE AT THE LAUNCH SITE

Figure AP 3-1. Coordinate System Description
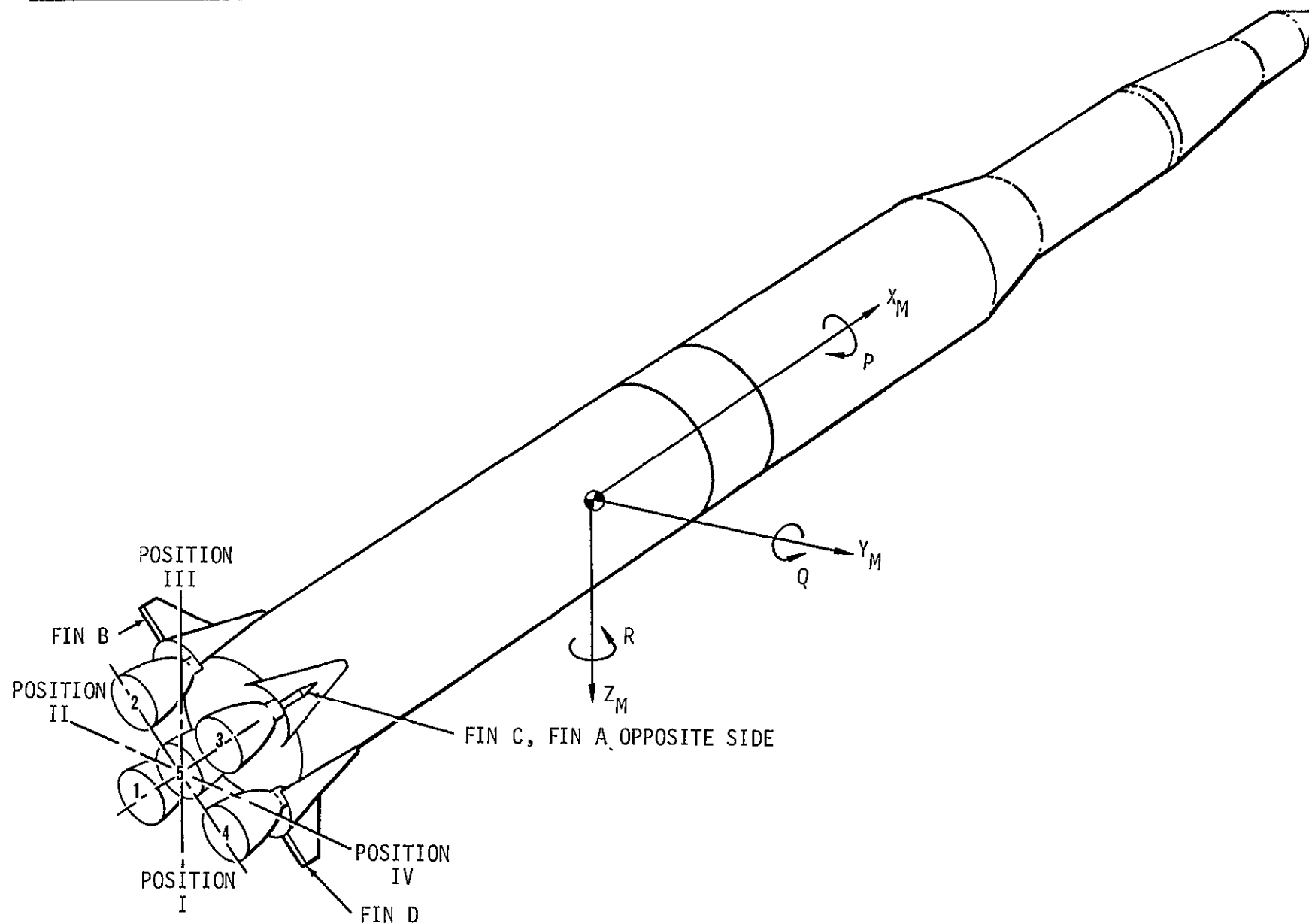
Figure AP 3-2.   Body Fixed Coordinate System Orientation

APPENDIX 4

TELEMETRY LOOK ANGLES

4. TELEMETRY LOOK ANGLES

Time histories of the telemetry look angles are not presented since these data vary greatly with the data and time of launch and with the restart opportunity selected.

APPENDIX 5

PREDICTED PROPULSION SYSTEM PERFORMANCE

5. PREDICTED PROPULSION SYSTEM PERFORMANCE

This appendix contains predicted propulsion system performance data in support of the stage objectives presented in section 3. The data are submitted in accordance with the requirements of the MSFC S-IVB Stage Test Information and Propulsion System Performance Prediction Requirements for Flight Test Planning document, (reference 14, appendix 11).

Table AP 5-1 contains the predicted performance of selected S-IVB-503N parameters and their associated 3 sigma dispersion limits. Table AP 5-2 is a list of symbols, with their definitions, used in the tabulated summaries of the predicted propulsion system performance as derived from the AA89 computer program (tables AP 5-3 and AP 5-4). Graphical representations of the first burn tabulated data are shown in figures AP 5-1 through 5-25; second burn tabulated data are shown in figures AP 5-26 through 5-50.

The propulsion system prediction as presented in this appendix is based on PU activate to occur at ESC +8 sec for first burn. Propellant management will maintain the engine performance at the high mixture ratio of 5.5:1 for the remainder of the first burn. Second burn will occur after a two-orbit coast period. The J-2 engine will start with the PU valve in the full open position (4.5:1), and at ESC +13 sec the PU valve will move to the null position in approximately one sec. The remainder of the burn will operate in the closed-loop mode with a PU system reference mixture ratio (RMR) of 5.0:1. Propellant management will nominally maintain a low EMR (4.5:1) until approximately ESC +88 sec. This is a result of the mission criterion to load LH2 for three orbits of boiloff and restart after two orbits.

The propulsion prediction is based on a nominal first burn time of 150.7 sec from ESC; second burn depletion will occur at ESC +339.5 sec.

PREDICTED PROPULSION SYSTEM PERFORMANCE PARAMETERS

PARAMETER	UNIT	VALUE	DISPERSION 3 sigma	REMARKS
First Burn				
Average Stage Longitudinal Thrust	lbf	202,647	±3,800	
Average LOX Flowrate	lbm/sec	395.28	±5.7	
Average LH2 Flowrate	lbm/sec	80.12	±1.1	
Average Stage Mass Flowrate	lbm/sec	475.40	±5.9	Determined from 90 percent thrust to ECC. Does not include ullage rocket operation.
Average Stage Longitudinal Specific Impulse	sec	426.37	±2.7	
Engine Total Impulse	lbf/sec	3.04×10^7	$\pm 2.2 \times 10^6$	
Start Impulse	lbf/sec	220,000	±30,000	Determine for the time period of ESC to 90 percent thrust buildup.
Cutoff Impulse	lbf/sec	47,276	+4,200 -4,000	Determined for the time period of ECC as monitored on the S-IVB stage until thrust decay to zero.
Time from 90 Percent Thrust to ECC (1)	sec	149.0	+8 -7	First burn ECC is a guidance command cutoff.
Total Loaded Propellants				
LOX	lbm	192,924	±2,160	Total propellant above engine main valves.
LH2	lbm	43,350	±485	
Total	lbm	236,274	±2,214	

PARAMETER	UNIT	VALUE	DISPERSION 3 sigma	REMARKS
Engine Propellant Consumption at ECC*				
LOX	lbm	58,897	±850	Based on 1st burn time of 149.0 sec. Does not include thrust buildup or cutoff consumption.
LH2	lbm	11,938	±164	
Total	lbm	70,835	+866	
Second Burn				
Average Stage Longitudinal Thrust	lbm	202,398	±3,800	
Average LOX Flowrate	lbm/sec	394.01	±5.7	
Average LH2 Flowrate	lbm/sec	80.37	±1.1	
Average Stage Mass Flowrate	lbm/sec	474.38	±5.9	Determined from 90 percnet thrust buildup to ECC. Does not include ullage rocket operation.
Average Stage Longitudinal Specific Impulse	sec	426.66	±2.7	
Engine Total Impulse	lbf/sec	7.0×10^{7}	$\pm 2.1 \times 10^{6}$	
Start Impulse	lbf/sec	220,000	±30,000	Determined for the time period of ESC to 90 percent thrust buildup.

TABLE AP 5-1 (Sheet 3 of 5)
PREDICTED PROPULSION SYSTEM PERFORMANCE PARAMETERS

PARAMETER	UNIT	VALUE	DISPERSION 3 sigma	REMARKS
Cutoff Impulse	lbf/sec	47,276	+4,200 −4,000	Determined for the time period of ECC as monitored on the S-IVB stage until thrust decay to zero.
Time from 90 Percent Thrust to ECC (1)				
1 1/2 Orbit	sec	336.6	±7	
2 1/2 Orbit	sec	334.6		
Total Depletion Burntime (ESC to ECC) (1)				
1 1/2 Orbit	sec	347.1	±7	
2 1/2 Orbit	sec	345.1		
Propellants on Board at Second ESC assuming nominal first burn.				
LOX				
1 1/2 Orbits	lbm	133,404	±90	Total propellants above main engine valves.
2 1/2 Orbits	lbm	133,314	±150	

PREDICTED PROPULSION SYSTEM PERFORMANCE PARAMETERS

PARAMETER	UNIT	VALUE	DISPERSION 3 sigma	REMARKS
LH2				
1 1/2 Orbits	lbm	28,696	+1,690 −3,020	Dispersions indicate boiloff variations only.
2 1/2 Orbits	lbm	27,806	+2,280 −4,060	
Total				
1 1/2 Orbits	lbm	162,100	+1,692 −3,021	
2 1/2 Orbits	lbm	161,120	+2,329 −4,088	
Engine Propellant Consumption at ECC (1)				
LOX				
1 1/2 Orbits	lbm	132,902	±2,036	Based on a 2nd burn time to depletion of 347.1 and 345.1 seconds for the 1 1/2 and 2 1/2 Orbits cases respectively. Does not include thrust buildup or cutoff consumption.
2 1/2 Orbits	lbm	131,849		
LH2				
1 1/2 Orbits	lbm	27,182	±380	
2 1/2 Orbits	lbm	26,876		
Total				
1 1/2 Orbits	lbm	160,084	±2,071	
2 1/2 Orbits	lbm	158,725	±2,071	

TABLE AP 5-1 (Sheet 5 of 5)
PREDICTED PROPULSION SYSTEM PERFORMANCE PARAMETERS

PARAMETER	UNIT	VALUE	DISPERSION 3 sigma	REMARKS
Total Engine Propellant Consumption (Includes First Burn and Second Burn)				
LOX	lbm	190,746	±2,206	RSS values for both 1st and 2nd burns.
LH2	lbm	38,834	±419	
Total	lbm	229,580	±2,245	

(1) Engine cutoff times are based on original information supplied by MSFC. Current MDC velocity cutoff time is predicted as 160.57 for 1st burn. Second burn cutoff is predicted at 324.24 and 322.76 for first and second opportunity restart respectively.

DEFINITION OF SYMBOLS USED WITH COMPUTER PROGRAM AA89

PRINTOUT SYMBOL	DEFINITION
ASUMB	Stage axial acceleration, (g's)
CSUBFEV	Vacuum thrust coefficient
DEL	PU valve position (deg)
DRAG	Atmospheric resistance to the motion of the vehicle
EMR	Total engine propellant mixture ratio. The ratio of the total engine LOX mass flowrate to the total engine LH2 mass flowrate
ENGINE ISP	Engine specific impulse (sec) engine thrust divided by engine mass flowrate
FPS	LH2 pump speed (RPM)
FSUBAUX	Auxiliary thrust (lbf)
FSUBE	Stage thrust (lbf)
FUEL OVB	LH2 overboard (lbm) through engine and vented
GGMR	Gas generator mixture ratio
HSUBF	Height of LH2 above pump inlet (in.); computed from height versus volume polynominal
HSUBO	Height of LOX above pump inlet (in.); computed from height versus volume polynominal
IMPSUBT	Stage total impulse (lbf/sec)
LPS	LOX pump speed (RPM)
OXID OVB	LOX overboard (lbm) through engine and vented
PCC	Thrust chamber pressure (psia) (Injector static pressure)
PFPI	LH2 pump inlet pressure, total (psia)
POPI	LOX pump inlet pressure, total (psia)
RHOSUBF	LH2 bulk density (lbm/ft^3); calculated from pump inlet temperature plus a bias

PRINTOUT SYMBOL	DEFINITION
RHOSUBO	LOX bulk density (lbm/ft^3); calculated from pump inlet temperature plus a bias
TFPI	LH2 pump inlet temperature (deg R)
TIME	Time from S-IVB stage engine start (sec)
TOPI	LOX pump inlet temperature (deg R)
TTFHE	GHE in LH2 tank ullage (lbm)
TTFLH2	GH2 in LH2 tank ullage (lbm)
TTMF	Total mass in LH2 tank ullage (lbm)
TTMO	Total mass in LOX tank ullage (lbm)
TTOHE	GHE in LOX tank ullage (lbm)
TTOLOX	GOX in LOX tank ullage (lbm)
TTPSUBF	LH2 tank top pressure (psia)
TTPSUBO	Oxidizer tank top pressure (psia)
VSUBF	LH2 volume in tank (ft^3)
VSUBO	Oxidizer volume in tank (ft^3)
WDOTFBO	Rate of LH2 boiloff (lbm/sec)
WDOTFGG	Gas generator fuel flowrate (lbm/sec)
WDOTFPR	LH2 tank pressurant flowrate (lbm/sec)
WDOTFVO	Rate of GH2 vented overboard (lbm/sec)
WDOTHE	LOX tank pressurant (GHe) flowrate (lbm/sec)
WDOTOBO	Rate of LOX boiloff (lbm/sec)
WDOTOGG	Gas generator LOX flowrate (lbm/sec)
WDOTOVO	Rate of GOX vented overboard (lbm/sec)
WDOTSUBF	Engine fuel flowrate (lbm/sec)

PRINTOUT SYMBOL	DEFINITION
WDOTSUBO	Engine oxidizer flowrate (lbm/sec)
WDOTSUBT	Total propellant consumption; includes auxiliary flows (lbm/sec)
WFBOT	Accumulated LH2 boiloff (lbm)
WF IN TANK	Weight of LH2 in tank (lbm)
WFPRT	Accumulated LH2 tank pressurant (lbm)
WF PU	PU indicated LH2 weight (lbm)
WFPU USABLE	PU indicated usable LH2 weight (lbm)
WF USABLE	Usable LH2 in tank (lbm)
WFVOT	Total GH2 vented overboard (lbm)
WOBOT	Accumulated LOX boiloff (lbm)
WO IN TANK	Weight of LOX in tank (lbm)
WO PU	PU indicated LOX weight (lbm)
WOPU USABLE	PU indicated usable LOX weight (lbm)
WO USABLE	Usable LOX in tank (lbm)
WOVOT	Total GOX vented overboard (lbm)
WSUBFT	Total LH2 onboard (lbm)
WSUBHE	Weight of helium in cold helium spheres (lbm)
WSUBO ERROR	Equivalent LOX weight error, defined as LH2 weight (PU indicated) times reference mixture ratio of PU system, subtracted from oxidizer weight (PU indicated) (lbm)
WSUBOT	Total LOX onboard (lbm)
WSUBV	Total weight of S-IVB plus payload (lbm)

TABLE AP 5-3 (Sheet 1 of 5)
PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (FIRST BURN) COMPUTER PROGRAM AA89
2-1/2 ORBIT MISSION

Variable name legend (rows 1–13, columns 1–5):

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	TIME	WDOTSUBO	WDOTSUBF	WDOTSUBT	DEL
2	FSUBE	TTPSUBO	TTPSUBF	HSUBO	HSUBF
3	EMR	POPI	PFPI	VSUBO	VSLBF
4	ENGINE ISP	TOPI	TFPI	WO PU	WF PU
5	CSUBFEV	RHOSUBO	RHOSUBF	WOPU USABLE	WFPU USABLE
6	PCC	WDOTOBO	WDOTFBO	WO USABLE	WF USABLE
7	LPS	WDOTHE	WDOTFPR	WO IN TANK	WF IN TANK
8	FPS	TTOHE	TTFHE	WSUBOT	WSUBFT
9	FSUBAUX	TTOLOX	TTFLH2	OX10 OVB	FUEL OVB
10	WSUBC ERROR	WDOOT	WFBOT	WDOTOVO	WDOTFVO
11	WSUBHE	TTMU	TTMF	WOVOT	WFVNT
12	GGMR	WDOTOGG	WDOTFGG	DRAG	WSUBV
13	ASUBM	WFPRT			IMPSUBT

Snapshot TIME = 3.000:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	3.000	0.000	3 171	3 171	-2.000
2	442.19	42.875	32.500	198.796	514.998
3	0.000	42.885	32 500	2722.788	10001.637
4	139.462	165.025	38.315	191630.705	37189.108
5	1.700	70.720	4.329	191745.604	37419.108
6	1.527	0.370	0.000	191881.604	37684.108
7	0.000	0.272	0.000	192555.889	43292.519
8	1046.940	6.065	17.500	192922.889	43340.519
9	0.000	35.610	40.000	0.000	9.481
10	0.000	1.110	0.000	0.000	0.000
11	-368.235	41.875	58.000	0.000	0.000
12	0.000	0.000	0 139	0.000	363187.406
13	0.001		0.000		1323.556

Snapshot TIME = 0.000:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	0.000	0.000	0.000	0.000	-2.000
2	0.00	43.000	32.500	198.798	515.105
3	0.000	43.000	32.500	2723.672	10057.177
4	0.000	165.150	38.330	0.000	0.000
5	1.733	70.698	4.306	192421.000	43037.000
6	0.000	0.370	0.000	192557.000	43302.000
7	0.000	0.238	0.000	192557.000	43302.000
8	0.000	5.300	17.000	192924.000	43350.000
9	0.000	34.500	40.000	0.000	0.000
10	0.000	0.000	0.000	0 000	0.000
11	369.000	40.000	58.000	0 000	0.000
12	0.000	0.000	0.000	0 000	363300.000
13	0.000		0.000		0.000

Snapshot TIME = 4.000:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	4.000	0.000	51.397	51.397	-2.000
2	12462.06	42.833	33.250	198.796	514.878
3	0.000	43.099	32.843	2721.916	9997.956
4	242.465	164.900	38.310	191630.582	37179.117
5	1.700	70.743	4.329	191745.473	37409.117
6	43.028	0.370	0.000	191881.473	37674.117
7	0.000	0.279	0.228	192555.520	43281.998
8	17009.271	6.340	17.500	192992.520	43329.998
9	0.000	35.980	40.114	0.000	19.888
10	0.000	1.480	0.000	0.000	0.000
11	367.959	42.520	58 114	0.000	0.000
12	0.000	0.000	2.253	0.000	363074.516
13	0.034		0.114		6326.549

Snapshot TIME = 0.500:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	0.500	0.000	3.170	3.170	-2 000
2	441.89	42.979	32.500	198.798	515.088
3	0.000	42.989	32.500	2723.669	10004.744
4	139.405	165 150	38.327	191631.018	37195.718
5	1.700	70.698	4.328	191745.934	37425.718
6	1.526	0.370	0.000	191881.934	37690.718
7	0.000	0.244	0.000	192556.814	43300.454
8	1046.738	5.420	17 500	192923.814	43348.454
9	0.000	34.685	40 000	0.000	1.546
10	0.000	0.185	0.000	0.000	0.000
11	368.880	40.305	58.000	0.000	0.000
12	0.000	0.000	0.139	0 000	363298.266
13	0.001		0.000		218.503

Snapshot TIME = 5.000:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	5.000	293.340	66 707	360.046	-2.000
2	155784.05	42 792	34.000	198 598	514.231
3	0.000	44.908	33.749	2719 034	9980.532
4	432.678	164.775	38.480	191490.215	37122.730
5	1.701	70.765	4.331	191602.684	37352.730
6	537.734	0.370	0.000	191738 684	37617.730
7	6004.466	0.286	0.456	192412.492	43225.082
8	22115.913	6.623	17.500	192779.492	43273.082
9	0.000	36.350	40.456	142.656	76.463
10	0.000	1 850	0.000	0 000	0.000
11	367.677	43.173	58.456	0.000	0.000
12	0.761	2.232	2 931	0 000	362874.570
13	0.429		0.456		92954.264

Snapshot TIME = 1.000:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	1 000	0.000	3.170	3.170	-2.000
2	441.94	42.958	32.500	198 797	515 070
3	0.000	42.968	32.500	2723.667	10004.122
4	139.414	165.150	38.325	191630 953	37194.396
5	1.700	70.698	4 328	191745.867	37424.396
6	1.526	0.370	0.000	191881 867	37689.396
7	0.000	0.249	0.000	192556.629	43298.867
8	1046.766	5.544	17 500	192923.629	43346.867
9	0.000	34.870	40.000	0.000	3.133
10	0.000	0.370	0.000	0.000	0.000
11	368.756	40.614	58.000	0.000	0.000
12	0.000	0.000	0.139	0 000	363296 492
13	0.001		0.000		439.460

Snapshot TIME = 5.500:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	5.500	309 150	68.606	377 756	-2.000
2	182590.74	42.771	34.000	198.390	513.844
3	4.506	45.587	33.836	2716.475	9971.065
4	483.356	164.712	38.265	191342.617	37088.907
5	1.701	70.776	4 432	191451 965	37318.907
6	630.190	0.370	0.000	191587.965	37583.907
7	6323.619	0.288	0.569	192261.654	43190.993
8	22770.471	6.767	17 500	192628.654	43238.993
9	0.000	36.535	40.712	293.311	110.295
10	0.000	2.035	0.000	0 000	0.000
11	367.533	43.502	58.712	0 000	0.000
12	0.779	2.351	3.018	0.000	362689.645
13	0.503		0 712		179196.807

Snapshot TIME = 1.500:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	1.500	0.000	3 170	3.170	-2.000
2	441 99	42.938	32.500	198.797	515 052
3	0.000	42.947	32.500	2723.664	10003.501
4	139.423	165.150	38.322	191630 893	37193.074
5	1.700	70.698	4.328	191745.801	37423.074
6	1.526	0.370	0.000	191881.801	37688.074
7	0.000	0.255	0.000	192556.443	43297.280
8	1046.794	5.670	17.500	192923.443	43345.280
9	0.000	35.055	40.000	0 000	4.720
10	0.000	0.555	0.000	0.000	0.000
11	368.630	40 925	58.000	0.000	0.000
12	0 000	0.000	0.139	0 000	363294.723
13	0.001		0.000		660.440

Snapshot TIME = 10.000:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	10.000	382.038	78.094	460 132	-2.000
2	194915.08	42.583	34.000	196 143	510.080
3	4.892	45.097	33.654	2693.148	9887.401
4	423.607	164.652	38.210	189753.182	36980.313
5	1.701	70.786	4 434	189828.469	36980.313
6	672.778	0 370	0.000	189964.469	37245.313
7	7816.898	0.307	0.615	190637.086	42850.016
8	25923.191	8.107	17.500	191004.086	42898.016
9	0.000	38.200	43.475	1916 213	448.509
10	0.000	3.700	0 000	0 000	0.000
11	366.193	46.507	61.475	0 000	0.000
12	0.845	2.906	3.437	0.000	360724.102
13	0.540		3.475		1042698.828

Snapshot TIME = 2.000:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	2.000	0.000	3.170	3.170	-2.000
2	442.03	42.917	32.500	198.797	515 034
3	0.000	42.927	32.500	2723.661	10002 880
4	139.432	165.150	38.320	191630.830	37191.752
5	1.700	70.698	4.328	191745.736	37421.752
6	1 526	0.370	0.000	191881.736	37686.752
7	0.000	0.261	0.000	192556 260	43295.693
8	1046.822	5.799	17.500	192923 260	43343.693
9	0.000	35.240	40.000	0.000	6 307
10	0.000	0.740	0.000	0.000	0.000
11	368.501	41.239	58.000	0.000	0.000
12	0.000	0.000	0.139	0.000	363292.949
13	0.001		0.000		881.445

Snapshot TIME = 15.000:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	15.000	393.004	78.588	471 592	-2.000
2	200617 43	42.275	33.710	193.607	505.915
3	5.001	44.781	33.370	2665.788	9797.432
4	425 405	164.654	36.215	187851.457	36357.974
5	1 701	70.784	4 333	187888.432	36587.473
6	692.478	0.370	0.000	188024.432	36852 473
7	8042 983	0.321	0.615	188695.857	42454.526
8	26091.678	9.679	17 500	189062.857	42502.526
9	0 000	40.050	46.550	3855.592	840.924
10	0.000	5.550	0.000	0.000	0.000
11	364.621	49.929	64.550	0 000	0.000
12	0 864	2.989	3 458	0 000	358387.383
13	0 560		6 550		2031713.359

Snapshot TIME = 2.500:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	2.500	0.000	3.170	3.170	-2.000
2	442.11	42.896	32.500	198 797	515.016
3	0.000	42.906	32.500	2723.224	10002.258
4	139.447	165.087	38.317	191630.768	37190.430
5	1 700	70.709	4.328	191745.670	37420.430
6	1.527	0.370	0 000	191881.670	37685.430
7	0.000	0.266	0.000	192556.074	43294.106
8	1046.881	5.930	17.500	192923 074	43342.106
9	0.000	35.425	40.000	0.000	7.894
10	0.000	0.925	0.000	0.000	0.000
11	368.370	41.555	58.000	0.000	0.000
12	0.000	0.000	0 139	0.000	363291.180
13	0.001		0 000		1102.481

Snapshot TIME = 20.000:

#	Col 1	Col 2	Col 3	Col 4	Col 5
1	20.000	397.140	78.769	475.909	-2.000
2	202476.16	41.900	33.420	191 294	501.922
3	5.042	44.384	33 081	2637 899	9707.218
4	425.452	164.657	38.220	185896.592	35969.429
5	1.701	70.783	4.333	185910.957	36193.643
6	698.923	0.370	0.000	186046.957	36458.643
7	8130 038	0.335	0 615	186717 189	42058.047
8	26156.361	11.319	17.500	187084.189	42106.047
9	0.000	41.900	49.025	5832.410	1234.328
10	0 000	7.400	0.000	0 000	0.000
11	362.980	53.419	67.625	0 000	0.000
12	0.871	3.021	3.466	0 000	356012 234
13	0 569		9.025		3040574.219

TABLE AP 5-3 (Sheet 2 of 5)
PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (FIRST BURN) COMPUTER PROGRAM AA89
2-1/2 ORBIT MISSION

#					
1	25.000	395.769	78.691	474.460	-2.000
2	201941.22	40.250	33.235	189.035	498.113
3	5.029	42.713	32.895	2609.978	9617.053
4	425.623	164.659	38.227	183934.014	35580.813
5	1.700	70.781	4.332	183931.363	35799.739
6	697.408	0.370	0.000	184067.383	36064.739
7	8119.003	0.227	0.615	184736.424	41661.495
8	26129.581	12.458	17.500	185103.424	41709.495
9	0.000	43.750	52.700	7811.326	1627.805
10	0.000	9.250	0.000	0.000	0.000
11	361.842	56.408	70.700	0.000	0.000
12	0.870	3.009	3.460	0.000	353634.918
13	0.571		12.700		4050200.094

#					
1	30.000	395.867	78.689	474.556	-2.000
2	202016.00	38.600	33.050	187.017	494.416
3	5.031	41.046	32.710	2582.052	9526.864
4	425.695	164.662	38.235	181961.352	35192.206
5	1.700	70.779	4.331	181951.516	35405.844
6	697.747	0.370	0.000	182087.516	35670.844
7	8115.173	0.236	0.615	182755.365	41264.950
8	26120.010	13.614	17.500	183122.365	41312.950
9	0.000	45.600	55.775	9790.533	2021.275
10	0.000	11.100	0.000	0.000	0.000
11	360.685	59.414	73.775	0.000	0.000
12	0.870	3.007	3.456	0.000	351257.313
13	0.575		15.775		5060123.438

#					
1	35.000	397.026	78.793	475.819	-2.000
2	202544.74	40.100	32.865	184.989	490.808
3	5.039	42.528	32.524	2553.995	9436.524
4	425.676	164.664	38.242	179979.512	34807.602
5	1.700	70.777	4.331	179962.439	35011.391
6	699.557	0.370	0.000	180098.439	35276.391
7	8125.681	0.245	0.015	180765.096	40867.848
8	26146.399	15.266	17.500	181132.096	40915.848
9	0.000	47.450	58.850	11778.953	2415.302
10	0.000	12.950	0.000	0.000	0.000
11	359.033	62.916	76.850	0.000	0.000
12	0.872	3.015	3.458	0.000	348869.941
13	0.581		18.850		6074078.250

#					
1	40.000	397.036	78.912	475.949	-2.000
2	202662.10	39.267	32.080	183.122	487.299
3	5.031	41.683	32.336	2525.982	9346.113
4	425.807	164.667	38.250	178008.355	34432.799
5	1.699	70.776	4.330	177976.533	34616.723
6	700.279	0.370	0.000	178112.533	34881.723
7	8135.821	0.250	0.015	178777.998	40470.531
8	26173.265	16.502	17.500	179144.998	40518.531
9	0.000	49.300	61.925	13764.201	2809.544
10	0.000	14.800	0.000	0.000	0.000
11	357.797	66.002	79.925	0.000	0.000
12	0.873	3.021	3.460	0.000	346485.527
13	0.585		21.925		7087093.813

#					
1	45.000	398.547	79.131	477.679	-2.000
2	203407.11	38.900	32.552	181.317	483.881
3	5.037	41.304	32.205	2497.956	9255.782
4	425.824	164.669	38.261	176041.576	34057.311
5	1.700	70.774	4.329	175989.877	34221.334
6	702.398	0.370	0.000	176125.877	34486.334
7	8156.157	0.361	0.615	176790.150	40072.494
8	26242.311	17.844	17.500	177157.150	40120.494
9	0.000	51.150	65.000	15750.199	3204.506
10	0.000	16.650	0.000	0.000	0.000
11	356.455	69.194	83.000	0.000	0.000
12	0.875	3.024	3.455	0.000	344099.641
13	0.591		25.000		8101012.875

#					
1	50.000	397.518	79.245	476.763	-2.000
2	203127.93	39.989	32.425	179.504	480.507
3	5.016	42.383	32.073	2469.827	9165.157
4	426.057	164.671	38.272	174063.781	33667.342
5	1.700	70.772	4.329	173996.016	33824.792
6	701.498	0.370	0.000	174132.016	34089.792
7	8139.163	0.259	0.015	174795.096	39673.303
8	26274.427	19.475	17.500	175162.096	39721.303
9	0.000	53.000	68.075	17743.404	3600.622
10	0.000	18.500	0.000	0.000	0.000
11	354.824	72.675	86.075	0.000	0.000
12	0.874	3.010	3.445	0.000	341705.398
13	0.594		28.075		9118582.875

#					
1	55.000	397.258	79.381	476.639	-2.000
2	203166.95	39.433	32.297	177.858	477.191
3	5.004	41.821	31.942	2441.785	9074.393
4	426.249	164.674	38.284	172089.396	33273.532
5	1.700	70.770	4.328	172008.371	33427.785
6	701.680	0.370	0.000	172144.371	33692.785
7	8138.125	0.263	0.015	172806.260	39273.646
8	26316.805	20.780	17.500	173173.260	39321.646
9	0.000	54.850	71.150	19730.389	3997.204
10	0.000	20.350	0.000	0.000	0.000
11	353.519	75.830	89.150	0.000	0.000
12	0.874	3.001	3.436	0.000	339316.906
13	0.599		31.150		10134317.250

#					
1	60.000	397.003	79.513	476.516	-2.000
2	203205.98	38.878	32.170	176.221	473.940
3	4.993	41.260	31.811	2413.759	8983.447
4	426.441	164.676	38.295	170116.287	32879.061
5	1.700	70.769	4.327	170022.012	33030.112
6	701.863	0.370	0.000	170158.012	33295.112
7	8136.983	0.267	0.615	170818.709	38873.324
8	26359.384	22.103	17.500	171185.709	38921.324
9	0.000	56.700	74.225	21716.090	4394.451
10	0.000	22.200	0.000	0.000	0.000
11	352.195	79.003	92.225	0.000	0.000
12	0.873	2.992	3.427	0.000	336929.031
13	0.603		34.225		11150246.875

#					
1	65.000	398.471	79.679	478.150	-2.000
2	203916.07	39.282	32.080	174.582	470.761
3	5.001	41.654	31.719	2385.691	8892.243
4	426.469	164.679	38.306	168130.445	32483.854
5	1.700	70.767	4.326	168032.711	32631.697
6	703.998	0.370	0.000	168168.711	32896.697
7	8154.833	0.374	0.615	168628.215	38472.260
8	26419.762	23.733	17.500	169195.215	38520.260
9	0.000	58.550	77.300	23704.734	4792.440
10	0.000	24.050	0.000	0.000	0.000
11	350.566	82.482	95.300	0.000	0.000
12	0.875	3.003	3.432	0.000	334537.473
13	0.610		37.300		12168012.875

#					
1	70.000	397.046	79.690	476.736	-2.000
2	203420.32	40.014	31.990	173.061	467.719
3	4.984	42.384	31.627	2357.618	8800.908
4	426.693	164.681	38.317	166136.977	32088.203
5	1.700	70.765	4.326	166043.213	32232.833
6	702.588	0.370	0.000	166179.223	32497.833
7	8134.057	0.271	0.615	166837.535	38070.748
8	26425.132	25.373	17.500	167204.535	38118.748
9	0.000	60.400	80.374	25693.564	5190.877
10	0.000	25.900	0.000	0.000	0.000
11	348.926	85.973	98.374	0.000	0.000
12	0.874	2.995	3.428	0.000	332145.281
13	0.612		40.375		13186346.750

#					
1	75.000	396.746	79.753	476.499	-2.000
2	203389.86	39.800	31.900	171.557	464.675
3	4.975	42.165	31.536	2329.605	8709.500
4	426.842	164.684	38.329	164157.795	31692.372
5	1.699	70.764	4.325	164058.031	31833.789
6	702.585	0.370	0.000	164194.031	32098.789
7	8131.160	0.273	0.615	164851.152	37669.054
8	26448.319	26.732	17.500	165218.152	37717.054
9	0.000	62.250	83.449	27678.098	5589.497
10	0.000	27.750	0.000	0.000	0.000
11	347.567	89.182	101.449	0.000	0.000
12	0.874	2.994	3.428	0.000	329757.203
13	0.617		43.450		14203369.750

#					
1	80.000	396.446	79.815	476.261	-2.000
2	203359.38	39.586	31.810	170.054	461.629
3	4.967	41.946	31.445	2301.612	8617.992
4	426.991	164.686	38.340	162188.600	31304.327
5	1.699	70.762	4.324	162074.342	31434.431
6	702.583	0.370	0.000	162210.342	31699.431
7	8128.262	0.275	0.615	162866.270	37267.047
8	26475.936	28.101	17.500	163233.270	37315.047
9	0.000	64.100	86.524	29661.129	5988.428
10	0.000	29.600	0.000	0.000	0.000
11	346.197	92.401	104.524	0.000	0.000
12	0.873	2.993	3.428	0.000	327370.316
13	0.621		46.525		15220240.250

#					
1	85.000	396.173	79.875	476.048	-2.000
2	203329.71	39.371	31.742	168.613	458.581
3	4.960	41.729	31.376	2273.637	8526.352
4	427.120	164.688	38.351	160213.881	30915.879
5	1.699	70.760	4.324	160092.086	31034.770
6	702.358	0.370	0.000	160228.086	31299.770
7	8127.367	0.276	0.015	160882.822	36864.737
8	26489.349	29.480	17.500	161249.822	36912.737
9	0.000	65.950	89.599	31642.727	6387.664
10	0.000	31.450	0.000	0.000	0.000
11	344.819	95.629	107.599	0.000	0.000
12	0.873	2.997	3.435	0.000	324984.559
13	0.626		49.600		16236960.250

#					
1	90.000	395.919	79.916	475.835	-2.000
2	203300.21	39.157	31.675	167.218	455.531
3	4.954	41.512	31.307	2245.680	8434.623
4	427.249	164.691	38.362	158236.252	30513.137
5	1.700	70.758	4.323	158111.154	30634.846
6	702.134	0.370	0.000	158247.154	30899.846
7	8126.437	0.278	0.615	158900.699	36462.164
8	26496.427	30.865	17.500	159267.699	36510.164
9	0.000	67.800	92.674	33623.000	6787.162
10	0.000	33.300	0.000	0.000	0.000
11	343.433	98.865	110.074	0.000	0.000
12	0.872	3.002	3.441	0.000	322599.859
13	0.630		52.075		17253531.000

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (FIRST BURN) COMPUTER PROGRAM AA89
2-1/2 ORBIT MISSION

#					
1	95.000	395.669	79.954	475.623	-2.000
2	203270.69	38.943	31.607	165.825	452.480
3	4.949	41.296	31.239	2217.740	8342.821
4	427.378	164.693	38.374	156259.879	30110.204
5	1.700	70.757	4.322	156131.479	30234.732
6	701.910	0.370	0.000	156267.479	30499.732
7	8125.499	0.279	0.615	156919.830	36059.401
8	26502.225	32.257	17.500	157286.830	36107.401
9	0.000	69.650	95.749	35602.020	7186.849
10	0.000	35.150	0.000	0.000	0.000
11	342.041	102.107	113.749	0.000	0.000
12	0.872	3.006	3.447	-0.000	-320216.230
13	0.635		55.750		18269952.500

#					
1	130.000	395.292	80.195	475.487	-2.000
2	203383.02	39.479	31.260	156.737	431.080
3	4.929	41.825	30.888	2022.122	7697.944
4	427.736	164.710	38.451	142440.709	27322.193
5	1.698	70.744	4.317	142273.080	27428.792
6	703.116	0.370	0.000	142409.080	27693.792
7	8133.986	0.284	0.615	143053.088	33234.917
8	26579.925	42.861	17.500	143420.088	33282.917
9	0.000	82.600	117.274	49455.811	9989.808
10	0.000	48.100	0.000	0.000	-0.000
11	331.437	125.660	135.274	0.000	0.000
12	0.878	3.019	3.438	0.000	303525.004
13	0.670		77.274		25392028.250

#					
1	100.000	395.452	79.985	475.438	-2.000
2	203241.11	38.729	31.540	164.431	449.427
3	4.944	41.079	31.171	2189.814	8250.951
4	427.482	164.696	38.385	154284.691	29710.569
5	1.700	70.755	4.321	154152.992	29834.451
6	701.686	0.370	0.000	154288.992	30099.451
7	8124.856	0.280	0.615	154940.152	35650.471
8	26505.938	33.655	17.500	155307.152	35704.471
9	0.000	71.500	98.824	37579.848	7586.704
10	0.000	37.000	0.000	0.000	0.000
11	340.643	105.355	116.824	0.000	0.000
12	0.872	3.010	3.453	0.000	317833.621
13	0.639		58.825		19286226.500

#					
1	135.000	395.176	80.253	475.429	-2.000
2	203301.15	39.327	31.220	155.502	428.017
3	4.924	41.674	30.847	1994.232	7605.494
4	427.742	164.713	38.462	140471.742	26920.457
5	1.698	70.742	4.317	140296.201	27027.233
6	702.876	0.370	0.000	140432.201	27292.233
7	8130.631	0.284	0.615	141075.018	32830.709
8	26593.686	44.280	17.500	141442.018	32878.709
9	0.000	84.450	120.349	51432.031	10390.941
10	0.000	49.950	0.000	0.000	0.000
11	330.017	128.930	138.349	0.000	0.000
12	0.877	3.016	3.439	0.000	301142.727
13	0.675		80.349		26408883.250

#					
1	105.000	396.977	80.113	477.090	-2.000
2	203930.38	39.062	31.490	163.122	446.372
3	4.955	41.409	31.120	2161.861	8158.954
4	427.447	164.698	38.396	152307.664	29311.307
5	1.700	70.753	4.321	152172.662	29433.844
6	704.046	0.370	0.000	152308.662	29698.844
7	8148.289	0.392	0.615	152958.631	35253.215
8	26552.719	35.254	17.500	153325.631	35301.215
9	0.000	73.350	101.899	39559.518	7986.885
10	0.000	38.850	0.000	0.000	0.000
11	339.044	108.803	119.899	0.000	0.000
12	0.875	3.024	3.455	0.000	315448.844
13	0.646		61.900		20303544.750

#					
1	140.000	395.060	80.312	475.372	-2.000
2	203339.37	39.176	31.180	154.286	424.953
3	4.919	41.523	30.806	1966.347	7512.949
4	427.748	164.715	38.472	138462.355	26525.385
5	1.699	70.739	4.316	138319.906	26625.385
6	702.637	0.370	0.000	138455.906	26890.385
7	8127.276	0.284	0.615	139097.529	32426.212
8	26610.408	45.701	17.500	139464.529	32474.212
9	0.000	86.300	123.424	53407.670	10792.363
10	0.000	51.800	0.000	0.000	0.000
11	328.597	132.200	141.424	0.000	0.000
12	0.876	3.014	3.440	0.000	298760.738
13	0.681		83.424		27425629.000

#					
1	110.000	395.778	80.080	475.858	-2.000
2	203472.23	40.085	31.440	161.810	443.312
3	4.942	42.435	31.071	2133.826	8066.807
4	427.590	164.701	38.407	150324.908	28911.524
5	1.699	70.751	4.320	150186.594	29032.716
6	703.030	0.370	0.000	150322.594	29297.716
7	8133.844	0.283	0.615	150971.369	34849.438
8	26545.588	37.193	17.500	151338.369	34897.438
9	0.000	75.200	104.974	41544.930	8387.588
10	0.000	40.700	0.000	0.000	0.000
11	337.105	112.592	122.974	0.000	0.000
12	0.876	3.019	3.447	0.000	313057.805
13	0.650		64.974		21323509.250

#					
1	145.000	394.987	80.314	475.301	-2.000
2	203311.84	39.024	31.135	153.201	421.887
3	4.918	41.375	30.761	1938.468	7420.346
4	427.754	164.718	38.483	136492.494	26123.386
5	1.699	70.737	4.315	136344.084	26223.386
6	702.624	0.370	0.000	136480.084	26488.386
7	8127.678	0.284	0.615	137120.516	32021.565
8	26614.266	47.122	17.500	137487.516	32069.565
9	0.000	88.150	126.499	55382.834	11193.936
10	0.000	53.650	0.000	0.000	0.000
11	327.175	135.472	144.499	0.000	0.000
12	0.876	3.011	3.436	0.000	296379.078
13	0.686		86.499		28442251.500

#					
1	115.000	395.657	80.080	475.737	-2.000
2	203449.23	39.933	31.390	160.503	440.255
3	4.941	42.279	31.020	2105.886	7974.697
4	427.651	164.703	38.419	148351.186	28514.081
5	1.698	70.750	4.319	148207.309	28631.874
6	703.311	0.370	0.000	148343.309	28896.874
7	8137.293	0.283	0.615	148990.893	34445.947
8	26549.431	38.608	17.500	149357.893	34493.947
9	0.000	77.050	108.049	43523.557	8788.003
10	0.000	42.550	0.000	0.000	0.000
11	335.690	115.858	126.049	0.000	0.000
12	0.878	3.021	3.442	0.000	310673.840
13	0.655		68.049		22240806.250

#					
1	146.000	394.973	80.314	475.287	-2.000
2	203306.33	38.994	31.126	152.984	421.274
3	4.918	41.346	30.752	1932.892	7401.822
4	427.755	164.718	38.485	136098.564	26042.986
5	1.699	70.736	4.315	135948.961	26142.986
6	702.621	0.370	0.000	136084.961	26407.986
7	8127.691	0.284	0.615	136725.154	31940.635
8	26615.037	47.406	17.500	137092.154	31988.635
9	0.000	88.520	127.114	55777.824	11274.251
10	0.000	54.020	0.000	0.000	0.000
11	326.891	136.126	145.114	0.000	0.000
12	0.876	3.011	3.435	0.000	295902.789
13	0.687		87.114		28645559.500

#					
1	120.000	395.542	80.081	475.624	-2.000
2	203426.71	39.782	31.340	159.208	437.198
3	4.939	42.127	30.971	2077.952	7882.558
4	427.705	164.706	38.430	146384.398	28132.608
5	1.697	70.748	4.319	146228.602	28231.034
6	703.595	0.370	0.000	146364.602	28496.034
7	8140.796	0.283	0.615	147010.994	34042.458
8	26553.872	40.025	17.500	147377.994	34090.458
9	0.000	78.900	111.124	45501.605	9188.418
10	0.000	44.400	0.000	0.000	0.000
11	334.273	119.124	129.124	0.000	0.000
12	0.880	3.024	3.437	0.000	308290.449
13	0.660		71.124		23357990.500

#					
1	147.000	394.958	80.315	475.273	-2.000
2	203300.82	38.964	31.117	152.767	420.661
3	4.918	41.316	30.743	1927.317	7383.297
4	427.756	164.719	38.487	135704.648	25962.585
5	1.699	70.736	4.315	135553.854	26062.585
6	702.619	0.370	0.000	135689.854	26327.585
7	8127.704	0.284	0.615	136329.809	31859.705
8	26615.809	47.691	17.500	136696.809	31907.705
9	0.000	88.890	127.729	56172.801	11354.566
10	0.000	54.390	0.000	0.000	0.000
11	326.606	136.780	145.729	0.000	0.000
12	0.876	3.010	3.435	0.000	295426.512
13	0.688		87.729		28848862.000

#					
1	125.000	395.408	80.136	475.545	-2.000
2	203404.88	39.630	31.300	157.972	434.140
3	4.934	41.976	30.930	2050.026	7790.298
4	427.730	164.708	38.441	144410.256	27729.114
5	1.698	70.746	4.318	144250.543	27830.057
6	703.355	0.370	0.000	144386.543	28095.057
7	8137.339	0.284	0.615	145031.742	33638.832
8	26566.203	41.442	17.500	145398.742	33686.832
9	0.000	80.750	114.199	47479.008	9588.968
10	0.000	46.250	0.000	0.000	0.000
11	332.855	122.392	132.199	0.000	0.000
12	0.879	3.021	3.438	0.000	305907.574
13	0.665		74.199		24375064.000

#					
1	148.000	394.944	80.315	475.259	-2.000
2	203295.32	38.933	31.108	152.550	420.047
3	4.917	41.287	30.734	1921.742	7364.770
4	427.757	164.719	38.489	135310.746	25882.184
5	1.699	70.735	4.315	135158.760	25982.184
6	702.616	0.370	0.000	135294.760	26247.184
7	8127.717	0.285	0.615	135934.477	31778.773
8	26616.581	47.975	17.500	136301.477	31826.773
9	0.000	89.260	128.344	56567.762	11434.882
10	0.000	54.760	0.000	0.000	0.000
11	326.322	137.435	146.344	0.000	0.000
12	0.876	3.010	3.434	0.000	294950.250
13	0.689		88.344		29052159.000

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (FIRST BURN) COMPUTER PROGRAM AA89
2-1/2 ORBIT MISSION

#	A1	A2	A3	A4	A5	#	B1	B2	B3	B4	B5
1	149.000	394.929	80.315	475.245	-2.000	1	154.600	395.075	80.329	475.404	-2.000
2	203289.81	38.903	31 099	152.333	419.434	2	204365.59	38.733	31.049	151 118	416.000
3	4.917	41.258	30.725	1916.166	7346.243	3	4.918	41.092	30 675	1884.942	7242.460
4	427.758	164.720	38.492	134916.863	25801.781	4	429.878	164.722	38 504	132831 164	26220.416
5	1.698	70.735	4.315	134763.684	25901.781	5	1.698	70.732	4 314	132671.311	26320.416
6	702.613	0.370	0.000	134899 684	26166.781	6	693.420	0.370	0.000	132807 311	26585.416
7	8127.730	0.285	0.015	135539.162	31697.841	7	7509.908	0.285	0.015	133325.238	31244.596
8	26619.200	48.260	17.500	135906.162	31745.841	8	26720.394	49.854	17.500	133692 238	31292.596
9	0.000	89.630	128.959	56962.707	11515.199	9	0.000	91.702	132.403	59174.559	11965.001
10	0.000	55.130	0 000	0.000	0.000	10	0.000	57.202	0.000	0.000	0.000
11	326.037	138.089	146.959	0.000	0.000	11	324.443	141.756	150.403	0.000	0.000
12	0.876	3.009	3.433	0 000	294474.000	12	0.839	2.957	3.522	0 000	291806.832
13	0.690		88.959		29255450.500	13	0.700		92 403		30393955.000
1	150.000	394.915	80.316	475.231	-2.000	1	154.700	340.461	69.220	409 680	-2.000
2	203284.31	38.873	31.090	152.116	418.821	2	176211.40	38.730	31.048	151.097	415.942
3	4.917	41.228	30.716	1910.591	7327.714	3	4.919	41.613	30.960	1884 409	7240.602
4	427.759	164.720	38.494	134522.992	25721.379	4	430.119	164.722	38.504	132796.871	26237.218
5	1.698	70.734	4.315	134368.621	25821.379	5	1.698	70.732	4.314	132636.898	26336.872
6	702.611	0.370	0.000	134504.621	26086.379	6	597.893	0.370	0.000	132772.898	26601.872
7	8127.743	0.285	0.615	135143.861	31616.909	7	6471.775	0.285	0.015	133287 463	31236.862
8	26621.820	48.545	17.500	135510.861	31664.909	8	23032.345	49.883	17.500	133654.463	31284.862
9	0.000	90.000	129.574	57357.639	11595.517	9	0.000	91.739	132.465	59212.297	11972.674
10	0.000	55.500	0.000	0.000	0.000	10	0.000	57.239	0.000	0.000	0.000
11	325.752	138.744	147.574	0.000	0.000	11	324.414	141.821	150.464	0.000	0.000
12	0.876	3.009	3.433	0.000	293997.770	12	0.839	2.548	3.036	0.000	291761.324
13	0.691		89.574		29458736.500	13	0.604		92.465		30413476.000
1	151.000	394.900	80.316	475.216	-2.000	1	154.800	208.721	42.457	251.178	-2.000
2	203278.80	38.842	31.081	151.899	418.208	2	107794.27	38.727	31.047	151.082	415.899
3	4.917	41.199	30.707	1905 016	7309.183	3	4.916	41.918	31.367	1884.020	7238.853
4	427.761	164.721	38.496	134129.133	25640.976	4	429.154	164.722	38.504	132762 732	26256.233
5	1.698	70.734	4.315	133973 570	25740.976	5	1.698	70.732	4.314	132612 645	26355.392
6	702.608	0.370	0.000	134109 570	26005.976	6	365.751	0.370	0.000	132748 645	26620.392
7	8127.756	0.285	0.015	134748.570	31535.976	7	3967 563	0.285	0.015	133259.846	31231.193
8	26624.439	48.829	17.500	135115.570	31583.976	8	14131.974	49.911	17.500	133626.846	31279.193
9	0.000	90.370	130.189	57752.559	11675.834	9	0.000	91.776	132.526	59239.877	11978 281
10	0.000	55.870	0.000	0.000	0.000	10	0.000	57.276	0.000	0.000	0 000
11	325.468	139.399	148 189	0.000	0.000	11	324.386	141.887	150.526	0.000	0.000
12	0.876	3.008	3.432	0.000	293521.543	12	0 839	1.562	1.863	0.000	291728.035
13	0.693		90.189		29662017.000	13	0.370		92.526		30427756 500
1	152.000	394.950	80.320	475.270	-2.000	1	154.900	79.401	16.226	95 627	-2.000
2	203300.14	38.812	31.072	151 682	417.595	2	41038.98	38.724	31 046	151.075	415.877
3	4.917	41.169	30.698	1899.441	7290.652	3	4.893	40.930	31.385	1883.822	7238.011
4	427.757	164.721	38.498	133768 648	25801.937	4	429.155	164.723	38 504	132762 150	26277.869
5	1.698	70.733	4.314	133611 895	25901.937	5	1.698	70.732	4.314	132601 980	26376.666
6	702.683	0.370	0.000	133747.895	26166.937	6	139.248	0.370	0.000	132737.980	26641.666
7	8128.593	0.285	0 015	134353.264	31455.042	7	1509.335	0.285	0.015	133245.818	31228.276
8	26628.301	49.114	17.500	134720.264	31503.042	8	5402.699	49.940	17.500	133612 818	31276.276
9	0.000	90.740	130.804	58147.496	11756.153	9	0.000	91.813	132.588	59253.867	11981.136
10	0.000	56.240	0 000	0.000	0.000	10	0.000	57.313	0.000	0 000	0.000
11	325.183	140.053	148.804	0.000	0.000	11	324.357	141.952	150.587	0.000	0.000
12	0.876	3.008	3.432	0.000	293045.305	12	0.834	0.594	0 712	0.000	291711.094
13	0.694		90.804		29865305.250	13	0.141		92.588		30434961.500
1	153.000	395.000	80.324	475.323	-2.000	1	155.000	34.097	6.612	40.710	-2 000
2	203321.48	38.782	31.063	151.465	416.981	2	16833.18	38 721	31.184	151.072	415 869
3	4.918	41.139	30 690	1893.865	7272.118	3	5.157	39.577	31.184	1883.753	7237.925
4	427.754	164.722	38.500	133408.117	25962.893	4	413.494	164 723	38 504	132760.676	26301.203
5	1.698	70.733	4.314	133250.170	26062.893	5	1.698	70.732	4.314	13260C.463	26399.813
6	702.757	0.370	0.000	133386.170	26327.893	6	57.116	0.370	0.000	132736.463	26664.813
7	8129.430	0.285	0.615	133957.908	31374.104	7	648.160	0.285	0.015	133740.938	31227.234
8	26632.165	49.398	17.500	134324.908	31422.104	8	2202.285	49.968	17.500	133607.938	31275.234
9	0.000	91.110	131.419	58542.480	11836.477	9	0.000	91.850	132.649	59258.711	11982.117
10	0 000	56.610	0.000	0.000	0.000	10	0.000	57 350	0.000	0.000	0.000
11	324 898	140.708	149.419	0.000	0.000	11	324.329	142.018	150.649	0 000	0.000
12	0.877	3.008	3.432	0.000	292569.012	12	0.879	0.255	0.290	0 000	291705.168
13	0.695		91.419		30068615.000	13	0.058		92.649		30437472.500
1	154.000	395.050	80.327	475 377	-2.000	1	155.100	25.167	5.001	30.168	-2.000
2	203342.83	38.752	31.054	151.248	416.368	2	12234.91	38.718	31 100	151 070	415.864
3	4.918	41.110	30.681	1888.288	7253.582	3	5 032	39.067	31 100	1883 712	7237 886
4	427.751	164.722	38.502	133107.537	26123.846	4	405.560	164.723	38.505	132761 135	26324.823
5	1.698	70.732	4.314	132888.398	26223.846	5	1.698	70.732	4.314	132600 908	26423.366
6	702.832	0.370	0.000	133024.398	26488.846	6	41.514	0.000	0 000	132736 908	26688 366
7	8130.267	0.285	0.615	133562.504	31293.162	7	478.398	0.285	0 615	133238.020	31226.598
8	26733.149	49.683	17.500	133929.504	31341.162	8	1666 235	49.996	17.500	133605.020	31274.598
9	0.000	91.480	132.034	58937 516	11916.803	9	0 000	91.868	132 711	59261.611	11982.691
10	0.000	56.980	0.000	0.000	0.000	10	0 000	57.368	0.000	0.000	0.000
11	324.614	141.363	150.034	0.000	0.000	11	324.300	142.064	150.710	0 000	0.000
12	0.873	3.008	3.447	0.000	292092.664	12	0.858	0.188	0.220	0.000	291701.617
13	0.696		92 034		30271946.000	13	0.042		92.711		30438892.750
1	154.500	395.075	80.329	475 404	-2.000	1	155.200	21.661	4.288	25 950	-2.000
2	203353.50	38.736	31.049	151.140	416.062	2	10431.70	38.715	31.084	151 069	415.860
3	4.918	41.095	30.676	1885.500	7244.313	3	5.051	38 969	31.084	1883 680	7237.800
4	427 749	164.722	38.503	132867.227	26204.322	4	401.999	164.723	38.505	132762 193	26348.532
5	1.698	70.732	4.314	132707 492	26304.322	5	1.698	70.732	4.314	132601 957	26447.035
6	702.869	0.370	0.000	132843.492	26569.322	6	35.396	0.000	0.000	132737.957	26712.035
7	8130.686	0.285	0.615	133364.783	31252.690	7	411.760	0.285	0.615	133235 705	31226 077
8	26783.642	49.826	17.500	133731 783	31300.690	8	1429.243	50.025	17.500	133602.705	31274.077
9	0.000	91.665	132.342	59135 051	11956.968	9	0.000	91.868	132.772	59263.926	11983.150
10	0.000	57.165	0.000	0.000	0.000	10	0.000	57.368	0.000	0 000	0.000
11	324.471	141.690	150.341	0 000	0.000	11	324.272	142.093	150.772	0.000	0.000
12	0.871	3.008	3.454	0.000	291854.473	12	0.861	0.162	0.188	0 000	291698.781
13	0.697		92.342		30373619.750	13	0.036		92 772		30440011.750

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (FIRST BURN) COMPUTER PROGRAM AA89
2-1/2 ORBIT MISSION

1	155.300	19.824	3.915	23.738	-2.000
2	9487.02	38.712	31.042	151.068	415.856
3	5.064	38.928	31.077	1883.651	7237.714
4	399.651	164.723	38.505	132763.488	26372.284
5	1.698	70.732	4.314	132603 246	26470.753
6	32.190	0.000	0.000	132739.246	26735.753
7	376.830	0.285	0.615	133233.631	31225.606
8	1305.106	50.053	17.500	133600.631	31273.606
9	0.000	91.868	132.834	59266.000	11983.560
10	0.000	57.368	0.000	0.000	0.000
-11-	324.243	142.121	150.833	0.000	0.000
12	0.862	0.148	0.172	0.000	291696.234
13	0.033		92.834		30441006.500
1	155.400	17.396	3.421	20.817	-2.000
2	8237.35	38.709	31.041	151.067	415.853
3	5.085	38.906	31.073	1883.625	7237.714
4	395.704	164.723	38.505	132764.988	26396.073
5	1.698	70.732	4.314	132604.738	26494.512
6	27.950	0.000	0.000	132740.738	26759.512
7	330.684	0.285	0.615	133231.760	31225.175
8	1140.874	50.082	17.500	133598.760	31273.175
9	0.000	91.868	132.895	59267.871	11983.929
10	0.000	57.368	0.000	0.000	0.000
11	324.215	142.150	150.895	0.000	0.000
12	0.866	0.130	0.150	0.000	291693.934
13	0.028		92.895		30441897.750
1	155.500	13.775	2.685	16.460	-2.000
2	6372.36	38.706	31.040	151.066	415.850
3	5.131	38.878	31.069	1883.603	7237.572
4	387.149	164.723	38.505	132766 789	26419.922
5	1.698	70.732	4 314	132606.533	26518.333
6	21.622	0.000	0.000	132742.533	26783.333
7	261.852	0.285	0.615	133230.191	31224.807
8	895.643	50.110	17.500	133597.191	31272.807
9	0.000	91.868	132.957	59269.439	11984 236
10	0 000	57.368	0.000	0.000	0 000
11	324.186	142.178	150.956	0.000	0.000
12	0.873	0.103	0 118	0 000	291691.996
13	0.022		92 957		30442632.500
1	155.600	9.727	1.862	11.589	-2.000
2	4287.92	38.703	31.040	151 065	415.848
3	5.224	38.837	31.062	1883.587	7237.529
4	369.999	164.723	38.506	132768.982	26443.846
5	1.698	70.732	4.314	132608.723	26542.234
6	14.549	0.000	0.000	132744.723	26807.234
7	184.906	0.285	0.615	133229.018	31224.518
8	621.334	50.139	17.500	133596.018	31272.518
9	0.000	91.868	133.018	59270.613	11984.463
10	0.000	57.368	0.000	0.000	0.000
11	324.158	142.207	151.018	0.000	0.000
12	0.889	0.073	0.082	0.000	291690.535
13	0.015		93.018		30443164.250
1	155.700	6.544	1.215	7 759	-2.000
2	2650.27	38.700	31.039	151.065	415.847
3	5.387	38 790	31.054	1883.576	7237.505
4	341.566	164.723	38.506	132771.547	26467.841
5	1.698	70.732	4.314	132611.283	26566.210
6	8.993	0.000	0.000	132747 283	26831.210
7	124.405	0.285	0.615	133228 215	31224.305
8	405.520	50.167	17.500	133595 215	31272.305
9	0.000	91.868	133.080	59271.416	11984.615
10	0.000	57.368	0.000	0.000	0.000
11	324.129	142.235	151.079	0.000	0.000
12	0.916	0.049	0 053	0.000	291689.520
13	0.009		93.080		30443505.000
1	155 800	4.521	0.803	5.224	-2.000
2	1610.18	38.697	31.038	151.065	415.845
3	5.629	38.753	31.047	1883 568	7237.491
4	302.462	164.723	38.506	132774 361	26491.882
5	1.698	70.732	4.314	132614.096	26590.238
6	5.464	0.000	0.000	132750.096	26855.238
7	85.933	0.285	0.615	133227.666	31224.144
8	268.155	50.196	17.500	133594.666	31272.144
9	0.000	91.868	133.141	59271.965	11984.715
10	0.000	57.368	0.000	0 000	0.000
11	324.101	142.264	151.141	0 000	0.000
12	0.957	0.034	0.035	0.000	291688.809
13	0.006		93.141		30443715.500
1	155.900	0.000	0.000	0.000	-2.000
2	0.00	38.694	31.037	151 064	415.844
3	0.000	38.728	31.043	1883.564	7237.487
4	0.000	164.723	38.506	132777.426	26515.971
5	1.698	70.732	4.314	132617 158	26614.317
6	0.030	0.000	0.000	132753.158	26879.317
7	0 000	0.285	0 615	133227 365	31224.032
8	0.000	50.224	17.500	133594 365	31272.032
9	0 000	91.868	133.203	59272 266	11984.765
10	0.000	57.368	0 000	0 000	0.000
11	324.072	142.292	151.202	0.000	0.000
12	0.000	0.000	0.000	0.000	291688.395
13	0.000		93.203		30443804.500

TABLE AP 5-4 (Sheet 1 of 6)
PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
2-1/2 ORBIT MISSION

#					
1	170.000	0.000	0.000	0.000	-30.400
2	0.00	40.500	29.500	150.911	389.587
3	0.000	40.500	29.500	1883.354	6501.621
4	0.000	165.500	39.980	132972.461	26559.631
5	1.659	70.591	4.269	132811.348	26559.402
6	0.000	0.385	0.000	132947.348	26824.402
7	0.000	0.100	0.000	132947.348	27758.402
8	0.000	0.010	41.990	133314.348	27806.402
9	0.000	316.885	310.849	59327.266	15272.749
10	0.000	282.386	3440.034	0.000	0.000
11	278.979	370.403	349.177	0.000	3289.997
12	0.000	0.000	0.000	0.000	287942.746
13	0.000		98.799		30443804.500

#					
1	177.000	0.000	4.008	4.008	-30.400
2	377.51	40.500	29.500	150.909	389.410
3	0.000	40.508	29.499	1883.316	6443.392
4	94.184	165.500	39.224	132969.777	26562.609
5	1.659	70.591	4 304	132808.656	26540.686
6	1.335	0.385	0.000	132944.656	26805.686
7	0.000	0.100	0.000	132944.656	27735.099
8	1327.279	0.710	41.990	133311.656	27783.099
9	0.000	319.578	310.849	59327.266	15296.052
10	0.000	285.078	3440.034	0.000	0.000
11	278.279	373.795	349.177	0.000	3289.997
12	0.000	0.000	0.172	0 000	287916.754
13	0.001		98.799		30446830.500

#					
1	171.000	0.000	2.992	2.992	-30.400
2	411.50	40.500	29.500	150.911	389.565
3	0.000	40.509	29.500	1883.348	6493.217
4	137.531	165.500	39.872	132972.076	26571.460
5	1.659	70.591	4.275	132810.963	26557.114
6	1.456	0.385	0.000	132946.963	26822.114
7	0.000	0.100	0.000	132946.963	27755.458
8	995.952	0.110	41.990	133313.963	27803.458
9	0.000	317.270	310.849	59327.266	15275.692
10	0.000	282.770	3440.034	0.000	0.000
11	278.879	370.887	349.177	0.000	3289.997
12	0.000	0.000	0.128	0.000	287939.418
13	0.001		98.799		30444190.500

#					
1	178.000	0.000	4.269	4.269	-30.400
2	346.49	40.500	29.500	150.909	389.379
3	0.000	40.507	29.498	1883.310	6435.113
4	81.265	165.500	39.116	132969.393	26560.663
5	1.659	70.591	4.309	132808.271	26537.201
6	1.227	0.385	0.000	132944.271	26802.201
7	0.000	0.100	0.000	132944.271	27730.959
8	1412.286	0.810	41.990	133311.271	27778.959
9	0.000	319.962	310.849	59327.266	15300.192
10	0.000	285.462	3440.034	0.000	0.000
11	278.179	374.279	349.177	0 000	3289.997
12	0.000	0.000	0.183	0.000	287912.230
13	0.001		98.799		30447191.500

#					
1	172.000	0.000	2.993	2.993	-30.400
2	447.37	40.500	29.500	150.910	389.542
3	0.000	40.510	29.500	1883.343	6484.861
4	149.457	165.500	39.764	132971.693	26570.241
5	1.659	70.591	4.280	132810.578	26554.775
6	1.583	0.385	0.000	132946.578	26819.775
7	0.000	0.100	0.000	132946.578	27752.465
8	995.513	0.210	41.990	133313.578	27800.465
9	0.000	317.655	310.849	59327.266	15278.686
10	0.000	283.155	3440.034	0.000	0.000
11	278.779	371.372	349.177	0.000	3289.997
12	0.000	0.000	0.128	0.000	287936.043
13	0.002		98.799		30444618.750

#					
1	179.000	41.827	32.160	73.987	-30.400
2	37130.74	40.500	29.467	150.903	389.334
3	1.301	40.671	29.321	1882.915	6426.532
4	501.854	165.450	39.008	132958.566	26557.072
5	1.660	70.600	4.314	132797.424	26531.931
6	131.321	0.385	0.000	132933.424	26696.931
7	948.307	0.135	0.300	132933.424	27725.034
8	10668.711	0.928	41.990	133300.424	27773.034
9	0.000	320.347	310 999	59337.729	15305.967
10	0.000	285.847	3440.034	0.000	0.000
11	278.061	374.781	349.327	0.000	3289.997
12	0.235	0.326	1.384	0.000	287895.457
13	0.129		98.949		30454909.500

#					
1	173.000	0.000	3.182	3.182	-30.400
2	483.26	40.500	29 500	150.910	389.519
3	0.000	40.510	29.500	1883.338	6476.542
4	151.885	165.500	39.656	132971.309	26568.956
5	1.659	70.591	4.285	132810.193	26552.342
6	1.710	0.385	0.000	132946.193	26817.342
7	0.000	0.100	0.000	132946.193	27749.376
8	1057.267	0.310	41.990	133313.193	27797.376
9	0.000	318.039	310.849	59327.266	15281.774
10	0.000	283.539	3440.034	0.000	0.000
11	278.679	371.856	349.177	0.000	3289.997
12	0.000	0.000	0.136	0.000	287932.566
13	0.002		98.799		30445082.750

#					
1	180.000	268.145	70 093	338.238	-30.400
2	150271.44	40.500	29.433	150.831	388.890
3	3.826	42.612	29.073	1880.869	6406.066
4	444.277	165.400	38.900	132827.033	26519.097
5	1.660	70.609	4.319	132665.557	26473.921
6	531.263	0.385	0.000	132801.557	26738.921
7	6066.934	0.170	0.600	132801.557	27666.369
8	23316.617	1.080	41.990	133168.557	27714.369
9	0.000	320.731	311.449	59469.211	15364.182
10	0.000	286.232	3440.034	0.000	0.000
11	277.909	375.319	349.777	0.000	3289.997
12	0.689	2.085	3.025	0.000	287704.922
13	0.522		99.399		30552650.000

#					
1	174.000	0.000	3.370	3.370	-30.400
2	469.30	40.500	29.500	150.910	389.494
3	0.000	40.510	29.500	1883.332	6468.237
4	139.244	165.500	39.548	132970.926	26567.553
5	1.659	70.591	4.290	132809.809	26549.720
6	1.660	0.385	0.000	132945.809	26814.720
7	0.000	0.100	0.000	132945.809	27746.099
8	1118.965	0.410	41.990	133312.809	27794.099
9	0.000	318.424	310.849	59327.266	15285.052
10	0.000	283.924	3440.034	0.000	0.000
11	278.579	372.341	349.177	0.000	3289.997
12	0.000	0.000	0.144	0.000	287928.906
13	0.002		98.799		30445564.250

#					
1	180.000	301.601	70.839	372.439	-30.400
2	160943.19	40.500	29.417	150.752	388.621
3	4.258	42.765	29 100	1878.672	6397.172
4	432.132	165.375	38.890	132684.797	26497.112
5	1.660	70.613	4.319	132522.904	26438.713
6	569.011	0.385	0.000	132658.904	26703.713
7	6823.713	0.187	0 600	132658 904	27630.833
8	23559.645	1.169	41 990	133055.904	27678.833
9	0.000	320.924	311 749	59611.670	15399.417
10	0.000	286.424	3440.034	0.000	0.000
11	277.819	375.600	350.077	0.000	3289.997
12	0.767	2.345	3 057	0.000	287526.734
13	0.560		99.699		30630461.500

#					
1	175.000	0.000	3.559	3.559	-30.400
2	438.72	40.500	29 500	150.910	389.468
3	0.000	40.509	29.499	1883 327	6459.945
4	123.265	165.500	39.440	132970 543	26566.031
5	1.659	70.591	4.295	132809.424	26546.909
6	1.552	0.385	0.000	132945.424	26811.909
7	0.000	0.100	0.000	132945.424	27742.633
8	1180.608	0.510	41.990	133313.193	27790.633
9	0.000	318.808	310.849	59327.266	15288.518
10	0.000	284.309	3440.034	0.000	0.000
11	278.479	372.826	349.177	0.000	3289.997
12	0.000	0.000	0.152	0.000	287925.055
13	0.002		98.799		30446017.000

#					
1	181.000	303.894	70.960	374.854	-30.400
2	162070.88	40.500	29.400	150.669	388.350
3	4.283	42.813	29.091	1876.409	6388.249
4	432.357	165.350	38.880	132533 678	26475.053
5	1 660	70.617	4.320	132371.330	26403.290
6	573.028	0.385	0.000	132507.330	26668.290
7	6876.103	0.205	0.600	132507.330	27595.082
8	23595.166	1.268	41.990	132874.330	27643.082
9	0 000	321.116	312.049	59763.053	15434.869
10	0.000	286.616	3440.034	0.000	0.000
11	277.721	375.891	350.377	0.000	3289.997
12	0.772	2.363	3.062	0.000	287339.410
13	0 564		99.999		30711216.500

#					
1	176.000	0.000	3.748	3 748	-30.400
2	408.12	40.500	29.500	150.909	389.440
3	0.000	40.509	29.499	1883.321	6451.667
4	108.888	165.500	39.332	132970.041	26564.392
5	1.659	70.591	4.300	132809.041	26543.910
6	1.444	0.385	0.000	132945.041	26808.910
7	0.000	0.100	0.000	132945.041	27738.978
8	1242.197	0.610	41.990	133312.041	27786.978
9	0.000	319.193	310.849	59327.266	15292.172
10	0.000	284.693	3440.034	0.000	0.000
11	278.379	373.310	349.177	0 000	3289.997
12	0.000	0.000	0.161	0.000	287921.016
13	0.001		98.799		30446439.000

#					
1	182.000	308.097	71.208	379.305	-30.400
2	164366.43	40.500	29.367	150.501	387.807
3	4.327	42.831	29.059	1871.839	6370.376
4	433.336	165.300	38.860	132228.191	26430.824
5	1.660	70.626	4.321	132064.922	26332.260
6	581 175	0.385	0.000	132200.922	26597.260
7	6971.482	0.240	0.600	132200.922	27523.397
8	23668.123	1.490	41.990	132567.922	27571.397
9	0.000	321.501	312.649	60069.076	15505.954
10	0.000	287.001	3440.034	0.000	0.000
11	277.499	376.498	350.977	0.000	3289.997
12	0 780	2.396	3.072	0.000	286961.316
13	0.573		100.599		30874422.250

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
2-1/2 ORBIT MISSION

#						#					
1	183.000	311.426	71.453	382.879	-30.400	1	184.200	375.117	75.682	450.799	-2.000
2	167930.61	40.487	29.333	150.331	387.261	2	194793.07	40.472	29.299	150 096	386.581
3	4.358	42.867	29.032	1867.461	6352.450	3	4.957	42.876	28.981	1861.425	6330.160
4	438.599	165.301	38.840	131918.967	26370.152	4	432.106	165.302	38.816	131492.758	26279.379
5	1.660	70.626	4.321	131754.762	26260.979	5	1.699	70.625	4.322	131327.283	26171.993
6	593.783	0.385	0.000	131890.762	26525.979	6	672.860	0.385	0.000	131463.283	26436.993
7	7046.884	0.248	0.607	131890.762	27451.460	7	7710.798	0.258	0.615	131463.283	27361.688
8	23742.506	1.734	41.990	132257.762	27499.460	8	25272.099	2.037	41.990	131830.283	27409.688
9	0.000	321.885	313.251	60378.852	15577.289	9	0.000	322.347	313.987	60805.869-	15666.324
10	0.000	287.385	3440.034	0.000	0.000	10	0.000	287.847	3440.034	0.000	0.000
11	277.255	377.126	351.578	0.000	3289.997	11	270.951	377.891	352.314	0.000	3289.997
12	0.786	2.421	3.082	0.000	286579.219	12	0.861	2.855	3.316	0.000	286061.969
13	0.586		101.201		31040572.250	13	0.681		101.937		31263867.250
1	183.200	329.675	72.338	402.014	-19.040	1	184.400	375.644	75.839	451.483	-2.000
2	175389.92	40.485	29.327	150.296	387.152	2	196080.74	40.470	29.298	150 055	386.466
3	4.557	42.875	29.027	1866.567	6348.847	3	4.953	42.897	28.981	1860.364	6326.367
4	436.278	165.301	38.836	131855.826	26355.534	4	434.304	165.302	38 812	131417.830	26263.929
5	1.673	70.626	4.322	131691.434	26246.649	5	1.699	70.625	4.323	131252.129	26156.848
6	615.438	0.385	0.000	131827.434	26511.649	6	677.308	0.385	0 000	131388.129	26421.848
7	7227.389	0.250	0.610	131827.434	27436.999	7	7721.561	0.259	0.615	131388.129	27346.412
8	24066.826	1.784	41.990	132194.434	27484.999	8	25322.826	2.089	41.990	131755 129	27394.412
9	0.000	321.962	313.373	60442.104	15591.628	9	0.000	322.424	314.110	60880.947	15681.477
10	0.000	287.462	3440.034	0.000	0.000	10	0.000	287.924	3440.034	0.000	0.000
11	277.205	377.253	351.700	0.000	3289.997	11	276.900	378.020	352.437	0.000	3289.997
12	0.812	2.545	3.132	0.000	286501.430	12	0.860	2.859	3.323	0.000	285971.539
13	0.612		101.323		31074528.250	13	0.686		102.060		31302954.750
1	183.400	353.419	73.769	427.188	-7.680	1	184.600	376.174	75.934	452.107	-2.000
2	185306.94	40.482	29.320	150.259	387.041	2	196862.08	40.467	29.297	150.014	386.350
3	4.791	42.883	29.023	1865.618	6345.199	3	4.954	42.917	28.981	1859.302	6322.567
4	433.783	165.301	38.832	131788.855	26340.720	4	435.432	165.303	38.808	131342.795	26248.450
5	1.689	70.626	4.322	131624.268	26232.126	5	1.699	70.625	4.323	131176.867	26141.675
6	644.221	0.385	0.000	131760.268	26497.126	6	680.007	0 385	0.000	131312.867	26406.675
7	7456.714	0.251	0.613	131760 268	27422.345	7	7732.372	0.261	0.615	131312.867	27331.108
8	24592.739	1.834	41.990	132127 268	27470.345	8	25352.515	2.141	41.990	131679.867	27379.108
9	0.000	322.039	313.495	60509.191	15606.159	9	0.000	322.501	314.233	60956.131	15696.658
10	0.000	287.539	3440.034	0.000	0.000	10	0.000	288.001	3440.034	0.000	0.000
11	277.155	377.380	351.823	0.000	3289.997	11	276.848	378.149	352.560	0.000	3289.997
12	0.842	2.705	3.214	0.000	286419.609	12	0.861	2.863	3 327	0.000	285880.973
13	0.647		101 445		31110055.250	13	0.689		102.183		31342274.750
1	183.500	370.676	75.133	445.809	-2.000	1	184.800	376.699	75.965	452.664	-2.000
2	192792.61	40.481	29.317	150.240	386.985	2	197133.57	40.465	29.296	149.972	386.234
3	4.934	42.886	29.017	1865.118	6343.352	3	4.959	42.916	28.980	1858.238	6318.767
4	432.456	165.301	38.830	131753.541	26333.198	4	435.496	165.303	38.804	131267.656	26232.961
5	1.699	70.625	4.322	131588.850	26224.751	5	1.699	70.625	4 323	131101.502	26126.492
6	665.942	0.385	0.000	131724.850	26489.751	6	680.945	0.385	0.000	131237 502	26391.492
7	7619.225	0.252	0.615	131724.850	27414.906	7	7743.197	0.262	0.615	131237.502	27315.795
8	25095.118	1.859	41.990	132091.850	27462.906	8	25361.008	2.193	41.990	131604.502	27363.795
9	0.000	322.077	313.556	60544.572	15613.538	9	0.000	322.577	314.356	61031.420	15711.849
10	0.000	287.578	3440.034	0.000	0 000	10	0.000	288.078	3440 034	0.000	0.000
11	277.130	377.444	351.884	0.000	3289.997	11	276.795	378.278	352 683	0.000	3289.997
12	0.857	2.822	3.293	0.000	286376.754	12	0.861	2.867	3.328	0.000	285790.293
13	0.673		101.507		31128587.000	13	0.690		102.306		31381674.500
1	183.600	371.462	75.211	446.673	-2.000	1	185.000	377.225	75.996	453.221	-2.000
2	192811.65	40.480	29.313	150.219	386.927	2	197405.05	40.462	29.294	149.931	386.118
3	4.939	42.888	29.003	1864.594	6341.480	3	4.964	42.914	28.979	1857 172	6314 966
4	431.662	165.302	38.828	131716.043	26325.536	4	435.560	165.303	38.800	131192.410	26217.467
5	1.699	70.625	4.322	131551.703	26217.238	5	1.699	70.625	4.323	131026.029	26111.304
6	666.009	0.385	0.000	131687.703	26482.238	6	681 883	0.385	0.000	131162.029	26376.304
7	7635.399	0.253	0.615	131687.703	27407.327	7	7754 021	0.264	0.615	131162.029	27300.475
8	25120.427	1.884	41.990	132054.703	27455.327	8	25369.500	2.246	41.990	131529.029	27348.475
9	0.000	322.116	313.618	60581.680	15621.055	9	0.000	322.654	314.479	61106.814	15727.046
10	0.000	287.616	3440.034	0.000	0.000	10	0.000	288.155	3440.034	0.000	0.000
11	277 104	377.507	351.946	0.000	3289.997	11	276.743	378.408	352.806	0 000	3289.997
12	0.858	2.828	3.296	0.000	286332.027	12	0.862	2.871	3 330	0 000	285699.504
13	0.673		101.568		31147867.250	13	0.691		102.429		31421128.500
1	183.800	373.027	75.367	448.394	-2.000	1	190.000	394.270	78.292	472.562	-2.000
2	192846.92	40.477	29.307	150 179	386.812	2	201051.15	40.400	29.267	148.876	383.191
3	4.949	42.872	28.993	1863.542	6337.718	3	5.036	42.773	28.905	1830 035	6219.347
4	430.084	165.302	38.824	131642.199	26310.182	4	425.449	165.308	38 700	129273 624	25831.491
5	1.699	70.625	4.322	131477 176	26202.188	5	1.699	70.622	4.328	129104.139	25728.376
6	666.134	0.385	0.000	131613.176	26467.188	6	694.498	0.385	0.000	129240.139	25993.376
7	7667.717	0.254	0 615	131613.176	27392.145	7	8105.517	0.282	0.615	129240 139	26914.271
8	25170.901	1.935	41.990	131980.176	27440.145	8	26077.566	3.622	41.990	129607.139	26962.271
9	0.000	322.193	313.741	60656.131	15636.154	9	0.000	324.577	317.554	63026.783	16110.175
10	0.000	287.693	3440.034	0.000	0 000	10	0.000	290.078	3440.034	0.000	0 000
11	277.054	377.635	352.068	0.000	3289.997	11	275.367	381.707	355.681	0.000	3289.997
12	0.860	2.839	3.303	0.000	286242.320	12	0.876	3.001	3.425	0 000	283391.406
13	0.674		101.691		31186433.000	13	0.709		105.504		32421635.500
1	184.000	374.591	75 524	450.115	-2 000	1	200.000	395.705	78.398	474.102	-2.000
2	193505.42	40.475	29.300	150.137	386.697	2	201745.16	40.090	29.211	146 706	377.208
3	4.960	42.856	28.982	1862.485	6333.949	3	5.047	42.472	28.651	1774 196	6031.835
4	429.902	165.302	38.820	131567.580	26294.797	4	425.531	165.318	38 616	125316.795	25046.960
5	1.699	70.625	4 322	131402.332	26187.106	5	1.700	70.616	4.331	125150.134	24945.194
6	668.412	0.385	0.000	131538.332	26452 106	6	696.724	0.385	0.000	125286.134	25210.194
7	7700.036	0.256	0.615	131538.332	27376.932	7	8115.863	0.305	0.615	125286.134	26124.536
8	25221.367	1.986	41.990	131905.332	27424.932	8	26061.558	6.565	41.990	125653.134	26172.536
9	0.000	322.270	313.864	60730.896	15651.203	9	0.000	328.423	323 703	66976.942	16893.759
10	0.000	287.770	3440.034	0.000	0.000	10	0.000	293.924	3440.034	0.000	0.000
11	277.003	377.763	352.191	0.000	3289.997	11	272.424	388.495	362.031	0.000	3289.997
12	0.862	2.851	3.310	0.000	286152.262	12	0.878	3.005	3.423	0.000	278647.668
13	0.676		101.814		31225037.250	13	0.724		111.654		34435781.500

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
2-1/2 ORBIT MISSION

#					
1	210.000	396.496	78.610	475.106	-2.000
2	202241.77	39.779	29.156	144.530	371.215
3	5.044	42.174	28.792	1718.184	5851.270
4	425.677	165.328	38.648	121354.422	24269.144
5	1.699	70.610	4.330	121184.503	24160.729
6	698.832	0.385	0.000	121320.503	24425.729
7	8134.985	0.318	0.615	121320.503	25333.519
8	26107.317	9.678	41.990	121687.503	25381.519
9	0.000	332.269	329.853	70938.728	17678.627
10	0.000	297.770	3440.034	0.000	0.000
11	269.310	395.454	368.181	0.000	3289.997
12	0.881	3.016	3.426	0.000	273891.020
13	0.738		117.804		36455833.000

#					
1	270.000	395.255	79.730	474.985	-2.000
2	202983.85	40.100	29.050	131.468	334.870
3	4.957	42.589	28.662	1381.799	4753.290
4	427.348	165.388	38.840	97607.219	19498.249
5	1.700	70.574	4.320	97382.803	19402.992
6	700.736	0.237	0.000	97518.803	19667.992
7	8125.775	0.470	0.615	97518.803	20536.466
8	26508.457	32.485	41.990	97885.803	20584.466
9	0.000	349.999	366.751	94722.697	22438.781
10	0.000	315.499	3440.034	0.000	0.000
11	246.503	435.991	405.079	0.000	3289.997
12	0.877	3.009	3.429	0.000	245292.268
13	0.828		154.703		48630953.000

#					
1	220.000	396.579	78.927	475.507	-2.000
2	202547.23	39.469	29.100	142.352	365.201
3	5.025	41.880	28.729	1662.107	5669.939
4	425.961	165.338	38.680	117394.474	23473.948
5	1.700	70.604	4.328	117214.981	23373.481
6	699.592	0.385	0.000	117350.981	23638.472
7	8136.708	0.328	0.615	117350.981	24539.709
8	26209.365	12.908	41.990	117717.981	24587.709
9	0.000	336.115	336.003	74904.402	18466.287
10	0.000	301.616	3440.034	0.000	0.000
11	260.080	402.530	374.330	0.000	3289.997
12	0.881	3.003	3.411	0.000	260127.688
13	0.753		123.954		38479772.000

#					
1	280.000	394.839	79.787	474.625	-2.000
2	202909.17	39.564	29.039	129.298	328.780
3	4.949	42.069	28.650	1325.861	4568.847
4	427.514	165.398	38.872	93701.296	18687.996
5	1.699	70.570	4.319	93429.847	18605.724
6	701.196	0.269	0.000	93565.847	18870.724
7	8131.657	0.351	0.615	93565.847	19732.645
8	26537.923	36.029	41.990	93932.847	19780.645
9	0.000	352.531	372.901	98673.122	23236.451
10	0.000	318.031	3440.034	0.000	0.000
11	242.958	442.067	411.228	0.000	3289.997
12	0.880	3.012	3.422	0.000	240535.490
13	0.844		160.853		50660414.000

#					
1	230.000	396.378	79.220	475.599	-2.000
2	202761.12	39.159	29.090	140.174	359.163
3	5.003	41.586	28.713	1606.035	5487.720
4	426.328	165.348	38.712	113422.651	22691.308
5	1.700	70.598	4.327	113246.467	22583.088
6	700.357	0.343	0.000	113382.467	22848.088
7	8135.929	0.335	0.615	113382.467	23742.772
8	26332.434	16.224	41.990	113749.467	23790.772
9	0.000	339.796	342.152	78869.236	19257.073
10	-0.000	305.296	3440.034	0.000	0.000
11	262.764	409.527	380.480	0.000	3289.997
12	0.879	2.988	3.399	0.000	264362.238
13	0.767		130.104		40506307.500

#					
1	290.000	394.512	79.784	474.296	-2.000
2	202826.79	39.029	29.028	127.131	322.688
3	4.945	41.548	28.639	1269.948	4384.227
4	427.637	165.408	38.904	89756.134	17889.324
5	1.697	70.567	4.317	89480.196	17808.244
6	701.655	0.301	0.000	89616.196	18073.244
7	8138.247	0.350	0.615	89616.196	18928.613
8	26546.946	39.533	41.990	89983.196	18976.613
9	0.000	355.383	379.051	102619.920	24034.334
10	0.000	320.883	3440.034	0.000	0.000
11	239.454	448.424	417.378	0.000	3289.997
12	0.884	3.017	3.411	0.000	235781.809
13	0.860		167.003		52689091.000

#					
1	240.000	395.858	79.373	475.230	-2.000
2	202745.88	38.848	29.080	137.998	353.108
3	4.987	41.292	28.699	1550.011	5304.862
4	426.626	165.358	38.744	109454.938	21893.000
5	1.699	70.592	4.325	109282.058	21790.489
6	700.421	0.292	0.000	109418.058	22055.489
7	8130.676	0.339	0.615	109418.058	22943.620
8	26392.814	19.601	41.990	109785.058	22991.620
9	0.000	342.971	348.302	82830.471	20050.076
10	-0.000	308.471	3440.034	0.000	0.000
11	259.387	416.078	386.630	0.000	3289.997
12	0.879	2.987	3.399	0.000	259598.678
13	0.781		136.254		42533837.000

#					
1	300.000	395.847	79.982	475.829	-2.000
2	203444.29	38.725	29.017	124.564	316.591
3	4.949	41.259	28.625	1214.040	4199.325
4	427.558	165.418	38.936	85811.228	17071.858
5	1.699	70.564	4.319	85531.228	17010.091
6	703.119	0.240	0.000	85667.228	17275.091
7	8152.023	0.476	0.615	85667.228	18123.907
8	26600.926	43.249	41.990	86034.228	18171.907
9	0.000	358.089	385.200	106566.183	24832.890
10	0.000	323.589	3440.034	0.000	0.000
11	235.738	454.845	423.528	0.000	3289.997
12	0.884	3.022	3.418	0.000	231028.135
13	0.881		173.153		54718140.500

#					
1	240.500	395.830	79.379	475.209	-2.000
2	202743.97	38.833	29.079	137.889	352.805
3	4.987	41.277	28.698	1547.212	5295.707
4	426.641	165.358	38.746	109256.704	21853.045
5	1.699	70.591	4.325	109083.988	21750.819
6	700.424	0.289	0.000	109219.988	22015.819
7	8136.399	0.339	0.615	109219.988	22903.623
8	26395.668	19.770	41.990	109586.988	22951.623
9	0.000	343.116	348.610	83028.396	20089.765
10	-0.000	308.616	3440.034	0.000	0.000
11	259.218	416.393	386.937	0.000	3289.997
12	0.879	2.987	3.399	0.000	259360.611
13	0.782		136.561		42635209.500

#					
1	310.000	395.972	80.117	476.089	-2.000
2	203549.54	39.350	29.006	122.790	310.479
3	4.942	41.900	28.612	1157.952	4013.837
4	427.545	165.428	38.968	81851.063	16273.151
5	1.700	70.561	4.314	81569.974	16209.966
6	703.071	0.179	0.000	81705.974	16474.966
7	8146.820	0.477	0.615	81705.974	17317.229
8	26660.612	48.015	41.990	82072.974	17365.229
9	0.000	360.181	391.350	110525.344	25633.418
10	0.000	325.682	3440.034	0.000	0.000
11	230.972	461.703	429.677	0.000	3289.997
12	0.882	3.019	3.423	0.000	226260.201
13	0.900		179.303		56753107.000

#					
1	250.000	396.894	79.589	476.483	-2.000
2	203309.47	38.736	29.070	135.824	347.041
3	4.987	41.194	28.686	1494.023	5121.518
4	426.814	165.368	38.776	105493.320	21101.840
5	1.700	70.586	4.324	105320.804	20996.329
6	702.429	0.240	0.000	105456.804	21261.329
7	8145.048	0.458	0.615	105456.804	22142.908
8	26480.320	23.193	41.990	105823.804	22190.908
9	0.000	345.629	354.452	86789.066	20844.638
10	-0.000	311.129	3440.034	0.000	0.000
11	255.795	422.329	392.779	0.000	3289.997
12	0.880	2.996	3.404	0.000	254836.711
13	0.798		142.404		44562233.500

#					
1	320.000	396.164	80.156	476.320	-2.000
2	203641.78	39.975	28.994	120.615	304.361
3	4.942	42.540	28.600	1101.847	3827.977
4	427.532	165.438	39.000	77905.821	15457.294
5	1.699	70.558	4.313	77607.751	15408.967
6	703.623	0.117	0.000	77743.751	15673.967
7	8149.558	0.478	0.615	77743.751	16509.677
8	26719.213	52.789	41.990	78110.751	16557.677
9	0.000	361.660	397.500	114486.088	26434.820
10	0.000	327.161	3440.034	0.000	0.000
11	226.198	467.956	435.827	0.000	3289.997
12	0.882	3.013	3.415	0.000	221490.428
13	0.919		185.453		58789061.500

#					
1	260.000	396.800	79.716	476.516	-2.000
2	203491.53	39.418	29.060	133.645	340.959
3	4.978	41.891	28.673	1437.892	4937.574
4	427.040	165.378	38.808	101542.538	20295.312
5	1.700	70.580	4.322	101350.168	20200.121
6	702.508	0.205	0.000	101486.168	20465.121
7	8145.087	0.465	0.615	101486.168	21340.148
8	26511.214	27.810	41.990	101853.168	21388.148
9	0.000	347.788	360.601	90757.544	21641.249
10	0.000	313.288	3440.034	0.000	0.000
11	251.178	429.104	398.929	0.000	3289.997
12	0.879	3.007	3.420	0.000	250063.314
13	0.814		148.554		46596534.000

#					
1	330.000	394.429	80.166	474.594	-2.000
2	202957.88	39.900	28.983	118.401	298.242
3	4.920	42.481	28.587	1045.910	3642.046
4	427.645	165.404	39.034	73972.821	14663.549
5	1.697	70.555	4.311	73657.821	14607.868
6	701.900	0.108	0.000	73793.821	14872.868
7	8125.426	0.346	0.615	73793.821	15702.026
8	26768.872	56.555	41.990	74160.821	15750.026
9	0.000	362.735	403.049	118434.943	27236.322
10	0.000	328.235	3440.034	0.000	0.000
11	222.431	472.797	441.977	0.000	3289.997
12	0.876	2.991	3.415	0.000	216732.846
13	0.936		191.603		60820353.000

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
2-1/2 ORBIT MISSION

#					
1	340.000	394.270	80.201	474.471	-2.000
2	202907.79	39.650	28.972	116 132	292.120
3	4.916	42.245	28.576	990.010	3455.892
4	427.651	165.458	39.068	70045.075	13859.331
5	1.699	70.554	4.310	69713.170	13806.394
6	700.890	0.112	0.000	69849.170	14071.394
7	8120.102	0.344	0.615	69849.170	14893.999
8	26784.702	60.010	41.990	70216.170	14941.999
9	0.000	363.835	409.799	122378.494	28038.198
10	0.000	329.336	3440.034	0.000	0.000
11	218.976	477.353	448.126	0.000	-3289.997
12	0.874-	2.995	3.427	0.000	211980.168
13	0.957		197.752		62849683.000

#					
1	350.000	394.125	80.223	474.347	-2.000
2	202857.63	39.400	28.961	113.838	285.996
3	4.913	42.007	28.565	934.124	3269.539
4	427.656	165.468	39.102	66118.792	13071.267
5	1.701	70.554	4.308	65769.987	13004.642
6	699.879	0.116	0.000	65905.987	13269.642
7	8114.899	0.342	0.615	65905.987	14085.694
8	26795.454	63.445	41.990	66272.987	14133.694
9	0.000	364.976	415.949	126320.536	28840.353
10	0.000	330.476	3440.034	0.000	0.000
11	215.542	481.927	454.276	0.000	3289.997
12	0.873	3.000	3.437	0.000	207228.682
13	0.979		203.902		64878513.000

#					
1	360.000	393.981	80.245	474.226	-2.000
2	202807.04	39.150	28.950	111.466	279.870
3	4.910	41.767	28.554	878.258	3083.000
4	427.659	165.478	39.136	62193.926	12272.530
5	1.701	70.554	4.307	61828.228	12202.671
6	699.718	0.120	0.000	61964.228	12467.671
7	8114.218	0.340	0.615	61964.228	13277.171
8	26810.432	66.859	41.990	62331.228	13325.171
9	0.000	366.155	422 098	130261.116	29642.727
10	0.000	331.655	3440.034	0.000	0 000
11	212.127	486.521	460.426	0.000	3289.997
12	0.872	2.999	3.438	0.000	202478 398
13	1.002		210.052		66906838.000

#					
1	370.000	393.872	80.233	474.105	-2.000
2	202756.38	38.900	28.939	109.078	273.743
3	4.909	41.527	28.544	822.416	2896.309
4	427.661	165 488	39.170	58270.761	11476.268
5	1.701	70.553	4.305	57888.176	11400.630
6	699.556	0.000	0.000	58024.176	11665.630
7	8113 836	0.338	0.615	58024.176	12468.577
8	26812.978	70.253	41.990	58391.176	12516.577
9	0.000	366.912	428.248	134200.410	30445 171
10	0.000	332.412	3440.034	0.000	0.000
11	208.733	490.673	466.575	0.000	3289.997
12	0.872	2.998	3.437	0.000	197729.752
13	1.025		216.202		68934636.000

#					
1	380.000	393.764	80.218	473.982	-2.000
2	202705.04	38.650	28.928	106.584	267.618
3	4.909	41.282	28.534	766.599	2709.517
4	427.664	165.498	39.204	54349.415	10674.892
5	1.701	70.553	4.303	53949 952	10598.742
6	699.393	0.000	0.000	54085.952	10863 742
7	8113.481	0.336	0.615	54085.952	11660.137
8	26814.112	73.627	41 990	54452.952	11708.137
9	0 000	366.912	434.398	138138.635	31247.461
10	0.000	332.412	3440.034	0.000	0.000
11	205.359	494.047	472 725	0 000	3289.997
12	0.872	2.998	3.436	0 000	192983.088
13	1.050		222.352		70961920.000

#					
1	390.000	395.607	80.306	475.914	-2.000
2	203465.57	39 200	28.917	104.061	261.489
3	4.926	41.835	28.524	710.605	2522.451
4	427.526	165.511	39.238	50406.467	9878.433
5	1.702	70.552	4.302	49998.841	9796.264
6	701.609	0.000	0.000	50134.841	10061.264
7	8135.731	0.464	0.615	50134.841	10851 106
8	26852.226	77.986	41.990	50501.841	10899.106
9	0.000	366.912	440.547	142089.746	32050.342
10	0.000	332.412	3440.034	0 000	0.000
11	200.999	498.406	478.875	0 000	3289.997
12	0.875	3.010	3.441	0.000	188222.945
13	1.081		228.502		72994505.000

#					
1	400.000	395.884	80.311	476.195	-2.000
2	203573.05	39.950	28.906	101.404	255.357
3	4.929	42.584	28.514	654.501	2335.192
4	427.499	165.525	39.272	46461.551	9078.550
5	1.703	70.554	4.300	46041.333	8993.542
6	701.905	0.000	0.000	46177.333	9258.542
7	8137.022	0 461	0.615	46177.333	10041.832
8	26860.776	82.608	41.990	46544.333	10089.832
9	0.000	366.912	446.697	146047.254	32853.466
10	0.000	332.412	3440.034	0.000	0.000
11	196.378	503.027	485.024	0.000	3289.997
12	0.876	3.012	3.440	0.000	183456.164
13	1.110		234.652		75029680.000

#					
1	410.000	394.263	80.215	474.479	-2.000
2	202891.10	40.050	28.894	98.709	249.231
3	4.915	42.682	28.504	598.536	2147.954
4	427.608	165.539	39.306	42527.580	8284.915
5	1.702	70.557	4.299	42094.803	8191.502
6	699.886	0.000	0.000	42230.803	8456.502
7	8115.955	0.329	0.615	42230.803	9233.239
8	26833.387	86.196	41.990	42597.803	9281.239
9	0.000	366.912	452.847	149993 783	33655.909
10	0.000	-332.412	3440.034	0.000	0.000
11	192.789	506.615	491.174	0.000	3289.997
12	0.874	3.001	3.435	0.000	178701.041
13	1.135		240 802		77060205.000

#					
1	420.000	394.219	80.204	474.422	-2.000
2	202865.77	39.987	28.883	95.880	243.107
3	4.915	42.610	28.495	542.634	1960.650
4	427 606	165.553	39.340	38581.192	7477.608
5	1.702	70.560	4.297	38152.338	7389.773
6	699.798	0.000	0.000	38288 338	7654.773
7	8115.893	0.327	0.615	38288.338	8424.957
8	26835.729	89.473	41.990	38655.338	8472.957
9	0.000	366.912	458.996	153936.248	34458.041
10	0.000	332.412	3440 034	0.000	0.000
11	189.512	509.892	497.324	0.000	3289.997
12	0.874	3.001	3.434	0.000	173950.295
13	1.166		246.951		79088977.000

#					
1	430.000	394.170	80.191	474.361	-2.000
2	202838.88	39.925	28.872	92 943	236.984
3	4.915	42.531	28.485	486.746	1773.235
4	427.604	165.569	39.374	34612 905	6680.039
5	1.702	70.563	4 295	34210 333	6588.163
6	699.705	0.000	0.000	34346 333	6853.163
7	8115.824	0.325	0 015	34346.333	7616.795
8	26837.996	92.733	41 990	34713 333	7664.795
9	0.000	366.912	465.146	157878.254	35260.054
10	0.000	332.412	3440.034	0 000	0.000
11	186.252	513 151	503 473	0.000	3289.997
12	0.874	3.001	3.432	0 000	169200.127
13	1.199		253 101		81117485.000

#					
1	440.000	394.127	80.180	474.306	-2 000
2	202814.27	39.883	28.861	89.891	230.867
3	4.916	42.468	28.475	430.869	1585 658
4	427.602	165.584	39.408	30633.254	5887.169
5	1.702	70.566	4.294	30268.812	5786 674
6	699.618	0.000	0.000	30404.812	6051.674
7	8115.779	0.323	0.615	30404.812	6808.753
8	26840.369	95.974	41.990	30771 812	6856.753
9	0.000	366.912	471 296	161819.775	36061.946
10	0.000	332.412	3440.034	0.000	0.000
11	183.011	516.393	509 623	0.000	3289.997
12	0.875	3.001	3.431	0.000	164450.564
13	1.233		259.251		83145731.000

#					
1	450.000	394.084	80 168	474.252	-2.000
2	202769.71	39.856	28.850	86.602	224.783
3	4.916	42.404	28.466	375.002	1397.958
4	427.599	165.600	39.442	26652 733	5089.571
5	1.702	70.569	4 293	26327 702	4985.301
6	699.532	0.000	0.000	26463 702	5250.301
7	8115.734	0.321	0.615	26463.702	6000.827
8	26842.745	99.198	41.990	26830.702	6048.827
9	0 000	366.912	477 445	165760.885	36863.722
10	0.000	332.412	3440.034	0.000	0.000
11	179.787	519.616	515.773	0.000	3289 997
12	0 875	3.001	3.430	0.000	159701.527
13	1.270		265 401		85173740.000

#					
1	460.000	394.078	79 797	473.876	-2 000
2	202502.81	39.828	29.479	83.146	218 670
3	4.938	42.323	29 146	319.146	1209.911
4	427.333	165.628	39.476	22668.406	4284.162
5	1.702	70.571	4 292	22386.532	4183.522
6	698.378	0.000	0 000	22522.532	4448.522
7	8112.593	0.319	1 040	22522.532	5192.496
8	26838.809	102.403	41.990	22889.532	5240.496
9	0 000	366.912	487.739	169702.055	37661.760
10	0.000	332.412	3440.034	0.000	0.000
11	176.582	522.820	526.066	0.000	3289.997
12	0.875	2.998	3.426	0 000	154952.027
13	1.307		275 694		87198899.000

#					
1	470.000	394.004	79.812	473.816	-2.000
2	202485.66	39.800	30.107	79.456	212.227
3	4 937	42.233	29 734	263 302	1021.666
4	427.351	165 656	39.510	18678.263	3487.536
5	1 702	70.573	4.291	18446.060	3381.588
6	698 337	0.000	0.000	18582 060	3646.588
7	8112 715	0.317	1.040	18582.060	4384.009
8	26841.234	105.583	41.990	18949.060	4432.009
9	0.000	366.912	498.138	173642.527	38459.847
10	0.000	332.412	3440.034	0.000	0.000
11	173.402	526.000	536.466	0.000	3289.997
12	0.875	2.998	3 426	0 000	150203.068
13	1 348		286.094		89223842 000

#					
1	480.000	393.929	79.826	473.755	-2.000
2	202467.99	39.800	30 736	75.299	204.960
3	4.935	42.140	30.360	207.471	833.336
4	427.369	165.683	39.544	14688.869	2680.069
5	1.702	70.575	4.290	14506.327	2579.512
6	698.294	0.000	0.000	14642.327	2844.512
7	8112.832	0.314	1.040	14642.327	3575.381
8	26843.635	108.734	41.990	15009.327	3623.381
9	0.000	366.912	508.538	177582.260	39258.076
10	0.000	332.412	3440.034	0.000	0.000
11	170.250	529.151	546.865	0.000	3289.997
12	0.875	2.997	3.427	0.000	145454.707
13	1.392		296.493		91248604.000

#					
1	490.000	393.834	79.836	473.670	-2.000
2	202439.88	39.800	31.293	70 627	196.693
3	4.933	42.010	30.912	151.658	644.865
4	427.386	165.717	39.278	10700.300	1860.132
5	1.702	70.576	4.290	10567.408	1777.304
6	698.218	0.000	0.000	10703.408	2042.304
7	8112.878	0.311	1.040	10703.408	2766.620
8	26845.573	111.857	41.990	11070.408	2814.620
9	0.000	366.912	518.938	181521.180	40056.437
10	0.000	332.412	3440.034	0.000	0.000
11	167.127	532.274	557.265	0.000	3289.997
12	0.875	2.997	3.427	0.000	140707.025
13	1.439		306.893		93273168.000

#					
1	500.000	393.708	79.840	473.549	-2.000
2	202396.20	39.800	31.779	65.110	186.767
3	4.931	41.820	31.385	95.863	456.269
4	427.403	165.758	39.612	6712.404	1067.449
5	1.702	70.576	4.291	6629.584	975.025
6	698.095	0.000	0.000	6765.584	1240.025
7	8112.820	0.308	1 040	6765.584	1957.788
8	26846.805	114.951	41.990	7132.584	2005.788
9	0.000	366.912	529.337	185459.002	40854.869
10	0 000	332.412	3440.034	0.000	0.000
11	164.033	535.367	567.664	0.000	3289.997
12	0.875	2.996	3.426	0 000	135960.371
13	1.489		317 293		95297375.000

#					
1	510.000	393.530	79.842	473.372	-2.000
2	202330.69	39.810	32.264	57.538	174.005
3	4.929	41.496	31.846	40 088	267.719
4	427.424	165.800	39.646	2726.840	234.410
5	1.702	70.575	4.291	2693.203	172.703
6	697.907	0.000	0.000	2829.203	437.703
7	8112 539	0.305	1.040	2829.203	1148.914
8	26847.021	118.017	41.990	3196.203	1196.914
9	0.000	366.912	539.737	189395.385	41653.344
10	0.000	332.412	3440.034	0.000	0.000
11	160.967	538.433	578.064	0.000	3289.997
12	0.874	2.995	3.426	0.000	131215.115
13	1.542		327.892		97321076.000

#					
1	515.130	393.380	79.839	473.219	-2.000
2	202272.35	39 816	32.513	51 579	165.614
3	4.927	41.190	32.076	11 484	171.005
4	427.439	165.826	39.063	682.191	-199.777
5	1.702	70.574	4.292	674 491	-238.924
6	697.739	0.000	0.000	810.491	26.076
7	8112.172	0.304	1.040	810.491	733.925
8	26845.973	119.579	41.990	1177.491	781.925
9	0.000	366.912	545.072	191414.096	42062.998
10	0.000	332.412	3440.034	0.000	0.000
11	159.405	539.994	583.399	0.000	3289.997
12	0.874	2.994	3.425	0.000	128781.415
13	1.571		333.028		98359012.000

#					
1	515.200	391.580	79.849	471.429	-2.000
2	202290.35	39.816	32.517	51.467	165.481
3	4.904	41.201	32.079	11.097	169.694
4	429.101	165.826	39 064	654.869	-205.366
5	1.702	70.574	4.292	647 491	-244.508
6	685.089	0.000	0.000	783.173	20.492
7	7440.529	0.304	1.040	783.173	728.295
8	26455.266	119.600	41.990	1150.173	776.295
9	0.000	366.912	545.145	191441.414	42068.555
10	0.000	332.412	3440.034	0.000	0.000
11	159.384	540.015	583.472	0.000	3289.997
12	0.842	2.945	3.499	0.000	128748.468
13	1.571		333.100		98373091.000

#					
1	515.230	391.580	79.798	471 378	-2.000
2	203297.15	39.817	32.518	51.418	165.423
3	4.907	41.199	32.080	10.929	169.120
4	431.283	165.826	39.664	642.620	-208.105
5	1.702	70.574	4.292	635.269	-246.947
6	688.499	0.000	0 000	771.269	18.053
7	7440.533	0.304	1.040	771 269	725.836
8	26438.375	119.609	41.990	1138.269	773.836
9	0 000	366.912	545.176	191453 316	42070.982
10	0.000	332.412	3440.034	0 000	0.000
11	159.375	540.025	583.503	0 000	3289.997
12	0.842	2.945	3 496	0.000	128734.104
13	1.579		333.132		98379240.000

#					
1	515.330	337.449	68.398	405 847	-2.000
2	175290.15	39.817	32.523	51.241	165.241
3	4.934	41.698	32 376	10.399	167.321
4	431.912	165.827	39.664	605.067	-215.882
5	1.702	70.574	4.292	597 866	-254.593
6	593.649	0.000	0.000	733 866	10.407
7	6411.976	0.304	1.040	733 866	718.124
8	22661.341	119.639	41 990	1100 866	766.124
9	0.000	366.912	545 280	191490.721	42078.590
10	0.000	332.412	3440.034	0 000	0.000
11	159.345	540.055	583.607	0.000	3289.997
12	0.847	2.537	2 997	0.000	128688.990
13	1.362		333.236		98398659.000

#					
1	515.430	206.875	38.103	244.978	-2.000
2	107230.72	39.817	32.528	51 111	165.108
3	5.429	42.125	32.803	10 011	166.007
4	437.716	165.827	39.664	577 262	-221.823
5	1 702	70.574	4 292	570.532	-260.123
6	363.154	0.000	0.000	706.532	4.877
7	3930.894	0.304	1.040	706.532	712.530
8	12624.286	119.670	41.990	1073.532	760.530
9	0.000	366.912	545 364	191518.055	42084.081
10	0.000	332.412	3440.034	0.000	0.000
11	159.314	540.085	583.711	0 000	3289.997
12	0.932	1.556	1.069	0.000	128656.062
13	0.833		333.340		98412864.000

#					
1	515 530	78.699	9 881	88 560	-2 000
2	40824.43	39.817	32 533	51.045	165.051
3	7 964	41.477	32.658	9.815	165.439
4	460 875	165.828	39.665	563.052	-224.479
5	1 702	70.574	4.292	556.667	-262.481
6	138 259	0.000	0.000	692.667	2.519
7	1495 382	0.304	1.040	692 667	710.106
8	3273.914	119.700	41.990	1059.667	758.106
9	0.000	366.912	545.488	191531.920	42086.400
10	0.000	332.412	3440.034	-0.000	0.000
11	159.284	540.116	583.815	0 000	3289.997
12	1.367	0.592	0.433	0 000	128639.772
13	0.317		333 444		98420031.000

#					
1	515.630	33.796	0 000	33 796	-2.000
2	16745.17	39.817	32 538	51.023	165.042
3	0.000	40.464	32.068	9 747	165 355
4	495.440	165.828	39 665	558 078	-224.925
5	1 702	70.574	4.292	551.868	-262.797
6	56.710	0.000	0.000	687.868	2.203
7	642 166	0.304	1 040	687.868	709.724
8	0.000	119.730	41 990	1054.868	757.724
9	0.000	366.912	545.592	191536.719	42086.678
10	0.000	332.412	3440.034	0 000	0.000
11	159.254	540.146	583 919	0 000	3289.997
12	0.000	0.254		0.000	128634.591
13	0.130		333 548		98422528.000

#					
1	515.730	24.944	4.971	29.915	-2.000
2	12170.94	39.817	32.543	51 009	165.029
3	5.018	40.081	32.592	9.706	165.227
4	406.846	165.829	39 665	555.144	-225.445
5	1.702	70.574	4 292	548.994	-263.297
6	41.219	0.000	0.000	684.994	1.703
7	473.973	0.304	1.040	684.994	709 158
8	1647 041	119.761	41.990	1051.994	757.158
9	0.000	366.912	545.696	191539.592	42087.140
10	0.000	332.412	3440 034	0 000	0.000
11	159.223	540.176	584.023	0 000	3289 997
12	0.861	0.188	0.218	0.000	128631.151
13	0.095		333 652		98423940.000

#					
1	515.830	21.470	4.263	25.732	-2.000
2	10377.17	39.817	32 547	50 998	165.015
3	5.037	40.009	32.583	9 674	165.097
4	403.274	165.829	39.066	552.814	-225.970
5	1.702	70.573	4.292	546.701	-263.792
6	35.144	0.000	0.000	682.701	1.208
7	407.951	0.303	1.040	682.701	708.598
8	1412.323	119.791	41 990	1049.701	756.598
9	0.000	366.912	545.800	191541.887	42087.596
10	0.000	332.412	3440.034	0 000	0.000
11	159 193	540.207	584.127	0 000	3289.997
12	0 864	0.161	0 187	0 000	128628.298
13	0.081		333 756		98425053.000

#					
1	515.930	19.648	3 891	23.539	-2.000
2	9437.43	39.817	32 552	50.988	165.003
3	5.049	39.981	32 583	9 645	164.979
4	406.919	165.830	39.666	550.731	-226.446
5	1.702	70 573	4.292	544 647	-264.238
6	31.961	0.000	0.000	680 647	0.762
7	373 343	0.303	1 040	680.647	708.067
8	1289.238	119.821	41.990	1047.646	756.087
9	0.000	366.912	545.904	191543.939	42088.003
10	0.000	332.412	3440.034	0.000	0.000
11	159.163	540.237	584.231	0 000	3289.997
12	0.867	0.148	0.170	0 000	128625.732
13	0.073		333.860		98426042.000

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
2-1/2 ORBIT MISSION

1	516.030	17.242	3.400	20.643	-2.000	1	516.330	6.487	1 208	7.694	-2.000
2	8194.28	39.818	32.557	50.980	164.992	2	2636.41	39.818	32.572	50.963	164.969
3	5.070	39.967	32.585	9.618	164.869	3	5.372	39.886	32.585	9.569	164.040
4	396.960	165.830	39.067	548.851	-226.878	4	342.657	165.832	39.668	545 282	-227.740
5	1.702	70.573	4.292	542.792	-264.643	5	1.702	70.573	4.292	539.281	-265.440
6	27.751	0.000	0.000	678.792	0.357	6	8.929	0.000	0.000	675.281	-0.440
7	327.624	0.303	1.040	678.792	707.616	7	123.253	0.303	1.040	675.281	706.623
8	1126.639	119.852	41.990	1045 792	755.616	8	400.072	119.943	41.990	1042.281	754.623
9	0.000	366.912	546.008	191545.795	42088.370	9	0.000	366.912	546.320	191549.305	42089.051
10	0.000	332.412	3440.034	0.000	0.000	10	0.000	332.412	3440.034	0.000	0.000
11	159.132	540.267	584.335	0.000	3289.997	11	159.041	540.358	584.047	0.000	3289.997
12	0.870	0.130	0.149	0.000	128623.407	12	0.922	0.049	0.053	0.000	128618.903
13	0.064		333.964		98426928.000	13	0.020		334.276		98428526.000

1	516.130	13.653	2.669	16.322	-2.000	1	516.430	4.481	0.798	5.279	-2.000
2	6339.04	39.818	32.562	50.972	164.983	2	1601.76	39.818	32.577	50.960	164.964
3	5.116	39.948	32.587	9.596	164.775	3	5.613	39.860	32.585	9.561	164.593
4	388.379	165.831	39.667	547.274	-227.247	4	303.433	165.832	39.668	544.728	-227.891
5	1.702	70.573	4.292	541.239	-264.987	5	1.702	70.573	4.292	538.737	-265.578
6	21.468	0.000	0.000	677.239	0.013	6	5.425	0.000	0.000	674.737	-0.578
7	259.428	0.303	1.040	677 239	707.207	7	85.137	0.303	1.040	674.737	706.419
8	884.182	119.882	41.990	1044.239	755.207	8	264.467	119.973	41.990	1041.737	754.419
9	0.000	366.912	546.112	191547.348	42088.675	9	0.000	366.912	546.424	191549.850	42089.151
10	0.000	332.412	3440.034	0 000	0.000	10	0.000	332.412	3440.034	0.000	0.000
11	159.102	540.298	584.439	0.000	3289.997	11	159.011	540.389	584.751	0.000	3289.997
12	0.878	0.103	0.117	0.000	128621.445	12	0.963	0.034	0.035	0.000	128618.156
13	0.049		334.068		98427658.000	13	0.012		334.480		98428735.000

1	516.230	9.641	1.851	11.492	-2.000	1	516.530	0.000	0.000	0.000	-2.000
2	4265.50	39.818	32.567	50.967	164.975	2	0.00	39.818	32 581	50.959	164.960
3	5.209	39.919	32.587	9.580	164.698	3	0.000	39.844	32 587	9.557	164.558
4	371.177	165.831	39.067	546.092	-227.533	4	0.000	165.833	39.668	544.424	-227.990
5	1.702	70.573	4.292	540.076	-265.251	5	1.702	70.573	4.292	538.440	-265.665
6	14.446	0.000	0.000	676 076	-0.251	6	0.000	0.000	0.000	674 440	-0.665
7	183.194	0.303	1.040	676.076	706.877	7	0.000	0.303	1.040	674.440	706.266
8	613.184	119.912	41.990	1043.076	754.877	8	0.000	120.003	41.990	1041.440	754.266
9	0.000	366.912	546.216	191548 510	42088 901	9	0.000	366.912	546.528	191550.146	42089.200
10	0.000	332 412	3440.034	0 000	0.000	10	0.000	332.412	3440.034	0.000	0.000
11	159.072	540.328	584.543	0.000	3289.997	11	158.981	540.419	584.855	0 000	3289.997
12	0.894	0.072	0.081	0.000	128619.953	12	0.000	0.000	0.000	0.000	128617.706
13	0.033		334.172		98428187.000	13	0.000		334.484		98428823.000

TABLE AP 5-5 (Sheet 1 of 5)
PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (FIRST BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

#						#					
1	0.000	0.000	0.000	0.000	-2.000	1	4.000	0.000	51.397	51.397	-2.000
2	0.00	43.000	32.500	198.798	515.105	2	12462.06	42.833	33.250	198.796	514.878
3	0.000	43.000	32.500	2723.672	10057.177	3	0.000	43.099	32.643	2721.916	9997.956
4	0.000	165.150	38.330	0.000	0.000	4	242.465	164.900	38.910	191630.582	37179.117
5	1.733	70.698	4.306	192421.000	43037.000	5	1.700	70.743	4.329	191745.473	37409.117
6	0.000	0.370	0.000	192557.000	43302.000	6	43.028	0.370	0.000	191881.473	37674.117
7	0.000	0.238	0.000	192557.000	43302.000	7	0.000	0.279	0.428	192555.520	43281.998
8	0.000	5.300	17.500	192924.000	43350.000	8	17009.271	6.340	17.500	192922.520	43329.998
9	0.000	34.500	40.000	0.000	0.000	9	0.000	35.980	40.114	0.000	19.888
10	0.000	0.000	0.000	0.000	0.000	10	0.000	1.480	0.000	0.000	0.000
11	369.000	40.000	58.000	0.000	0.000	11	367.959	42.520	58.114	0.000	0.000
12	0.000	0.000	0.000	0.000	363300.000	12	0.000	0.000	2.253	0.000	363074.516
13	0.000		0.000			13	0.034		0.114		6326.549
1	0.500	0.000	3.170	3.170	-2.000	1	5.000	293.340	66.707	360.046	-2.000
2	441.89	42.979	32.500	198.798	515.088	2	155764.05	42.792	34.000	198.598	514.231
3	0.000	42.989	32.500	2723.669	10004.744	3	0.000	44.908	33.749	2719.034	9980.532
4	139.405	165.150	38.327	191631.018	37195.718	4	432.678	164.775	38.280	191490.215	37122.730
5	1.700	70.698	4.328	191745.934	37475.718	5	1.701	70.765	4.331	191602.684	37352.730
6	1.526	0.370	0.000	191881.934	37690.718	6	537.734	0.370	0.000	191738.684	37617.730
7	0.000	0.244	0.000	192556.814	43300.454	7	6004.466	0.286	0.456	192412.492	43225.082
8	1046.738	5.420	17.500	192923.814	43348.454	8	22115.913	6.623	17.500	192779.492	43273.082
9	0.000	34.685	40.000	0.000	1.546	9	0.000	36.350	40.456	142.656	76.463
10	0.000	0.185	0.000	0.000	0.000	10	0.000	1.850	0.000	0.000	0.000
11	368.880	40.305	58.000	0.000	0.000	11	367.677	43.173	58.456	0.000	0.000
12	0.000	0.000	0.139	0.000	363874.570	12	0.761	2.232	2.931	0.000	362874.570
13	0.001		0.000		218.503	13	0.429		0.456		92954.264
1	1.000	0.000	3.170	3.170	-2.000	1	5.500	309.150	68.606	377.756	-2.000
2	441.94	42.958	32.500	198.797	515.070	2	182590.74	42.771	34.000	198.390	513.844
3	0.000	42.968	32.500	2723.664	10004.122	3	0.000	45.587	33.836	2716.475	9971.065
4	139.414	165.150	38.325	191630.953	37194.396	4	483.356	164.712	38.265	191342.617	37088.907
5	1.700	70.698	4.328	191745.867	37424.396	5	1.701	70.776	4.332	191451.965	37318.907
6	1.526	0.370	0.000	191881.867	37689.396	6	630.190	0.370	0.000	191587.965	37583.907
7	0.000	0.249	0.000	192556.629	43298.867	7	6323.619	0.288	0.569	192261.654	43190.993
8	1046.766	5.544	17.500	192923.629	43346.867	8	22770.471	6.767	17.500	192628.654	43238.993
9	0.000	34.870	40.000	0.000	3.133	9	0.000	36.535	40.712	293.311	110.295
10	0.000	0.370	0.000	0.000	0.000	10	0.000	2.035	0.000	0.000	0.000
11	368.756	40.614	58.000	0.000	0.000	11	367.533	43.502	58.712	0.000	0.000
12	0.000	0.000	0.139	0.000	363296.492	12	0.779	2.351	3.018	0.000	362689.645
13	0.001		0.000		439.460	13	0.503		0.712		179196.807
1	1.500	0.000	3.170	3.170	-2.000	1	10.000	382.038	78.094	460.132	-2.000
2	441.99	42.938	32.500	198.797	515.052	2	194915.08	42.583	34.000	196.143	510.080
3	0.000	42.947	32.500	2723.664	10003.501	3	0.000	45.097	33.054	2693.148	9887.401
4	139.423	165.150	38.322	191630.893	37193.074	4	423.607	164.652	38.210	189753.182	36750.313
5	1.700	70.698	4.328	191745.801	37423.074	5	1.701	70.786	4.334	189828.469	36980.313
6	1.526	0.370	0.000	191881.801	37688.074	6	672.778	0.370	0.000	189964.469	37245.313
7	0.000	0.255	0.000	192556.443	43297.280	7	7816.898	0.307	0.615	190637.086	42850.016
8	1046.794	5.670	17.500	192923.443	43345.280	8	25923.191	3.107	17.500	191004.086	42898.016
9	0.000	35.055	40.000	0.000	4.720	9	0.000	38.200	43.475	1916.213	448.509
10	0.000	0.555	0.000	0.000	0.000	10	0.000	3.700	0.000	0.000	0.000
11	368.630	40.925	58.000	0.000	0.000	11	356.193	46.507	61.475	0.000	0.000
12	0.000	0.000	0.139	0.000	363294.723	12	0.845	2.906	3.437	0.000	360724.102
13	0.001		0.000		660.440	13	0.540		—3.475		1042698.828
1	2.000	0.000	3.170	3.170	-2.000	1	15.000	393.004	78.588	471.592	-2.000
2	442.05	42.917	32.500	198.797	515.034	2	200617.43	42.275	33.710	193.607	505.915
3	0.000	42.927	32.500	2723.661	10002.880	3	5.001	44.781	33.370	2665.788	9797.432
4	139.432	165.150	38.320	191630.830	37191.752	4	425.405	164.654	38.215	187851.457	36357.974
5	1.700	70.698	4.328	191745.736	37421.752	5	1.701	70.784	4.333	187888.432	36587.473
6	1.526	0.370	0.000	191881.736	37686.752	6	692.478	0.370	0.000	188024.432	36852.473
7	0.000	0.261	0.000	192556.260	43295.693	7	8042.993	0.321	0.615	188695.857	42454.526
8	1046.822	5.799	17.500	192923.260	43343.693	8	26091.678	9.669	17.500	189062.857	42502.526
9	0.000	35.240	40.000	0.000	6.307	9	0.000	40.050	46.550	3855.592	840.924
10	0.000	0.740	0.000	0.000	0.000	10	0.000	5.550	0.000	0.000	0.000
11	368.501	41.239	58.000	0.000	0.000	11	364.621	49.929	64.550	0.000	0.000
12	0.000	0.000	0.139	0.000	363292.949	12	0.864	2.989	3.458	0.000	358387.383
13	0.001		0.000		881.445	13	0.560		6.550		2031713.359
1	2.500	0.000	3.170	3.170	-2.000	1	20.000	397.140	78.769	475.909	-2.000
2	442.11	42.896	32.500	198.797	515.016	2	202476.16	41.900	33.420	191.294	501.922
3	0.000	42.906	32.500	2723.224	10002.258	3	5.042	44.384	33.081	2637.899	9707.218
4	139.447	165.087	38.317	191630.768	37190.430	4	425.452	164.657	38.220	185896.592	35969.429
5	1.700	70.709	4.328	191745.670	37420.430	5	1.701	70.783	4.333	185910.957	36193.643
6	1.527	0.370	0.000	191881.670	37685.430	6	696.923	0.370	0.000	186046.957	36458.643
7	0.000	0.266	0.000	192556.074	43294.106	7	8130.038	0.335	0.615	186717.189	42058.047
8	1046.881	5.930	17.500	192923.074	43342.106	8	26150.361	11.319	17.500	187084.189	42106.047
9	0.000	35.425	40.000	0.000	7.894	9	0.000	41.900	49.625	5832.410	1234.328
10	0.000	0.925	0.000	0.000	0.000	10	0.000	7.400	0.000	0.000	0.000
11	368.370	41.555	58.000	0.000	0.000	11	362.980	53.419	67.625	0.000	0.000
12	0.000	0.000	0.139	0.000	363291.180	12	0.871	3.021	3.466	0.000	356012.234
13	0.001		0.000		1102.481	13	0.569		9.625		3040574.219
1	3.000	0.000	3.171	3.171	-2.000	1	25.000	395.769	78.691	474.460	-2.000
2	442.19	42.875	32.500	198.796	514.998	2	201941.72	40.250	33.235	189.035	498.113
3	0.000	42.885	32.500	2722.788	10001.637	3	5.029	42.713	32.895	2609.978	9617.053
4	139.462	165.025	38.315	191630.705	37189.108	4	425.623	164.659	38.227	183934.014	35580.813
5	1.700	70.720	4.329	191745.604	37419.108	5	1.700	70.781	4.332	183931.383	35799.739
6	1.527	0.370	0.000	191881.604	37684.108	6	697.408	0.370	0.000	184067.383	36064.739
7	0.000	0.272	0.000	192555.889	43292.519	7	8113.003	0.227	0.615	184736.424	41661.495
8	1046.940	6.065	17.500	192922.889	43340.519	8	26129.581	12.458	17.500	185103.424	41709.495
9	0.000	35.610	40.000	0.000	9.481	9	0.000	43.750	52.700	7811.326	1627.805
10	0.000	1.110	0.000	0.000	0.000	10	0.000	9.250	0.000	0.000	0.000
11	368.235	41.875	58.000	0.000	0.000	11	361.842	56.408	70.700	0.000	0.000
12	0.000	0.000	0.139	0.000	363187.406	12	0.870	3.009	3.460	0.000	353634.918
13	0.001		0.000		1323.556	13	0.571		12.700		4050200.094

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (FIRST BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

1	30.000	395.867	78.689	474.556	-2.000
2	202016.00	38.600	33.050	187.017	494.416
3	5.031	41.046	32.710	2582.052	9526.864
4	425.695	164.662	38.235	181961.352	35192.206
5	1.700	70.779	4.331	181951.516	35405.844
6	697.747	0.370	0.000	182087.516	35670.844
7	8115.173	0.236	0.015	182755.365	41264.950
8	26120.010	13.614	17.500	183122.365	41312.950
9	0.000	45.600	55.775	9790.533	2021.275
10	0.000	11.100	0.000	0.000	-0.000
11	360.605	-59.414	-73.775	0.000	0.000
12	0.870	3.007	3.456	0.000	351257.313
13	0.575		15.775		5060123.438
1	35.000	397.026	78.793	475.819	-2.000
2	202544.74	40.100	32.865	184.989	490.808
3	5.039	42.528	32.524	2553.595	9436.524
4	425.676	164.664	38.242	179979.512	34807.602
5	1.700	70.777	4.331	179962.439	35011.391
6	699.557	0.370	0.000	180098.439	35276.391
7	8125.681	0.245	0.015	180765.096	40867.848
8	26140.399	15.266	17.500	181132.096	40915.848
9	0.000	47.450	58.850	11778.953	2415.302
10	0.000	12.950	0.000	0.000	0.000
11	359.033	62.916	76.850	0.000	0.000
12	0.872	3.015	3.458	0.000	348869.941
13	0.581		18.850		6074078.250
1	40.000	397.036	78.912	475.940	-2.000
2	202662.10	39.267	32.680	183.122	487.299
3	5.031	41.683	32.536	2525.982	9346.113
4	425.807	164.667	38.250	178008.355	34432.799
5	1.699	70.776	4.330	177976.533	34616.723
6	700.279	0.370	0.000	178112.533	34881.723
7	8133.821	0.250	0.015	178777.998	40470.531
8	26173.265	16.502	17.500	179144.996	40518.531
9	0.000	49.300	61.925	13764.201	2809.544
10	0.000	14.800	0.000	0.000	0.000
11	357.797	66.002	79.925	0.000	0.000
12	0.873	3.021	3.460	0.000	346495.527
13	0.585		21.925		7087093.813
1	45.000	398.547	79.131	477.679	-2.000
2	203407.11	38.900	32.552	181.317	483.881
3	5.037	41.304	32.205	2497.956	9255.782
4	425.824	164.669	38.261	176041.576	34057.311
5	1.700	70.774	4.329	175989.877	34221.334
6	702.398	0.370	0.000	176125.877	34486.334
7	8156.157	0.361	0.015	176790.150	40072.494
8	26242.311	17.844	17.500	177157.150	40120.494
9	0.000	51.150	65.000	15750.199	3204.506
10	0.000	16.650	0.000	0.000	0.000
11	356.455	69.194	83.000	0.000	0.000
12	0.875	3.024	3.455	0.000	344099.641
13	0.591		25.000		8101012.875
1	50.000	397.518	79.245	476.763	-2.000
2	203127.93	39.989	32.425	179.504	480.507
3	5.016	42.383	32.073	2469.827	9165.157
4	426.057	164.671	38.272	174063.367	33607.342
5	1.700	70.772	4.329	173996.016	33824.792
6	701.498	0.370	0.000	174132.016	34089.792
7	8139.163	0.259	0.615	174795.096	39673.303
8	26274.427	19.475	17.500	175162.096	39721.303
9	0.000	53.000	68.075	17743.404	3600.622
10	0.000	18.500	0.000	0.000	0.000
11	354.824	72.675	86.075	0.000	0.000
12	0.874	3.010	3.445	0.000	341705.398
13	0.594		28.075		9118582.875
1	55.000	397.258	79.381	476.639	-2.000
2	203166.95	39.433	32.297	177.858	477.191
3	5.004	41.821	31.942	2441.785	9074.393
4	426.249	164.674	38.284	172089.396	33273.532
5	1.700	70.770	4.328	172008.371	33427.785
6	701.680	0.370	0.000	172144.371	33692.785
7	8138.125	0.263	0.015	172806.260	39275.646
8	26310.805	20.780	17.500	173173.260	39321.646
9	0.000	54.850	71.150	19730.389	3997.204
10	0.000	20.350	0.000	0.000	0.000
11	353.519	75.830	89.150	0.000	0.000
12	0.874	3.001	3.436	0.000	339316.906
13	0.599		31.150		10134317.250
1	60.000	397.003	79.513	476.516	-2.000
2	203205.98	38.878	32.170	176.221	473.940
3	4.993	41.260	31.811	2413.759	8983.447
4	426.441	164.676	38.295	170116.287	32879.061
5	1.700	70.769	4.327	170022.012	33030.112
6	701.863	0.370	0.000	170158.012	33295.112
7	8136.963	0.267	0.015	170818.709	38873.324
8	26359.384	22.103	17.500	171185.709	38921.324
9	0.000	56.700	74.225	21716.090	4394.451
10	0.000	22.200	0.000	0.000	0.000
11	352.195	79.003	92.225	0.000	0.000
12	0.873	2.992	3.427	0.000	336929.031
13	0.603		34.225		11150246.875

1	65.000	398.471	79.679	478.150	-2.000
2	203916.07	39.282	32.080	174.582	470.761
3	5.001	41.654	31.719	2385.691	8892.243
4	426.469	164.679	38.306	168130.445	32483.854
5	1.700	70.767	4.326	168032.711	32631.697
6	703.998	0.370	0.000	168168.711	32896.697
7	8154.833	0.374	0.015	168828.215	38472.260
8	26419.762	23.733	17.500	169195.215	38520.260
9	0.000	58.550	77.300	23704.734	4792.440
10	0.000	24.050	0.000	0.000	0.000
11	350.566	82.482	95.300	0.000	0.000
12	0.875	3.003	3.432	0.000	334537.473
13	0.610		37.300		12168020.875
1	70.000	397.040	79.690	476.736	-2.000
2	203420.32	40.014	31.990	173.061	467.719
3	4.982	42.384	31.627	2357.618	8800.908
4	426.693	164.681	38.317	166136.977	32088.203
5	1.700	70.765	4.326	166032.223	32232.833
6	702.588	0.370	0.000	166179.223	32497.833
7	8134.057	0.271	0.015	166837.535	38070.748
8	26425.132	25.373	17.500	167204.535	38118.748
9	0.000	60.400	80.374	25693.564	5190.877
10	0.000	25.900	0.000	0.000	0.000
11	348.926	85.973	98.374	0.000	0.000
12	0.874	2.995	3.428	0.000	332145.281
13	0.612		40.375		13186346.750
1	75.000	396.746	79.753	476.499	-2.000
2	203369.66	39.800	31.900	171.557	464.675
3	4.975	42.165	31.536	2329.605	8709.500
4	426.842	164.684	38.329	164157.795	31692.372
5	1.699	70.764	4.325	164058.031	31833.789
6	702.585	0.370	0.000	164194.031	32098.789
7	8131.160	0.273	0.015	164851.152	37669.054
8	26446.319	26.732	17.500	165218.152	37717.054
9	0.000	62.250	83.449	27678.098	5589.497
10	0.000	27.750	0.000	0.000	0.000
11	347.567	89.182	101.449	0.000	0.000
12	0.874	2.994	3.428	0.000	329757.203
13	0.617		43.450		14203369.750
1	80.000	396.446	79.815	476.261	-2.000
2	203359.38	39.586	31.810	170.054	461.629
3	4.967	41.946	31.445	2301.612	8617.992
4	426.991	164.686	38.340	162188.000	31304.327
5	1.699	70.762	4.324	162074.342	31434.431
6	702.583	0.370	0.000	162210.342	31699.431
7	8128.262	0.275	0.015	162866.270	37267.047
8	26475.936	28.101	17.500	163233.270	37315.047
9	0.000	64.100	86.524	29661.129	5988.428
10	0.000	29.600	0.000	0.000	0.000
11	346.197	92.401	104.524	0.000	0.000
12	0.873	2.993	3.428	0.000	327370.316
13	0.621		46.525		15220240.250
1	85.000	396.173	79.875	476.048	-2.000
2	203329.71	39.371	31.742	168.613	458.581
3	4.960	41.729	31.376	2273.637	8526.352
4	427.120	164.688	38.351	160213.881	30915.899
5	1.699	70.760	4.324	160092.086	31034.770
6	702.358	0.370	0.000	160228.086	31299.770
7	8127.307	0.276	0.015	160882.822	36864.737
8	26489.349	29.480	17.500	161249.822	36912.737
9	0.000	65.950	89.599	31642.727	6387.664
10	0.000	31.450	0.000	0.000	0.000
11	344.819	95.629	107.599	0.000	0.000
12	0.873	2.997	3.435	0.000	324984.559
13	0.626		49.600		16236960.250
1	90.000	395.919	79.916	475.835	-2.000
2	203300.21	39.157	31.675	167.218	455.531
3	4.954	41.512	31.307	2245.680	8434.623
4	427.271	164.691	38.362	158236.252	30513.137
5	1.700	70.758	4.323	158111.154	30634.846
6	702.134	0.370	0.000	158247.154	30899.846
7	8126.437	0.278	0.015	158900.699	36462.164
8	26496.427	30.865	17.500	159267.699	36510.164
9	0.000	67.800	92.674	33623.000	6787.162
10	0.000	33.300	0.000	0.000	0.000
11	343.483	98.865	110.674	0.000	0.000
12	0.872	3.002	3.441	0.000	322599.859
13	0.630		52.675		17253531.000
1	95.000	395.669	79.954	475.623	-2.000
2	203270.69	38.943	31.607	165.825	452.480
3	4.949	41.296	31.239	2217.740	8342.821
4	427.378	164.693	38.374	156259.879	30110.204
5	1.700	70.757	4.322	156131.479	30234.732
6	701.910	0.370	0.000	156267.479	30499.732
7	8125.499	0.279	0.015	156919.830	36059.401
8	26502.225	32.257	17.500	157286.830	36107.401
9	0.000	69.650	95.749	35602.020	7186.849
10	0.000	35.150	0.000	0.000	0.000
11	342.041	102.107	113.749	0.000	0.000
12	0.872	3.006	3.447	0.000	320216.230
13	0.635		55.750		18269952.500

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (FIRST BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

#					
1	100.000	395.452	79.985	475.438	-2.000
2	203241.11	38.729	31.540	164.431	449.427
3	4.944	41.079	31.171	2189.814	8250.951
4	427.482	164.696	38.385	154284.691	29710.569
5	1.700	70.755	4.321	154152.992	29834.451
6	701.686	0.370	0.000	154288.992	30099.451
7	8124.856	0.280	0.015	154940.152	35656.471
8	26505.938	33.655	17.500	155307.152	35704.471
9	0.000	71.500	98.824	37579.848	7586.704
10	0.000	37.000	0.000	0.000	0.000
11	340.643	105.355	116.824	0.000	0.000
12	0.872	3.010	3.453	0.000	317833.621
13	0.639		58.825		19286226.500

#					
1	105.000	396.977	80.113	477.090	-2.000
2	203930.38	39.062	31.490	163.122	446.372
3	4.955	41.409	31.120	2161.861	8158.954
4	427.447	164.698	38.396	152307.664	29311.307
5	1.700	70.753	4.321	152172.662	29433.844
6	704.046	0.370	0.000	152308.662	29698.844
7	8148.289	0.392	0.015	152958.631	35253.215
8	26552.719	35.254	17.500	153325.631	35301.215
9	0.000	73.350	101.899	39559.518	7986.885
10	0.000	38.850	0.000	0.000	0.000
11	339.044	108.803	119.899	0.000	0.000
12	0.875	3.024	3.455	0.000	315448.844
13	0.640		61.900		20303544.750

#					
1	110.000	395.778	80.080	475.858	-2.000
2	203472.23	40.085	31.440	161.810	443.312
3	4.942	42.435	31.071	2133.826	8066.807
4	427.590	164.701	38.407	150324.908	28911.524
5	1.699	70.751	4.320	150186.594	29032.716
6	703.030	0.370	0.000	150322.594	29297.716
7	8133.844	0.283	0.015	150971.369	34849.438
8	26545.588	37.193	17.500	151338.369	34897.438
9	0.000	75.200	104.974	41544.930	8387.588
10	0.000	40.700	0.000	0.000	0.000
11	337.105	112.592	122.974	0.000	0.000
12	0.876	3.019	3.447	0.000	313057.805
13	0.650		64.974		21323509.250

#					
1	115.000	395.657	80.080	475.737	-2.000
2	203449.23	39.933	31.390	160.503	440.255
3	4.941	42.279	31.020	2105.886	7974.697
4	427.651	164.703	38.419	148351.186	28514.081
5	1.698	70.750	4.319	148207.309	28631.874
6	703.311	0.370	0.000	148343.309	28896.874
7	8137.293	0.263	0.015	148990.893	34445.947
8	26549.431	38.608	17.500	149357.893	34493.947
9	0.000	77.050	108.049	43523.557	8788.003
10	0.000	42.550	0.000	0.000	0.000
11	335.690	115.858	126.049	0.000	0.000
12	0.878	3.021	3.442	0.000	310673.840
13	0.655		68.049		22340806.250

#					
1	120.000	395.542	80.081	475.624	-2.000
2	203426.71	39.782	31.340	159.208	437.198
3	4.939	42.127	30.971	2077.952	7882.558
4	427.705	164.706	38.430	146380.398	28132.608
5	1.697	70.748	4.319	146228.602	28231.034
6	703.595	0.370	0.000	146364.602	28496.034
7	8140.796	0.283	0.015	147010.994	34042.458
8	26553.872	40.025	17.500	147377.994	34090.458
9	0.000	78.900	111.124	45501.605	9188.418
10	0.000	44.400	0.000	0.000	0.000
11	334.273	119.124	129.124	0.000	0.000
12	0.880	3.024	3.437	0.000	308290.449
13	0.660		71.124		23357990.500

#					
1	125.000	395.408	80.136	475.545	-2.000
2	203404.88	39.630	31.300	157.972	434.140
3	4.934	41.976	30.930	2050.626	7790.298
4	427.730	164.708	38.441	144410.256	27729.114
5	1.698	70.746	4.318	144250.543	27830.057
6	703.355	0.370	0.000	144386.543	28095.057
7	8137.339	0.284	0.615	145031.742	33638.832
8	26566.203	41.442	17.500	145398.742	33686.832
9	0.000	80.750	114.199	47479.008	9586.968
10	0.000	46.250	0.000	0.000	0.000
11	332.855	122.392	132.199	0.000	0.000
12	0.879	3.021	3.438	0.000	305907.574
13	0.665		74.199		24375064.000

#					
1	130.000	395.292	80.195	475.487	-2.000
2	203383.02	39.479	31.260	156.737	431.080
3	4.929	41.825	30.888	2022.122	7697.944
4	427.736	164.710	38.451	142440.709	27322.193
5	1.698	70.744	4.317	142273.080	27428.792
6	703.116	0.370	0.000	142409.080	27693.792
7	8133.986	0.284	0.015	143053.088	33234.917
8	26579.925	42.861	17.500	143420.088	33282.917
9	0.000	82.600	117.274	49455.811	9989.808
10	0.000	48.100	0.000	0.000	0.000
11	331.437	125.660	135.274	0.000	0.000
12	0.878	3.019	3.438	0.000	303525.004
13	0.670		77.274		25392028.250

#					
1	135.000	395.176	80.253	475.429	-2.000
2	203361.15	39.327	31.220	155.502	428.017
3	4.924	41.674	30.847	1994.232	7605.494
4	427.742	164.713	38.462	140471.742	26920.457
5	1.698	70.742	4.317	140296.201	27027.233
6	702.876	0.370	0.000	140432.201	27292.233
7	8130.631	0.284	0.015	141075.018	32830.709
8	26593.686	44.280	17.500	141442.018	32878.709
9	0.000	84.450	120.449	51432.031	10390.941
10	0.000	49.950	0.000	0.000	0.000
11	330.017	128.930	138.349	0.000	0.000
12	0.877	3.016	3.439	0.000	301142.727
13	0.675		80.349		26408883.250

#					
1	140.000	395.060	80.312	475.372	-2.000
2	203339.37	39.176	31.180	154.286	424.953
3	4.919	41.523	30.806	1966.347	7512.949
4	427.748	164.715	38.472	138462.355	26525.385
5	1.699	70.739	4.316	138319.906	26625.385
6	702.637	0.370	0.000	138455.906	26890.385
7	8127.276	0.284	0.015	139097.529	32426.212
8	26610.408	45.701	17.500	139464.529	32474.212
9	0.000	86.300	123.424	53407.670	10792.363
10	0.000	51.800	0.000	0.000	0.000
11	328.597	132.200	141.424	0.000	0.000
12	0.876	3.014	3.440	0.000	299760.738
13	0.681		83.424		27425490.000

#					
1	145.000	394.987	80.314	475.301	-2.000
2	203311.84	39.024	31.135	153.201	421.887
3	4.918	41.375	30.761	1938.468	7420.346
4	427.754	164.718	38.483	136492.494	26123.386
5	1.699	70.737	4.315	136344.084	26223.386
6	702.624	0.370	0.000	136480.084	26488.386
7	8127.678	0.284	0.015	137120.516	32021.565
8	26614.266	47.122	17.500	137487.516	32069.565
9	0.000	88.150	126.499	55362.834	11193.936
10	0.000	53.650	0.000	0.000	0.000
11	327.175	135.472	144.499	0.000	0.000
12	0.876	3.011	3.436	0.000	296379.078
13	0.686		86.499		28442251.500

#					
1	146.000	394.973	80.314	475.287	-2.000
2	203306.33	38.994	31.126	152.984	421.274
3	4.918	41.346	30.752	1932.892	7401.822
4	427.755	164.718	38.485	136098.564	26042.986
5	1.699	70.736	4.315	135948.961	26142.986
6	702.621	0.370	0.000	136084.961	26407.986
7	8127.691	0.284	0.015	136725.154	31940.635
8	26615.037	47.406	17.500	137092.154	31988.635
9	0.000	88.520	127.114	55777.824	11274.251
10	0.000	54.020	0.000	0.000	0.000
11	326.891	136.126	145.114	0.000	0.000
12	0.876	3.011	3.435	0.000	295902.789
13	0.687		87.114		28645559.500

#					
1	147.000	394.958	80.315	475.273	-2.000
2	203300.82	38.964	31.117	152.767	420.661
3	4.918	41.316	30.743	1927.317	7383.297
4	427.756	164.719	38.487	135704.648	25962.585
5	1.699	70.736	4.315	135553.854	26062.585
6	702.619	0.370	0.000	135689.854	26327.585
7	8127.704	0.294	0.015	136329.809	31859.705
8	26615.809	47.691	17.500	136696.809	31907.705
9	0.000	88.890	127.729	56172.801	11354.566
10	0.000	54.390	0.000	0.000	0.000
11	326.606	136.780	145.729	0.000	0.000
12	0.876	3.010	3.435	0.000	295426.512
13	0.688		87.729		28848862.000

#					
1	148.000	394.944	80.315	475.259	-2.000
2	203295.32	38.933	31.108	152.550	420.047
3	4.917	41.287	30.734	1921.742	7364.770
4	427.757	164.719	38.489	135310.746	25882.184
5	1.699	70.735	4.315	135158.760	25982.184
6	702.616	0.370	0.000	135294.760	26247.184
7	8127.717	0.285	0.015	135934.477	31778.773
8	26616.581	47.975	17.500	136301.477	31826.773
9	0.000	89.260	128.344	56567.762	11434.882
10	0.000	54.760	0.000	0.000	0.000
11	326.322	137.435	146.344	0.000	0.000
12	0.876	3.010	3.434	0.000	294950.250
13	0.639		88.344		29052159.000

#					
1	149.000	394.929	80.315	475.245	-2.000
2	203289.81	38.903	31.099	152.333	419.434
3	4.917	41.258	30.725	1916.166	7346.243
4	427.758	164.720	38.492	134916.863	25801.781
5	1.698	70.735	4.315	134763.684	25901.781
6	702.613	0.370	0.000	134899.684	26166.781
7	8127.730	0.285	0.015	135539.162	31697.841
8	26619.200	48.260	17.500	135906.162	31745.841
9	0.000	89.630	128.959	56962.707	11515.199
10	0.000	55.130	0.000	0.000	0.000
11	326.037	138.089	146.959	0.000	0.000
12	0.876	3.009	3.433	0.000	294474.000
13	0.690		88.959		29255450.500

TABLE AP 5-5 (Sheet 4 of 5)
PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (FIRST BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

Left group

#					
1	150.000	394.915	80.316	475.231	-2.000
2	203284.31	38.873	31.090	152 116	418.821
3	4.917	41.228	30.716	1910.591	7327.714
4	427.759	164.720	38.494	134522.992	25721.379
5	1.698	70.734	4.315	134368.621	25821.379
6	702.611	0.370	0.000	134504.621	26086.379
7	8127.743	0.285	0.615	135143.861	31616.909
8	26621.820	48.545	17.500	135510.861	31664.909
9	0.000	90.000	129.574	57357.639	11595.517
10	0.000	55.500	0.000	-0.000	-0.000
11	-325.752	138.744	147.574	0.000	0.000
12	0.876	3.009	3.433	0.000	293997.770
13	0.691		89.574		29458736.500
1	151.000	394.900	80.316	475.216	-2.000
2	203278.80	38.842	31.081	151.899	418.208
3	4.917	41.199	30.707	1905.016	7309.183
4	427.761	164.721	38.496	134129 133	25640.976
5	1.698	70.734	4.315	133973.570	25740.976
6	702.608	0.370	0.000	134109.570	26005.976
7	8127.756	0.285	0.615	134748.570	31535.976
8	26624.439	48.829	17.500	135115.570	31583.976
9	0.000	90.370	130.189	57752.559	11675.834
10	0.000	55.870	0.000	0.000	0.000
11	325.468	139.399	148.189	0.000	0.000
12	0 876	3.008	3 432	0.000	293521.543
13	0.693		90 189		29662017.000
1	152.000	394.950	80.320	475.270	-2.000
2	203300.14	38.812	31.072	151.682	417.595
3	4.917	41.169	30.698	1899.441	7290.652
4	427.757	164.721	38.498	133768.648	25801.937
5	1.698	70.733	4.314	133611.895	25901.937
6	702.683	0.370	0.000	133747.895	26166.937
7	8128.593	0.285	0.615	134353 264	31455.042
8	26628.301	49.114	17.500	134720.264	31503.042
9	0.000	90.740	130.804	58147 496	11756.153
10	0.000	56.240	0.000	0.000	0.000
11	325.183	140.053	148.804	0.000	0.000
12	0.876	3.008	3.432	0.000	293045.305
13	0.694		90.804		29865305.250
1	153.000	395.000	80.324	475.323	-2.000
2	203321.48	38.782	31.063	151.465	416.981
3	4.918	41.139	30.690	1893.865	7272.118
4	427.754	164.722	38 500	133408.117	25962.893
5	1.698	70.733	4 314	133250.170	26062.893
6	702.757	0.370	0.000	133386.170	26327 893
7	8129.430	0.285	0.615	133957.908	31374.104
8	26632.165	49.398	17.500	134324 908	31422.104
9	0.000	91.110	131.419	58542.480	11836.477
10	0.000	56.610	0.000	0.000	0.000
11	324.898	140.708	149.419	0.000	0.000
12	0.877	3.008	3.432	0.000	292569.012
13	0.695		91.419		30068615.000
1	154.000	395.050	80 327	475.377	-2.000
2	203342.83	38.752	31.054	151.248	416.368
3	4.918	41.110	30.681	1888.288	7253.582
4	427.754	164.722	38.502	133047.537	26123.846
5	1.698	70.732	4 314	132888.398	26223.846
6	702.832	0.370	0.000	133004.398	26488.846
7	8130.267	0.285	0.615	133562.504	31293.162
8	26733.149	49.683	17.500	133929.504	31341.162
9	0.000	91.480	132.034	58937.516	11916.603
10	0.000	56.980	0.000	0.000	0 000
11	324.614	141.363	150.034	0.000	0.000
12	0.873	3.008	3.447	0 000	292092.664
13	0.696		92.034		30271946.000
1	154.500	395.075	80.329	475.404	-2.000
2	203353.70	38.736	31 049	151.140	416.062
3	4.918	41.095	30.676	1885.500	7244.313
4	427.754	164.722	38.503	132867.227	26204.322
5	1.698	70.732	4 314	132707.492	26304.322
6	702.869	0.370	0.000	132843.492	26569.322
7	8130.686	0.285	0.615	133364.783	31252.690
8	26783.642	49.826	17.500	133731.783	31300.690
9	0.000	91.665	132.342	59135.051	11956.968
10	0.000	57.165	0.000	0.000	0.000
11	324.471	141.690	150.341	0.000	0.000
12	0.871	3.008	3.454	0.000	291854.473
13	0.697		92.342		30373619.750
1	154.600	395.075	80.329	475.404	-2.000
2	204365.59	38.733	31.049	151.118	416.000
3	4.918	41.092	30.675	1884.942	7242.460
4	429.878	164.722	38.504	132831.164	26220.416
5	1.698	70 732	4.314	132671 311	26320.416
6	693.420	0.370	0.000	132807.311	26585.416
7	7509.908	0.285	0 015	133325 238	31244.596
8	26720.394	49.854	17.500	133692.238	31292.596
9	0.000	91.702	132.403	59174.559	11965.001
10	0.000	57.202	0.000	0.000	0.000
11	324.443	141.756	150.403	0.000	0.000
12	0.839	2.957	3.522	0 000	291806.832
13	0.700		92.403		30393955.000

Right group

#					
1	154.700	340.461	69.220	409.680	-2.000
2	176211.40	38.730	31.048	151.097	415.942
3	4.919	41.613	30.960	1884.409	7240.602
4	430.119	164.722	38.504	132796.871	26237.218
5	1.698	70.732	4.314	132636.898	26336.872
6	597.893	0.370	0.000	132772.898	26601.672
7	6471.775	0.285	0.615	133287.463	31236.862
8	23032.345	49.883	17.500	133654.463	31284.862
9	0.000	91.739	132.465	59212.297	11972.674
10	0.000	57.239	0.000	0.000	0.000
11	324.414	141.821	150.464	0.000	0.000
12	0.839	2.548	3.036	0.000	291761.324
13	0.604		92.465		30413476.000
1	154.800	208.721	42.457	251.178	-2.000
2	107794.27	38.727	31.047	151 082	415.899
3	4.916	41.918	31.367	1884.020	7238.853
4	429.154	164.722	38.504	132772.732	26256.233
5	1.698	70.732	4.314	132612.645	26355.392
6	365.751	0.370	0.000	132748.645	26620.392
7	3967.563	0.285	0.615	133259.846	31231.193
8	14131.974	49.911	17.500	133626.846	31279.193
9	0.000	91.776	132.526	59239.877	11978.281
10	0.000	57.276	0.000	0.000	0.000
11	324.386	141.887	150.526	0 000	0.000
12	0.839	1.562	1 863	0 000	291728.035
13	0.370		92.526		30427756.500
1	154.900	79.401	16.426	95.627	-2.000
2	41038.98	38.724	31.046	151.075	415.877
3	4.893	40.930	31.385	1883.822	7238.011
4	429.155	164.723	38.504	132762 150	26277.869
5	1.698	70.732	4.314	132601.980	26376.666
6	139.248	0.370	0.000	132737.980	26641.666
7	1509.335	0 285	0.615	133245.818	31228.276
8	5402.699	49.940	17.500	133612 818	31276.276
9	0 000	91.813	132.588	59253.867	11981.136
10	0 000	57.313	0 000	0.000	0.000
11	324.357	141.952	150.587	0.000	0.000
12	0.834	0.594	0.712	0.000	291711.094
13	0 141		92.588		30434961.500
1	155.000	34.097	6.012	40 710	-2.000
2	16833.18	38.721	31.045	151 072	415.869
3	5.157	39.577	31.184	1883.753	7237.925
4	413.494	164.723	38.504	132760.676	26301.203
5	1.698	70.732	4.314	132600.463	26399.813
6	57.116	0.370	0 000	132736.463	26664.813
7	648.160	0.285	0.615	133240 938	31227.234
8	2202.285	49.968	17.500	133607.938	31275.234
9	0.000	91.850	132.649	59258.711	11982.117
10	0.000	57.350	0.000	0.000	0.000
11	324.329	142.018	150.649	0.000	0.000
12	0.879	0.255	0.290	0.000	291705.168
13	0.058		92.649		30437472.500
1	155.100	25.167	5.001	30.168	-2.000
2	12234.91	38.718	31.044	151.070	415.864
3	5.032	39 067	31.100	1883.712	7237 886
4	405.560	164.723	38.505	132761.135	26324.823
5	1.698	70.732	4.314	132600.908	26423.366
6	41.514	0.000	0.000	132736.908	26688.366
7	478.398	0.285	0.615	133238.020	31226.598
8	1666.235	49 996	17.500	133605.020	31274.598
9	0.000	91.868	132.711	59261.611	11982.691
10	0.000	57.368	0.000	0.000	0.000
11	324.300	142.064	150.710	0.000	0.000
12	0.858	0 188	0.220	0.000	291701.617
13	0.042		92.711		30438892 750
1	155.200	21.661	4.288	25 550	-2.000
2	10431.70	38.715	31.043	151.069	415.860
3	5.051	38 969	31.084	1883.680	7237.800
4	401.999	164 723	38 505	132762 193	26348.532
5	1.698	70.732	4.314	132601.957	26447.035
6	35.396	0.000	0.000	132737.957	26712.035
7	411 760	0.285	0 615	133235.705	31226.077
8	1429.243	50.025	17 500	133602.705	31274.077
9	0.000	91.868	132.772	59263 926	11983.150
10	0.000	57.368	0.000	0.000	0 000
11	324.272	142.093	150.772	0.000	0.000
12	0 861	0.162	0.188	0 000	291698.781
13	0.036		92.772		30440011.750
1	155.300	19.824	3.915	23.738	-2.000
2	9487.02	38.712	31 042	151.068	415.856
3	5.064	38.928	31.077	1883.651	7237 714
4	399.651	164 723	38 505	132763.488	26372.284
5	1.698	70.732	4 314	132603.246	26470.753
6	32.190	0.000	0 000	132739.246	26735 753
7	376.830	0.285	0 015	133233.631	31225.606
8	1305 106	50.053	17.500	133600 631	31273.606
9	0 000	91.868	132.834	59266 000	11983.560
10	0 000	57.368	0.000	0.000	0.000
11	324 243	142 121	150.833	0.000	0.000
12	0.862	0 148	0.172	0.000	291696.234
13	0.033		92.834		3044100b.500

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (FIRST BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

1	155.400	17.396	3.421	20.817	-2.000
2	8237.35	38.709	31.041	151 067	415.853
3	5.085	38.906	31.073	1883.625	7237.635
4	395.704	164.723	38.505	132764.988	26396.073
5	1.698	70.732	4 314	132604.738	26494.512
6	27.950	0.000	0.000	132740 738	26759.512
7	330.684	0.285	0.615	133231.760	31225.175
8	1140.874	50.082	17.500	133598.760	31273.175
9	0.000	91.868	132.895	59267.871	11983.929
10	0.000	57.368	0.000	0.000	0.000
11	324.215	142.150	150.895	0 000	0.000
12	0.866	0.130	0.150	0.000	291693.934
13	0.028		92.895		30441897.750

1	155.700	6.544	1.215	7.759	-2.000
2	2650.27	38.700	31.039	151.065	415.847
3	5.387	38.790	31.054	1883.576	7237.505
4	341.566	164.723	38.506	132771.547	26467.841
5	1.698	70.732	4.314	132611.283	26566.210
6	8.993	0.000	0.000	132747.283	26831.210
7	124.405	0.285	0.615	133228.215	31224.305
8	405.520	50.167	17.500	133595.215	31272.305
9	0.000	91.868	133.080	59271.416	11984.615
10	0.000	57.368	0.000	0.000	0.000
11	324.129	142.235	151.079	0.000	0.000
12	0 916	0.049	0.053	0.000	291689.520
13	0.009		93.080		30443505.000

1	155.500	13.775	2 685	16.460	-2.000
2	6372.36	38.706	31 040	151.066	415.850
3	5 131	38 878	31 069	1883.603	7237.572
4	387.149	164.723	38.505	132766.789	26419.922
5	1.698	70.732	4.314	132606.533	26518.333
6	21.622	0.000	0 000	132742.533	26783.333
7	261.852	0.285	0.615	133230.191	31224.807
8	895.643	50.110	17.500	133597.191	31272.807
9	0.000	91.868	132.957	59269.439	11984.236
10	0.000	57.368	0.000	0.000	0.000
11	324.186	142.178	150.956	0.000	0.000
12	0.873	0.103	0 118	0.000	291691.996
13	0.022		92.957		30442632.500

1	155.800	4.521	0 803	5.324	-2.000
2	1610.18	38.697	31 038	151.065	415.845
3	5.629	38 753	31 047	1883.568	7237.491
4	302.462	164.723	38.506	132774.361	26491.882
5	1.698	70.732	4.314	132614.096	26590.238
6	5 464	0 000	0.000	132750.096	26855.238
7	85.933	0.285	0.615	133227.666	31224.144
8	268.155	50.196	17.500	133594.666	31272.144
9	0 000	91.868	133.141	59271.965	11984.715
10	0.000	57.368	0.000	0.000	0.000
11	324.101	142.264	151.141	0.000	0.000
12	0.957	0.034	0.035	0.000	291688.809
13	0.006		93.141		30443715.500

1	155.600	9.727	1.062	11.589	-2.000
2	4287.92	38.703	31 040	151.065	415.848
3	5.224	38.837	31 062	1883.587	7237.529
4	369.999	164.723	38 506	132768.582	26443.846
5	1.698	70.732	4.314	132608 723	26542.234
6	14.549	0.000	0.000	132744.723	26807.234
7	184.906	0.285	0.615	133229.018	31224.518
8	621.334	50.139	17.500	133596.018	31272.518
9	0.000	91.868	133.018	59270.613	11984.463
10	0 000	57 368	0 000	0.000	0.000
11	324.158	142.207	151.018	0.000	0.000
12	0.889	0.073	0.082	0.000	291690.535
13	0.015		93 018		30443164.250

1	155 900	0.000	0.000	0.000	-2.000
2	0.00	38.694	31.037	151.064	415.844
3	0.000	38.728	31.043	1883.564	7237.483
4	0.000	164.723	38.506	132777.426	26515.971
5	1.698	70 732	4.314	132617 158	26614.317
6	0 000	0.000	0.000	132753.158	26879.317
7	0 000	0.285	0.615	133227.305	31224.032
8	0.000	50.224	17.500	133594.365	31272.032
9	0.000	91.868	133.203	59272.266	11984.765
10	0.000	57.368	0.000	0.000	0.000
11	324 072	142.292	151.202	0.000	0.000
12	0.000	0.000	0.000	0.000	291688.395
13	0.000		93.203		30443804.500

TABLE AP 5-6 (Sheet 1 of 6)
PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

#						#					
1	170.000	0.000	0.000	0.000	-30.400	1	177.000	0.000	4.008	4.008	-30.400
2	0.00	40.500	29.500	150.960	396.330	2	377.51	40.500	29.500	150.959	396.154
3	0.000	40.500	29.500	1884.626	6709.942	3	0.000	40.508	29.499	1884.588	6650.026
4	0.000	165.500	39.980	133062.188	27365.794	4	94.184	165.500	39.224	133059.504	27346.698
5	1.659	70.591	4.270	132901.346	27449.437	5	1.659	70.591	4.405	132898.654	27430.721
6	0.000	0.385	0.000	133037.346	27714.437	6	1.335	0.385	0.000	133034.654	27695.721
7	0.000	0.100	0.000	133037.346	28648.437	7	0.000	0.100	0.000	133034.654	28625.135
8	0.000	0.010	41.990	133404.346	28696.437	8	1327.279	0.710	41.990	133401.654	28673.135
9	0.000	226.887	290.125	59327.266	14403.437	9	0.000	229.579	290.125	59327.266	14426.740
10	-0.000	192.387	2549.999	0.000	0.000	10	-0.000	195.080	2549.999	0.000	0.000
11	278.979	280.404	329.221	0.000	2419.997	11	278.279	283.797	329.221	0.000	2419.997
12	0.000	0.000	0.000	0.000	288922.781	12	0.000	0.000	0.172	0.000	288896.785
13	0.000		98.799		30443804.500	13	0.001		98.799		30446830.500
1	171.000	0.000	2.992	2.992	-30.400	1	178.000	0.000	4.269	4.269	-30.400
2	411.50	40.500	29.500	150.960	396.308	2	346.89	40.500	29.500	150.958	396.122
3	0.000	40.509	29.500	1884.621	6701.291	3	0.000	40.507	29.498	1884.583	6641.513
4	137.531	165.500	39.872	133061.803	27363.283	4	81.265	165.500	39.116	133059.109	27343.181
5	1.659	70.591	4.275	132900.961	27447.149	5	1.659	70.591	4.409	132898.270	27427.237
6	1.456	0.385	0.000	133036.961	27712.149	6	1.227	0.385	0.000	133034.270	27692.237
7	0.000	0.100	0.000	133036.961	28645.494	7	0.000	0.100	0.000	133034.270	28620.995
8	995.952	0.110	41.990	133403.961	28693.494	8	1412.236	0.810	41.990	133401.270	28668.995
9	0.000	227.272	290.125	59327.266	14406.380	9	0.000	229.964	290.125	59327.266	14430.880
10	-0.000	192.772	2549.999	0.000	0.000	10	-0.000	195.464	2549.999	0.000	0.000
11	278.879	280.889	329.221	0.000	2419.997	11	276.179	284.281	329.221	0.000	2419.997
12	0.000	0.000	0.128	0.000	288919.453	12	0.000	0.000	0.183	0.000	288892.262
13	0.001		98.799		30444190.500	13	0.001		98.799		30447191.500
1	172.000	0.000	2.993	2.993	-30.400	1	179.000	41.827	32.160	73.987	-30.400
2	447.37	40.500	29.500	150.960	396.285	2	37130.72	40.500	29.467	150.952	396.078
3	0.000	40.509	29.500	1884.615	6692.691	3	1.301	40.671	29.322	1884.187	6632.702
4	149.457	165.500	39.764	133061.576	27360.922	4	501.853	165.450	39.008	133048.293	27337.876
5	1.659	70.591	4.280	132900.576	27444.811	5	1.660	70.600	4.314	132887.422	27421.967
6	1.583	0.385	0.000	133036.576	27709.611	6	131.321	0.385	0.000	133023.422	27686.967
7	0.000	0.100	0.000	133036.576	28642.501	7	948.307	0.135	0.300	133023.422	28615.070
8	995.513	0.210	41.990	133403.576	28690.501	8	10668.709	0.928	41.990	133390.422	28663.070
9	0.000	227.656	290.125	59327.266	14409.373	9	0.000	230.348	290.275	59337.729	14436.655
10	-0.000	193.157	2549.999	0.000	0.000	10	-0.000	195.849	2549.999	0.000	0.000
11	278.779	281.374	329.221	0.000	2419.997	11	278.061	284.783	329.370	0.000	2419.997
12	0.000	0.000	0.128	0.000	288916.074	12	0.235	0.326	1.386	0.000	288875.488
13	0.002		98.799		30444618.750	13	0.129		98.949		30454909.500
1	173.000	0.000	3.182	3.182	-30.400	1	180.000	268.142	70.093	338.235	-30.400
2	483.26	40.500	29.500	150.960	396.262	2	150270.31	40.500	29.433	150.880	395.633
3	0.000	40.510	29.500	1884.610	6684.129	3	3.826	42.603	29.079	1882.081	6612.018
4	151.885	165.500	39.656	133061.035	27358.464	4	444.278	165.400	38.900	132916.760	27279.450
5	1.659	70.591	4.285	132900.191	27442.378	5	1.660	70.609	4.319	132755.555	27363.957
6	1.710	0.385	0.000	133036.191	27707.378	6	531.260	0.385	0.000	132891.555	27628.957
7	0.000	0.100	0.000	133036.191	28639.412	7	6066.924	0.170	0.600	132891.555	28556.405
8	1057.267	0.310	41.990	133403.191	28687.412	8	23316.557	1.080	41.990	133258.555	28604.405
9	0.000	228.041	290.125	59327.266	14412.462	9	0.000	230.733	290.125	59469.211	14494.870
10	-0.000	193.541	2549.999	0.000	0.000	10	-0.000	196.233	2549.999	0.000	0.000
11	278.679	281.858	329.221	0.000	2419.997	11	277.909	285.320	329.820	0.000	2419.997
12	0.000	0.000	0.136	0.000	288912.602	12	0.689	2.085	3.025	0.000	288684.957
13	0.002		98.799		30445082.750	13	0.521		99.399		30552649.500
1	174.000	0.000	3.370	3.370	-30.400	1	180.500	301.597	70.839	372.436	-30.400
2	469.30	40.500	29.500	150.960	396.237	2	160941.82	40.500	29.417	150.802	395.364
3	0.000	40.510	29.500	1884.604	6675.583	3	4.257	42.755	29.107	1879.944	6603.104
4	139.244	165.500	39.548	133060.604	27355.817	4	432.133	165.375	38.890	132774.525	27243.967
5	1.659	70.591	4.290	132899.809	27439.756	5	1.660	70.613	4.319	132612.904	27328.750
6	1.660	0.385	0.000	133035.809	27704.756	6	569.008	0.385	0.000	132748.904	27593.750
7	0.000	0.100	0.000	133035.809	28636.135	7	6823.700	0.187	0.600	132748.904	28520.869
8	1118.965	0.410	41.990	133402.809	28684.135	8	23559.575	1.169	41.990	133115.904	28568.869
9	0.000	228.425	290.125	59327.266	14415.740	9	0.000	230.925	291.025	59611.902	14530.105
10	-0.000	193.926	2549.999	0.000	0.000	10	-0.000	196.426	2549.999	0.000	0.000
11	278.579	282.343	329.221	0.000	2419.997	11	277.819	285.602	330.120	0.000	2419.997
12	0.000	0.000	0.144	0.000	288908.941	12	0.767	2.345	3.057	0.000	288506.773
13	0.002		98.799		30445564.250	13	0.558		99.699		30630460.000
1	175.000	0.000	3.559	3.559	-30.400	1	181.000	303.890	70.960	374.851	-30.400
2	438.72	40.500	29.500	150.960	396.211	2	162090.48	40.500	29.400	150.719	395.093
3	0.000	40.509	29.499	1884.599	6667.052	3	4.283	42.803	29.098	1877.681	6594.160
4	123.265	165.500	39.440	133060.271	27352.979	4	432.358	165.350	38.880	132623.406	27208.450
5	1.659	70.591	4.295	132899.424	27436.945	5	1.660	70.618	4.320	132461.330	27293.326
6	1.552	0.385	0.000	133035.424	27701.945	6	573.024	0.385	0.000	132597.330	27558.326
7	0.000	0.100	0.000	133035.424	28632.669	7	6876.089	0.205	0.600	132597.330	28485.118
8	1180.608	0.510	41.990	133402.424	28680.669	8	23595.075	1.268	41.990	132964.330	28533.118
9	0.000	228.810	290.125	59327.266	14419.206	9	0.000	231.118	291.025	59763.051	14565.556
10	-0.000	194.310	2549.999	0.000	0.000	10	-0.000	196.618	2549.999	0.000	0.000
11	278.479	282.827	329.221	0.000	2419.997	11	277.721	285.892	330.420	0.000	2419.997
12	0.000	0.000	0.152	0.000	288905.090	12	0.772	2.363	3.062	0.000	288319.445
13	0.002		98.799		30446017.000	13	0.562		99.999		30711214.500
1	176.000	0.000	3.748	3.748	-30.400	1	182.000	308.093	71.208	379.301	-30.400
2	408.12	40.500	29.500	150.960	396.183	2	164364.99	40.500	29.367	150.550	394.550
3	0.000	40.509	29.499	1884.594	6658.536	3	4.327	42.820	29.067	1873.111	6576.247
4	108.888	165.500	39.332	133059.887	27349.952	4	433.337	165.300	38.860	132317.922	27138.567
5	1.659	70.591	4.300	132899.039	27433.945	5	1.660	70.626	4.321	132154.924	27222.297
6	1.444	0.385	0.000	133035.039	27698.945	6	581.172	0.385	0.000	132290.924	27487.297
7	0.000	0.100	0.000	133035.039	28629.014	7	6971.468	0.240	0.600	132290.924	28413.434
8	1242.197	0.610	41.990	133402.039	28677.014	8	23668.051	1.490	41.990	132657.924	28461.434
9	0.000	229.195	290.125	59327.266	14422.860	9	0.000	231.502	291.025	60069.072	14636.641
10	-0.000	194.695	2549.999	0.000	0.000	10	-0.000	197.002	2549.999	0.000	0.000
11	278.379	283.312	329.221	0.000	2419.997	11	277.499	286.499	331.020	0.000	2419.997
12	0.000	0.000	0.161	0.000	288901.051	12	0.780	2.396	3.072	0.000	287941.355
13	0.001		98.799		30446439.000	13	0.571		100.599		30874418.250

TABLE AP 5-6 (Sheet 2 of 6)
PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

#					
1	183.000	311.422	71.453	382.875	-30.400
2	167929.10	40.487	29.333	150.380	394.005
3	4.358	42.856	29.039	1868.733	6558.280
4	438.600	165.301	38.840	132008.701	27068.437
5	1.660	70.626	4.321	131844.768	27151.016
6	593.779	0.385	0.000	131980.768	27416.016
7	7046.869	0.248	0.607	131980.768	28341.498
8	23742.432	1.734	41.990	132347.768	28389.498
9	0.000	231.887	292.527	60378.844	14707.975
10	-0.000	197.387	2549.999	0.000	0.000
11	277.255	287.128	331.622	0.000	2419.997
12	0.786	2.421	3.082	0.000	287559.262
13	0.584		101.201		31040566.500

#					
1	184.200	375.112	75.082	450.794	-2.000
2	194791.30	40.472	29.299	150.146	393.325
3	4.956	42.864	28.991	1862.697	6535.941
4	432.107	165.302	38.816	131582.500	26980.881
5	1.699	70.625	4.323	131417.297	27062.031
6	672.855	0.385	0.000	131553.297	27327.031
7	7710.781	0.258	0.615	131553.297	28251.726
8	25272.013	2.037	41.990	131920.297	28299.726
9	0.000	232.348	293.263	60805.854	14797.010
10	-0.000	197.849	2549.999	0.000	0.000
11	276.951	287.893	332.358	0.000	2419.997
12	0.861	2.855	3.316	0.000	287042.020
13	0.679		101.937		31263859.500

#					
1	183.200	329.671	72.339	402.010	-19.040
2	175388.37	40.485	29.327	150.346	393.895
3	4.557	42.864	29.035	1867.839	6554.669
4	436.279	165.301	38.836	131945.563	27054.337
5	1.673	70.626	4.322	131781.441	27136.086
6	615.434	0.385	0.000	131917.441	27401.686
7	7227.373	0.250	0.610	131917.441	28327.037
8	24060.750	1.784	41.990	132284.441	28375.037
9	0.000	231.964	292.649	60442.094	14722.314
10	-0.000	197.464	2549.999	0.000	0.000
11	277.205	287.255	331.744	0.000	2419.997
12	0.812	2.545	3.132	0.000	287481.477
13	0.610		101.323		31074522.250

#					
1	184.400	375.639	75.839	451.478	-2.000
2	196078.95	40.470	29.298	150.104	393.209
3	4.953	42.884	28.990	1861.636	6532.140
4	434.305	165.302	38.812	131507.572	26965.981
5	1.699	70.625	4.323	131342.143	27046.886
6	677.303	0.385	0.000	131478.143	27311.886
7	7721.544	0.259	0.615	131478.143	28236.450
8	25322.739	2.089	41.990	131845.143	28284.450
9	0.000	232.425	293.386	60880.932	14812.163
10	-0.000	197.926	2549.999	0.000	0.000
11	276.900	288.022	332.481	0.000	2419.997
12	0.860	2.859	3.323	0.000	286951.590
13	0.683		102.060		31302946.750

#					
1	183.400	353.415	73.770	427.184	-7.680
2	185305.32	40.482	29.320	150.309	393.784
3	4.791	42.871	29.031	1866.890	6551.012
4	433.783	165.301	38.832	131878.596	27040.047
5	1.689	70.626	4.322	131714.277	27122.163
6	644.217	0.385	0.000	131850.277	27387.163
7	7456.698	0.251	0.613	131850.277	28312.383
8	24592.659	1.834	41.990	132217.277	28360.383
9	0.000	232.041	292.771	60509.182	14736.846
10	-0.000	197.541	2549.999	0.000	0.000
11	277.155	287.382	331.866	0.000	2419.997
12	0.842	2.705	3.214	0.000	287399.660
13	0.645		101.445		31110048.750

#					
1	184.600	376.169	75.934	452.103	-2.000
2	196860.27	40.467	29.297	150.063	393.093
3	4.954	42.904	28.991	1860.574	6528.332
4	435.443	165.303	38.808	131432.537	26951.052
5	1.699	70.625	4.323	131266.881	27031.713
6	680.002	0.385	0.000	131402.881	27296.713
7	7732.355	0.261	0.615	131402.881	28221.146
8	25352.427	2.141	41.990	131769.881	28269.146
9	0.000	232.502	293.509	60956.115	14827.344
10	-0.000	198.002	2549.999	0.000	0.000
11	276.848	288.150	332.604	0.000	2419.997
12	0.861	2.863	3.327	0.000	286861.027
13	0.686		102.183		31342266.250

#					
1	183.500	370.671	75.133	445.804	-2.000
2	192790.91	40.481	29.317	150.289	393.728
3	4.934	42.874	29.026	1866.390	6549.161
4	432.457	165.301	38.830	131843.277	27032.791
5	1.699	70.626	4.322	131678.857	27114.789
6	665.938	0.385	0.000	131814.857	27379.789
7	7619.209	0.252	0.615	131814.857	28304.943
8	25095.036	1.859	41.990	132181.857	28352.943
9	0.000	232.079 *	292.832	60544.563	14744.224
10	-0.000	197.579	2549.999	0.000	0.000
11	277.130	287.445	331.928	0.000	2419.997
12	0.857	2.822	3.293	0.000	287356.797
13	0.671		101.507		31128590.250

#					
1	184.800	376.694	75.965	452.660	-2.000
2	197131.75	40.465	29.296	150.022	392.977
3	4.959	42.903	28.990	1859.510	6524.524
4	435.497	165.303	38.804	131357.398	26936.115
5	1.699	70.625	4.323	131191.516	27016.531
6	680.940	0.385	0.000	131327.516	27281.531
7	7743.179	0.262	0.615	131327.516	28205.833
8	25360.920	2.193	41.990	131694.516	28253.833
9	0.000	232.579	293.632	61031.404	14842.534
10	-0.000	198.079	2549.999	0.000	0.000
11	276.795	288.280	332.727	0.000	2419.997
12	0.861	2.867	3.328	0.000	286770.348
13	0.687		102.306		31381665.500

#					
1	183.600	371.457	75.211	446.668	-2.000
2	192809.91	40.480	29.313	150.269	393.670
3	4.939	42.876	29.012	1865.866	6547.285
4	431.662	165.302	38.828	131806.238	27025.396
5	1.699	70.625	4.322	131641.711	27107.275
6	666.004	0.385	0.000	131777.711	27372.275
7	7635.381	0.253	0.615	131777.711	28297.364
8	25120.341	1.884	41.990	132144.711	28345.364
9	0.000	232.118	292.894	60581.670	14751.741
10	-0.000	197.618	2549.999	0.000	0.000
11	277.104	287.509	331.989	0.000	2419.997
12	0.858	2.828	3.296	0.000	287312.074
13	0.671		101.568		31147860.250

#					
1	185.000	377.220	75.996	453.216	-2.000
2	197403.23	40.462	29.294	149.980	392.861
3	4.964	42.901	28.989	1858.444	6520.714
4	435.561	165.303	38.800	131282.152	26921.171
5	1.699	70.625	4.323	131116.043	27001.342
6	681.878	0.385	0.000	131252.043	27266.342
7	7754.003	0.264	0.615	131252.043	28190.513
8	25369.411	2.246	41.990	131619.043	28238.513
9	0.000	232.656	293.155	61106.799	14857.731
10	-0.000	198.156	2549.999	0.000	0.000
11	276.743	288.409	332.850	0.000	2419.997
12	0.862	2.871	3.330	0.000	286729.555
13	0.689		102.429		31421119.000

#					
1	183.800	373.022	75.367	448.389	-2.000
2	192845.19	40.477	29.307	150.228	393.555
3	4.949	42.860	29.002	1864.814	6543.516
4	430.084	165.302	38.824	131731.938	27010.589
5	1.699	70.625	4.322	131567.186	27092.225
6	666.129	0.385	0.000	131703.186	27357.225
7	7667.700	0.254	0.615	131703.186	28282.183
8	25170.815	1.935	41.990	132070.186	28330.183
9	0.000	232.195	293.017	60656.119	14766.799
10	-0.000	197.695	2549.999	0.000	0.000
11	277.054	287.637	332.112	0.000	2419.997
12	0.860	2.839	3.303	0.000	287222.367
13	0.671		101.691		31186426.000

#					
1	190.000	394.264	78.292	472.557	-2.000
2	201049.23	40.400	29.267	148.926	389.935
3	5.036	42.759	28.915	1831.307	6424.891
4	425.450	165.308	38.700	129363.725	26611.669
5	1.699	70.622	4.328	129194.176	26618.418
6	694.493	0.385	0.000	129330.176	26883.418
7	8105.497	0.282	0.615	129330.176	27804.313
8	26077.473	3.622	41.990	129697.176	27852.313
9	0.000	234.579	296.830	63026.744	15240.856
10	-0.000	200.079	2549.999	0.000	0.000
11	275.367	291.708	335.925	0.000	2419.997
12	0.876	3.001	3.425	0.000	284371.488
13	0.707		105.504		32421614.500

#					
1	184.000	374.586	75.524	450.110	-2.000
2	193503.68	40.475	29.300	150.187	393.440
3	4.960	42.843	28.991	1863.757	6539.739
4	429.903	165.302	38.820	131657.322	26995.750
5	1.699	70.625	4.322	131492.346	27077.144
6	668.407	0.385	0.000	131628.346	27342.144
7	7700.018	0.256	0.615	131628.346	28266.970
8	25221.281	1.986	41.990	131995.346	28314.970
9	0.000	232.271	293.140	60730.881	14781.889
10	-0.000	197.772	2549.999	0.000	0.000
11	277.003	287.765	332.235	0.000	2419.997
12	0.862	2.851	3.310	0.000	287132.313
13	0.674		101.814		31225029.750

#					
1	200.000	395.699	78.398	474.097	-2.000
2	201743.20	40.090	29.211	146.756	383.951
3	5.047	42.458	28.860	1775.490	6237.213
4	425.532	165.318	38.616	125406.951	25935.689
5	1.700	70.616	4.331	125240.226	25835.239
6	696.719	0.385	0.000	125376.226	26100.239
7	8115.843	0.305	0.615	125376.226	27014.582
8	26061.462	6.565	41.990	125743.226	27062.582
9	0.000	238.425	302.979	66976.849	16024.438
10	-0.000	203.925	2549.999	0.000	0.000
11	272.424	298.497	342.075	0.000	2419.997
12	0.878	3.005	3.423	0.000	279627.805
13	0.721		111.654		34435736.500

TABLE AP 5-6 (Sheet 3 of 6)
PREDICTED S-IVB-503N PROPULSION SYSTEM PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

#						#					
1	210.000	396.491	78.610	475.101	-2.000	1	270.000	395.249	79.730	474.979	-2.000
2	202239.77	39.779	29.156	144.579	377.958	2	202981.56	40.100	29.050	131.517	341.614
3	5.044	42.160	28.802	1719.458	6056.725	3	4.957	42.573	28.673	1383.079	4959.203
4	425.678	165.328	38.648	121444.300	25153.864	4	427.349	165.388	38.840	97696.847	20389.361
5	1.699	70.610	4.330	121274.651	25050.777	5	1.700	70.574	4.321	97473.336	20293.060
6	698.827	0.385	0.000	121410.651	25315.777	6	700.730	0.237	0.000	97609.336	20558.060
7	8134.965	0.318	0.615	121410.651	26223.567	7	8125.752	0.470	0.615	97609.336	21426.533
8	26107.219	9.678	41.990	121777.651	26271.567	8	26506.345	32.485	41.990	97976.336	21474.533
9	0.000	242.271	309.129	70938.577	16809.302	9	0.000	260.001	346.027	94722.162	21569.437
10	-0.000	207.771	2549.999	0.000	0.000	10	-0.000	225.501	2549.999	0.000	0.000
11	269.310	305.456	348.225	0.000	2419.997	11	246.503	345.992	385.123	0.000	2419.997
12	0.881	3.016	3.426	0.000	274871.215	12	0.877	3.009	3.429	0.000	246272.869
13	0.736		117.804		36455761.500	13	0.824		154.703		48630725.500

#						#					
1	220.000	396.573	78.928	475.501	-2.000	1	280.000	394.832	79.787	474.619	-2.000
2	202545.18	39.469	29.100	142.401	371.944	2	202906.84	39.564	29.039	129.348	335.523
3	5.025	41.865	28.739	1663.382	5875.471	3	4.949	42.053	28.661	1327.145	4774.837
4	425.962	165.338	38.680	117484.754	24372.899	4	427.515	165.398	38.872	93791.896	19592.446
5	1.700	70.604	4.328	117305.187	24263.522	5	1.699	70.570	4.319	93520.447	19495.795
6	699.586	0.385	0.000	117441.187	24528.522	6	701.189	0.269	0.000	93656.447	19760.795
7	8136.687	0.328	0.615	117441.187	25429.759	7	8131.634	0.351	0.615	93656.447	20622.716
8	26209.265	12.908	41.990	117808.187	25477.759	8	26537.808	36.029	41.990	94023.447	20670.716
9	0.000	246.117	315.279	74904.195	17596.960	9	0.000	262.533	352.177	98672.519	22367.104
10	-0.000	211.617	2549.999	0.000	0.000	10	-0.000	228.033	2549.999	0.000	0.000
11	266.080	312.532	354.374	0.000	2419.997	11	242.958	352.069	391.272	0.000	2419.997
12	0.881	3.003	3.411	0.000	270107.945	12	0.880	3.012	3.422	0.000	241516.162
13	0.750		123.954		38479675.500	13	0.840		160.853		50660158.500

#						#					
1	230.000	396.372	79.221	475.593	-2.000	1	290.000	394.505	79.784	474.290	-2.000
2	202759.03	39.159	29.090	140.223	365.906	2	202824.40	39.029	29.028	127.181	329.432
3	5.003	41.572	28.723	1607.311	5693.328	3	4.945	41.531	28.651	1271.232	4590.294
4	426.329	165.348	38.712	113512.999	23574.549	4	427.638	165.408	38.904	89846.702	18781.980
5	1.700	70.598	4.327	113336.739	23473.141	5	1.697	70.567	4.318	89570.865	18698.317
6	700.351	0.343	0.000	113472.739	23738.141	6	701.648	0.301	0.000	89706.865	18963.317
7	8135.908	0.335	0.615	113472.739	24632.825	7	8138.223	0.350	0.615	89706.865	19818.686
8	26332.332	16.224	41.990	113839.739	24680.825	8	26546.829	39.533	41.990	90073.865	19866.686
9	0.000	249.798	321.428	78868.962	18387.744	9	0.000	265.385	358.326	102619.249	23164.984
10	-0.000	215.298	2549.999	0.000	0.000	10	-0.000	230.886	2549.999	0.000	0.000
11	262.764	319.529	360.524	0.000	2419.997	11	239.454	358.425	397.422	0.000	2419.997
12	0.879	2.988	3.399	0.000	265342.563	12	0.864	3.017	3.411	0.000	236762.551
13	0.764		130.104		40506186.000	13	0.857		167.003		52688805.500

#						#					
1	240.000	395.852	79.373	475.225	-2.000	1	300.000	395.840	79.982	475.822	-2.000
2	202743.74	38.848	29.080	138.048	359.851	2	203441.84	38.725	29.017	125.013	323.335
3	4.987	41.277	28.710	1551.289	5510.546	3	4.949	41.242	28.637	1215.325	4405.469
4	426.627	165.358	38.744	109545.346	22789.414	4	427.559	165.418	38.936	85901.972	17983.298
5	1.699	70.592	4.325	109372.390	22680.545	5	1.699	70.564	4.316	85621.973	17900.169
6	700.415	0.292	0.000	109508.390	22945.545	6	703.112	0.240	0.000	85757.973	18165.169
7	8130.655	0.339	0.615	109508.390	23833.677	7	8151.998	0.476	0.615	85757.973	19013.985
8	26392.710	19.601	41.990	109875.390	23881.677	8	26606.806	43.249	41.990	86124.973	19061.985
9	0.000	252.973	327.578	82830.137	19180.743	9	0.000	268.091	364.476	106565.436	23963.536
10	-0.000	218.473	2549.999	0.000	0.000	10	-0.000	233.592	2549.999	0.000	0.000
11	259.387	326.080	366.674	0.000	2419.997	11	235.738	364.847	403.572	0.000	2419.997
12	0.879	2.987	3.399	0.000	260579.064	12	0.884	3.022	3.418	0.000	232008.957
13	0.778		136.254		42533689.500	13	0.877		173.153		54717826.000

#						#					
1	240.500	395.824	79.379	475.204	-2.000	1	310.000	395.965	80.117	476.082	-2.000
2	202741.83	38.833	29.079	137.939	359.548	2	203547.02	39.350	29.006	122.840	317.223
3	4.986	41.262	28.709	1548.490	5501.394	3	4.942	41.882	28.624	1159.239	4220.059
4	426.642	165.358	38.746	109341.114	22749.459	4	427.646	165.428	38.968	81941.494	17163.816
5	1.699	70.592	4.325	109174.323	22640.875	5	1.700	70.561	4.314	81660.794	17100.047
6	706.419	0.289	0.000	109310.323	22905.875	6	703.064	0.179	0.000	81796.794	17365.047
7	8130.377	0.339	0.615	109310.323	23793.679	7	8146.795	0.477	0.615	81796.794	18207.310
8	26395.564	19.770	41.990	109677.323	23841.679	8	26660.489	48.015	41.990	82163.794	18255.310
9	0.000	253.118	327.686	83028.167	19220.433	9	0.000	270.183	370.626	110524.521	24764.061
10	-0.000	218.618	2549.999	0.000	0.000	10	-0.000	235.684	2549.999	0.000	0.000
11	259.218	326.395	366.981	0.000	2419.997	11	230.972	371.705	409.721	0.000	2419.997
12	0.879	2.987	3.400	0.000	260341.002	12	0.882	3.019	3.423	0.000	227241.104
13	0.779		136.561		42635059.500	13	0.896		179.303		56752763.000

#						#					
1	250.000	396.887	79.589	476.477	-2.000	1	320.000	396.157	80.156	476.313	-2.000
2	203367.29	38.736	29.070	135.874	353.785	2	203639.19	39.975	28.994	120.665	311.105
3	4.987	41.179	28.697	1495.301	5327.278	3	4.942	42.522	28.613	1103.134	4034.315
4	426.815	165.368	38.776	105583.266	21989.539	4	427.533	165.438	39.000	77996.326	16363.757
5	1.700	70.586	4.324	105411.201	21886.389	5	1.699	70.558	4.313	77698.645	16299.052
6	702.423	0.240	0.000	105547.201	22151.389	6	703.616	0.117	0.000	77834.645	16564.052
7	8145.026	0.458	0.615	105547.201	23032.968	7	8149.532	0.478	0.615	77834.645	17399.763
8	26480.213	23.193	41.990	105914.201	23080.968	8	26719.086	52.789	41.990	78201.645	17447.763
9	0.000	255.631	333.728	86788.667	19975.302	9	0.000	271.662	376.776	114485.191	25565.458
10	-0.000	221.131	2549.999	0.000	0.000	10	-0.000	237.163	2549.999	0.000	0.000
11	255.795	332.330	372.823	0.000	2419.997	11	226.198	377.958	415.871	0.000	2419.997
12	0.880	2.996	3.404	0.000	255817.168	12	0.882	3.013	3.415	0.000	222471.406
13	0.795		142.404		44562059.500	13	0.915		185.453		58788686.500

#						#					
1	260.000	396.794	79.716	476.510	-2.000	1	330.000	394.421	80.166	474.587	-2.000
2	203489.29	39.418	29.060	133.695	347.703	2	202955.25	39.900	28.983	118.453	304.986
3	4.978	41.876	28.684	1439.172	5143.410	3	4.920	42.463	28.600	1047.199	3848.466
4	427.041	165.378	38.808	101632.548	21196.819	4	427.646	165.448	39.034	74063.402	15547.801
5	1.700	70.580	4.322	101440.630	21090.185	5	1.697	70.555	4.311	73748.792	15497.958
6	702.502	0.205	0.000	101576.630	21355.185	6	701.892	0.108	0.000	73884.792	15762.958
7	8145.064	0.465	0.615	101576.630	22230.211	7	8125.399	0.346	0.615	73884.792	16592.116
8	26511.105	27.810	41.990	101943.630	22278.211	8	26768.744	56.555	41.990	74251.792	16640.116
9	0.000	257.790	339.877	90757.080	20771.909	9	0.000	272.737	382.925	118433.970	26366.955
10	-0.000	223.290	2549.999	0.000	0.000	10	-0.000	238.238	2549.999	0.000	0.000
11	251.178	339.106	378.973	0.000	2419.997	11	222.031	382.799	422.021	0.000	2419.997
12	0.879	3.007	3.420	0.000	251043.840	12	0.876	2.991	3.415	0.000	217713.906
13	0.811		148.554		46596333.000	13	0.932		191.603		60819943.500

TABLE AP 5-6 (Sheet 4 of 6)
PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

#					
1	340 000	394.262	80.401	474 463	-2.000
2	202905.09	39.650	28.972	116.184	298.064
3	4.916	42.226	28.589	991 301	3662.391
4	427.652	165.458	39.068	70135.735	14752.826
5	1.699	70.554	4.310	69804.220	14696.488
6	700.882	0.112	0.000	69940.220	14961.488
7	8120.074	0.344	0 615	69940 220	15784.094
8	26784.570	60.010	41.990	70307.220	15832.094
9	0.000	273.837	389.075	122377.441	27168.827
10	-0.000	239.339	2549.999	0.000	0.000
11	218.976	387.354	428.170	0.000	2419.997
12	0.874	2.995	3.427	0.000	212961.313
13	0.953		197.752		62849238.500

#					
1	350.000	394.117	80.223	474 340	-2.000
2	202854.88	39.400	28.961	113.893	292.739
3	4.913	41.988	28.578	935.417	3476.116
4	427.657	165.468	39.102	66209.532	13945.225
5	1.701	70.554	4.308	65861.118	13894.741
6	699.872	0.116	0.000	65997.118	14159.741
7	8114.871	0.342	0.615	65997.118	14975.794
8	26779.370	63.445	41.990	66364.118	15023.794
9	0.000	274.978	395.225	126319.402	27970.978
10	-0.000	240.479	2549.999	0.000	0.000
11	215.542	391.929	434.320	0 000	2419.997
12	0.873	3.000	3.437	0 000	208209.910
13	0.974		203.902		64878033.500

#					
1	360.000	393.973	80.245	474 218	-2.000
2	202804.21	39.150	28.950	111.521	286.014
3	4.910	41.747	28.567	879 552	3289.656
4	427.660	165.478	39.136	62284.750	13159.073
5	1.701	70.553	4.307	61919.443	13092.775
6	699.710	0.120	0 000	62055.443	13357.775
7	8114.190	0.340	0 615	62055.443	14167.275
8	26810.294	66.859	41 990	62422.443	14215.275
9	0.000	276.157	401.374	130259.898	28773.347
10	-0 000	241.658	2549 999	0.000	0.000
11	212.127	396.523	440 470	0.000	2419.997
12	0.872	2.999	3.438	0.000	203459.717
13	0.997		210.052		66916324.000

#					
1	370.000	393.863	80.234	474.097	-2.000
2	202753.49	38.900	28.939	109 136	280.487
3	4.909	41.506	28.557	823 711	3103.044
4	427.662	165.488	39.170	58361 670	12360.271
5	1.701	70.553	4.305	57979 477	12290.739
6	699 548	0.600	0.000	58115 477	12555.739
7	8113.807	0.338	0 015	58115 477	13358.686
8	26812 838	70.253	41.990	58482.477	13406.686
9	0 000	276.914	407.524	134199.107	29575.785
10	-0.000	242.416	2549.999	0 000	0.000
11	208.733	400.675	446 019	0.000	2419.997
12	0.872	2.998	3 437	0.000	198711.162
13	1.020		216 202		68934084.000

#					
1	380 000	393.756	80.218	473.974	-2.000
2	202702.08	38.650	28.928	106.642	274.362
3	4.909	41.261	28.548	767 895	2916.331
4	427.665	165.498	39.204	54440.411	11565.175
5	1.701	70.553	4.303	54041.340	11488.856
6	699.385	0.000	0 000	54177.340	11753.856
7	8113.451	0.336	0 615	54177.340	12550.250
8	26813.967	73.627	41.990	54544.340	12598.250
9	0.000	276.914	413.074	138137.242	30378.071
10	-0.000	242.416	2549.999	0.000	0.000
11	205.359	404.048	452.769	0.000	2419.997
12	0.872	2.998	3 436	0.000	193904.590
13	1.045		222.352		70961333.000

#					
1	390.000	395.599	80.307	475.906	-2.000
2	203462.55	39 200	28 917	104.122	268.233
3	4.926	41.814	28.538	711.902	2729.344
4	427.527	165.511	39.238	50497.654	10758.748
5	1.702	70.552	4 302	50090.319	10686.383
6	701.601	0.000	0.000	50226.319	10951.383
7	8135.701	0.464	0.615	50226.319	11741.225
8	26852.078	77.986	41 990	50593.319	11789.225
9	0.000	276.914	419.623	142088.264	31180.947
10	-0.000	242.416	2549.999	0.000	0.000
11	200 999	408.407	458.919	0 000	2419.997
12	0.875	3.010	3.441	0.000	189204.543
13	1 075		228.202		72993882.000

#					
1	400.000	395.875	80.312	476 187	-2.000
2	203569.95	39.950	28 906	101.465	262.101
3	4.929	42.562	28 529	655 800	2542.165
4	427.500	165.525	39 272	46552.831	9966.067
5	1.703	70 553	4 300	46132.903	9883.667
6	701.896	0.000	0.000	46268.903	10148.667
7	8136.990	0.461	0.615	46268.903	10931.956
8	26860 624	82.608	41.990	46635.903	10979.956
9	0 000	276.914	425.973	146045.680	31984.066
10	-0.000	242.416	2549.999	0.000	0.000
11	196.378	413.029	465 068	0.000	2419.997
12	0.875	3.012	3.440	0.000	184437.859
13	1.104		234 652		75029017.000

#					
1	410.000	394.255	80.216	474.470	-2.000
2	202887.96	40.050	28.894	98.775	255.975
3	4.915	42.660	28.519	599.836	2355.006
4	427.609	165.539	39.306	42618.952	9161.721
5	1.702	70.557	4.299	42186.467	9081.632
6	699.877	0.000	0.000	42322.467	9346.632
7	8115 923	0.329	0.615	42322.467	10123.369
8	26833.233	86.196	41.990	42689.467	10171.369
9	0.000	276.914	432.123	149992.115	32786.503
10	-0.000	242.416	2549.999	0.000	0.000
11	192.789	416.617	471.218	0.000	2419.997
12	0.874	3.001	3.435	0.000	179682.834
13	1.129		240.802		77059508.000

#					
1	420.000	394.210	80 204	474.413	-2.000
2	202862.55	39.987	28.883	95.946	249.851
3	4.915	42.587	28.510	543.935	2167.782
4	427.607	165 553	39.340	38673.562	8374 140
5	1.702	70.560	4.297	38244.099	8279.908
6	699.789	0.000	0.000	38380.099	8544.908
7	8115.861	0.327	0.615	38380.099	9315.092
8	26835 571	89.473	41.990	38747.099	9363.092
9	0.000	276.914	438.272	153934.484	33588.630
10	-0.000	242.416	2549.999	0.000	0.000
11	189.512	419.894	477.368	0.000	2419.997
12	0.874	3.001	3.434	0.000	174932.189
13	1.160		246.951		79088232.000

#					
1	430 000	394.161	80.192	474.352	-2.000
2	202835.63	39.925	28.872	93 014	243.728
3	4.915	42.509	28.501	488 048	1980.448
4	427.605	165.569	39.374	34705.376	7565.729
5	1.702	70.503	4 295	34302.193	7478.304
6	699.696	0.000	0.000	34438.193	7743.304
7	8115.792	0.325	0.615	34438.193	8506.936
8	26837.837	92.733	41.990	34805.193	8554.936
9	0.000	276.914	444.422	157876.391	34390.637
10	-0.000	242.416	2549.999	0.000	0.000
11	186.252	423.153	483.517	0.000	2419.997
12	0.874	3.001	3.432	0.000	170182.127
13	1.192		253.101		81116704.000

#					
1	440.000	394.118	80.180	474.297	-2.000
2	202810.95	39.883	28.861	89.962	237 006
3	4.915	42.444	28.492	432.173	1793.003
4	427.603	165.584	39.408	30726.135	6768.286
5	1.702	70.566	4.294	30360.773	6676.821
6	699.609	0.000	0.000	30496 773	6941.821
7	8115.745	0.323	0 615	30496 773	7698.900
8	26846.206	95.974	41.990	30863.773	7746.900
9	0 000	276.914	450 572	161817.811	35192.523
10	-0.000	242.416	2549.999	0.000	0.000
11	183 011	426 395	489 667	0.000	2419.997
12	0.875	3.001	3.431	0.000	165432.672
13	1.226		259.451		83144906.000

#					
1	450.000	394.075	80 168	474 243	-2.000
2	202786.38	39.856	28.850	86.680	231.486
3	4.916	42.380	28 483	376.308	1605.401
4	427.601	165.600	39.442	26745 718	5973.482
5	1.702	70.569	4.292	26419.767	5875.454
6	699 523	0.000	0.000	26555.767	6140.454
7	8115 700	0 321	0 615	26555.767	6890.980
8	26842.582	99.198	41.990	26922.767	6938.980
9	0 000	276.914	456.721	165758.816	35994.293
10	-0.000	242.416	2549.999	0.000	0.000
11	179.787	429.618	495.817	0.000	2419.997
12	0.875	3.001	3.430	0.000	160683.746
13	1.262		265.401		85172877.000

#					
1	460.000	394.069	79.798	473.867	-2.000
2	202499.50	39.828	29.479	83 232	225.399
3	4 938	42.300	29.123	320.452	1417.392
4	427.334	165.628	39.476	22761.736	5178.906
5	1.702	70.571	4.291	22478.701	5073.681
6	698.369	0.000	0.000	22614.701	5338.681
7	8112.559	0.319	1 040	22614.701	6082.655
8	26838.647	102.403	41.990	22981.701	6130.655
9	0.000	276.914	467 015	169699.883	36792.325
10	-0.000	242.416	2549 999	0.000	0.000
11	176.582	432.823	506 110	0.000	2419.997
12	0 875	2.998	3.426	0 000	155934.355
13	1.299		275.694		87197998.000

#					
1	470 000	393.995	79.812	473.807	-2.000
2	202482.35	39.800	30 107	79.542	219.290
3	4.937	42.209	29.753	264.610	1229.268
4	427 352	165.656	39 510	18771.702	4368.581
5	1 702	70.573	4.291	18538.336	4271.753
6	698.328	0.000	0.000	18674.336	4536.753
7	8112 681	0.317	1.040	18674.336	5274.174
8	26841.070	105.583	41.990	19041.336	5322.174
9	0.000	276.914	477.414	173640.248	37590.406
10	-0 000	242.416	2549 999	0.000	0.000
11	173.402	436.003	516 510	0.000	2419.997
12	0.875	2 998	3.426	0 000	151185.510
13	1.339		286.094		89222889.000

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

1	480.000	393.920	79.826	473.746	-2.000	1	517.283	337.449	68.395	405.844	-2.000
2	202464.84	39.800	30.736	75.397	212.890	2	175256.38	39.819	32.018	46.578	179.186
3	4.935	42.116	30.383	208.781	1040.952	3	4.934	41.398	32.925	0.831	338.089
4	427.370	165.683	39.544	14782.417	3576.174	4	431.832	165.836	39.071	-77.323	556.720
5	1.702	70.575	4.290	14598.710	3469.683	5	1.702	70.573	4.290	-77.323	478.954
6	698.286	0.000	0.000	14734.710	3734.683	6	593.533	0.000	0.000	58 677	743.954
7	8112.800	0.314	1.040	14734 710	4465.552	7	6412.027	0.303	1.040	58 677	1450.393
8	26843.478	108.734	41.990	15101 710	4513.552	8	22660.376	126.231	41.990	-425.677	1498.393-
9	0.000	276.914	487.814	177579.873	38388.628	9	0.000	276.914	526.587	192255 906	41365.015
10	-0.000	242.416	2549.999	0.000	-0.000-	10	-0.000	242.416	2549.999	0.000	0.000
11	170.250	439.154-	526.909	0.000	2419.997	11	158.752	450.651	565.682	0 000	2419.997
12	0.875	2.997	3.427	0.000	14637.262	12	0.847	2.537	2.997	0.000	128746.069
13	1.383		296 493		9124761b.000	13	1.361		335.666		98792405.000
1	490.000	393.825	79.836	473.662	-2 000	1	517.383	206.875	38 102	244.977	-2.000
2	202437.03	39.800	31.293	70.740	205.747	2	107210.06	39.819	32.023	46.031	179.096
3	4.933	41.988	30.939	152.969	852.554	3	5 430	41.843	32.945	0.444	336.763
4	427.387	165.717	39.578	10793.958	2768.580	4	437 634	165.837	39.071	-104.657	550.779
5	1.702	70.576	4.289	10659.500	2667.481	5	1.702	70.573	4.290	-104.657	473.425
6	698 211	0.000	0 000	10795.500	2932.481	6	363.084	0.000	0 000	31.343	738.425
7	8112.849	0.311	1.040	10795.500	3656.797	7	3930.925	0.303	1.040	31.343	1444.798
8	26845.428	111.857	41.990	11162.900	3704.797	8	12623.749	120.262	41.990	398.343	1492.798
9	0.000	276.914	498.214	181518.684	39186.984	9	0.000	276.914	526.691	192283.240	41370.505
10	-0.000	242.416	2549.999	0.000	0.000	10	-0.000	242.416	2549.999	0.000	0.000
11	167.309	442.276	537.309	0.000	2419.997	11	158.722	450.681	565.786	0.000	2419.997
12	0.875	2.997	3.427	0.000	141689.695	12	0.932	1.555	1 069	0.000	128713.141
13	1.429		306.893		93272133.000	13	0.833		335 370		98806608.000
1	500.000	393.700	79.841	473.541	-2 000	1	517.483	78.699	9 681	88 580	-2 000
2	202393.86	39.800	31.779	65.246	197.560	2	40810.56	39.819	32.028	45.678	179.057
3	4.931	41.799	31 419	97.175	664.044	3	7.965	41.290	32.981	0.248	336.190
4	427.405	165.758	39.612	6806.607	1948.649	4	460.788	165.837	39 671	-118.523	548.123
5	1 702	70.575	4.289	6722.184	1865 208	5	1.702	70.573	4.290	-118 523	471.067
6	698.089	0.000	0.000	6858.184	2130.208	6	138.232	0.000	0.000	17.477	736.067
7	8112.797	0.308	1.040	6858.184	2847.971	7	1495.394	0.303	1.040	17 477	1442.374
8	26846.680	114.951	41.990	7225.184	2895.971	8	3273.775	120.292	41.990	384.477	1490.374
9	0.000	276 914	508.613	185456.400	39985.410	9	0.000	276.914	526.795	192297.105	41372.825
10	-0.000	242.416	2549.999	0.000	0.000	10	-0.000	242.416	2549.999	0.000	0.000
11	164.033	445.371	547.709	0.000	2419.997	11	158.692	450.711	565 890	0.000	2419 997
12	0.875	2.996	3.426	0.000	136943.154	12	1.367	0.592	0 433	0 000	128696.852
13	1.478		317.293		95296295.000	13	0.317		335 474		98813773 000
1	510.000	393.525	79 843	473 368	-2.000	1	517.583	33.796	0.000	33.796	-2.000
2	202329.98	39.810	32.264	57.772	187.818	2	16741.95	39.819	32.633	45.555	179.051
3	4.929	41.464	31.894	41.402	475 374	3	0.000	40.395	32.774	0.180	336.112
4	427.426	165.800	39.046	2820.709	1157 482	4	495.385	165.838	39 672	-123.322	547.677
5	1.702	70.575	4.289	2785.904	1062.890	5	1 702	70.573	4 290	-123.322	470.751
6	697 907	0.000	0.000	2921.904	1327.890	6	56.699	0.000	0.000	12.678	735.751
7	8112.533	0.305	1.040	2921 904	2039.101	7	642 172	0.303	1.040	12 678	1441.992
8	26846.967	119.017	41 990	3288.904	2087.101	8	0.000	120.322	41.990	379 678	1489.992
9	0.000	276.914	519.013	189392 680	40783.880	9	0 000	276.914	526.899	192301.906	41373.103
10	-0.000	242.416	2549.999	0.000	0.000	10	-0.000	242.416	2549.999	0 000	0.000
11	160.967	448.436	558.188	0.000	2419.997	11	158 662	450 742	565.994	0.000	2419.997
12	0.874	2.995	3.426	0.000	132196.004	12	0.000	0.254	0.000	0 000	128691.070
13	1.531		327.692		97319953.000	13	0.130		335.578		98816270.000
1	517.083	393.266	79.838	473 104	-2.000	1	517.683	24.944	4.971	29 915	-2.000
2	202228.89	39.819	32.008	47.535	179.442	2	12168.60	39.820	32.637	45.482	179.042
3	4.926	40.932	32.224	1.916	341 777	3	5.018	46.053	32.691	0.139	335.987
4	427.451	165.835	39.670	-0.748	572.823	4	406.770	165.838	39 672	-126.196	547.157
5	1.702	70.573	4 290	-0.748	494.623	5	1.702	70.573	4.290	-126.196	470.251
6	697.016	0.000	0.000	135.252	759.623	6	41 211	0.000	0.000	9.804	735.251
7	8111.816	0.303	1.040	135.252	1466.192	7	473.977	0.303	1.040	9 804	1441.427
8	26844.554	120.171	41.990	502.252	1514.192	8	1646.971	120.353	41.990	376.804	1489.427
9	0.000	276.914	528.379	192179.330	41349.423	9	0.000	276.914	527.003	192304.177	41373.564
10	-0.000	242.416	2549.999	0.000	0 000	10	-0.000	242.416	2549.999	0.000	0.000
11	158.813	450.590	565.474	0.000	2419.997	11	158 631	450.772	566 098	0.000	2419.997
12	0.874	2.994	3.425	0.000	128878.444	12	0.801	0.188	0.218	0 000	128688.230
13	1 570		335.058		98752766 000	13	0.095		335.682		98817682.000
1	517.100	391.580	79.845	471.425	-2.000	1	517 783	21.470	4 263	25.732	-2.000
2	202251.38	39.819	32.609	47.475	179.419	2	10375.17	39.820	32.642	45.423	179.033
3	4.904	40.946	32.424	1 821	341.452	3	5 037	39.989	32 681	0.106	335.858
4	429.021	165.835	39.070	-7 497	571.440	4	403.199	165.839	39.072	-128 489	546.632
5	1.702	70.573	4.290	-7.497	493.243	5	1.702	70.573	4 290	-128 489	469.756
6	684.956	0.000	0.000	128.503	758.243	6	35.137	0.000	0 000	7 511	734.756
7	7440.586	0.303	1.040	128.503	1464 801	7	407.954	0.303	1.040	7 511	1440.867
8	26454 143	120.176	41.990	495.503	1512.801	8	1412.263	120.383	41.990	374.511	1480.867
9	0 000	276.914	526.396	192186.080	41350.796	9	0.000	276.914	527.107	192307.072	41374.021
10	-0.000	242.416	2549.959	0.000	0.000	10	-0.000	242.416	2549 999	0 000	0.000
11	154.808	450.595	565.492	0.000	2419 997	11	158.601	450 802	566 202	0.000	2419.997
12	0.841	2.944	3.458	0.000	128830.304	12	0.864	0.161	0.187	0 000	128685.377
13	1.570		335.076		93756244.000	13	0.031		335.786		98818795.000
1	517.183	391.580	79.794	471.375	-2.000	1	517.883	19.648	3.891	23 539	-2.000
2	203257.98	39.819	32.013	47 073	179.311	2	9435.61	39.820	32.647	45.172	179.024
3	4.907	40.920	32.428	1.361	339.891	3	5.050	39.964	32 480	0.077	335.740
4	431.203	165.836	39.070	-39.920	564.723	4	400 844	165.839	39.673	-130.543	546.156
5	1.702	70.573	4.290	-39.920	486.600	5	1.702	70 573	4 290	-130.543	469.310
6	688.365	0.000	0.000	96.080	751.600	6	31.955	0.000	0 000	5 457	734.310
7	7440.592	0.303	1 040	96.080	1458.104	7	373.346	0.303	1 040	5.457	1440.355
8	26437.255	120.201	41.990	463.080	1506.104	8	1289.184	120.413	41.990	372 457	1488.355
9	0.000	276.914	526.483	192218.504	41357.408	9	0.000	276.914	527.211	192309 127	41374.428
10	-0.000	242.416	2549.999	0.000	0.000	10	-0.000	242.416	2549.999	0.000	0.000
11	158.783	450.620	565.578	0.000	2419.997	11	158.571	450.832	566.306	0 000	2419.997
12	0.842	2.944	3.796	0.000	128791.183	12	0.866	0.148	0.170	0 000	128682.812
13	1.578		335.162		98772990 000	13	0.073		335.690		98819784.000

PREDICTED S-IVB-503N PROPULSION SYSTEM
PERFORMANCE (SECOND BURN) COMPUTER PROGRAM AA89
1-1/2 ORBIT MISSION

1	517.983	17.242	3.400	20.642	-2.000	1	518.283	6.487	1.207	7.694	-2.000
2	8192.71	39.820	32.652	44.915	179.017	2	2635.91	39.820	32 667	44.429	179.001
3	5.071	39.951	32.083	0 051	335.632	3	5.372	39.880	32.681	0 001	335.404
4	396.886	165.840	39.073	-132.397	545.724	4	342.593	165 841	39.674	-135.908	544.863
5	1.702	70.573	4.290	-132.397	468.905	5	1.702	70.572	4.290	-135.908	468.108
6	27.746	0.000	0.000	3.603	733.905	6	8.927	0 000	0.000	0 092	733.108
7	327.626	0.303	1.040	3.603	1439.885	7	123.254	0.303	1.040	0.092	1438.891
8	1126.591	120.444	41.990	370 603	1487.885	8	400 055	120.534	41 990	367.092	1486 891
9	0.000	276.914	527.315	192310.980	41374.795	9	0.000	276.914	527 027	192314.492	41375.476
10	-0.000	242.416	2549.999	0.000	0.000	10	-0.000	242.416	2549.999	0.000	0.000
11	158.540	450.863	566.410	0 000	2419.997	11	158.450	450.954	566 722	0 000	2419.997
12	0.870	0.130	0.149	0 000	128680.487	12	0 922	0.049	0.053	0.000	128675.982
13	0.064		335.994		98820670.000	13	0.020		336.306		98822268.000

1	518.083	13.653	2.069	16.322	-2.000	1	518.383	4.481	0.798	5.279	-2.000
2	6337.82	39.820	32.057	44.700	179.010	2	1601.46	39.820	32 671	44.353	178.997
3	5.116	39.934	32.084	0.029	335.537	3	5.613	39.857	32.080	-0.006	335.358
4	388.306	165.840	39.073	-133.951	545.355	4	303.377	165.842	39.675	-136 452	544.711
5	1.702	70.573	4.290	-133.951	468.561	5	1.702	70.572	4.290	-136 452	467.970
6	21.464	0.000	0.000	2.049	733.561	6	5.424	0.000	0 000	-0.452	732.970
7	259.430	0.303	1.040	2.049	1439.476	7	85.138	0.303	1.040	-0.452	1436.688
8	884.145	120.474	41.990	369 049	1487.476	8	264 456	120.565	41.990	366.548	1486.688
9	0.000	276.914	527.419	192312 533	41375.100	9	0.000	276.914	527.731	192315 035	41375.576
10	-0.000	242.416	2549.999	0.000	0.000	10	-0.000	242.416	2549.999	0 000	0.000
11	158.510	450.893	566.514	0.000	2419.997	11	158.419	450.984	566 826	0 000	2419.997
12	0.878	0.103	0.117	0.000	128678.524	12	0.963	0 034	0.035	0.000	128675.235
13	0.049		336.098		98821400.000	13	0.012		336 410		98822477.000

1	518.183	9.641	1.851	11 492	-2.000	1	518.483	0.000	0.000	0 000	-2.000
2	4264.68	39.820	32.062	44.539	179.005	2	0.00	39.821	32 076	44 312	178 995
3	5.209	39.909	32.083	0.013	335.462	3	0 000	39.843	32 082	-0 011	335.323
4	371.108	165.841	39.674	-135 113	545.069	4	0 000	165.842	39 675	-136.749	544.613
5	1.702	70.572	4.290	-135.113	468.297	5	1.702	70.572	4 290	-136.749	467.883
6	14.443	0.000	0.000	0.867	733.297	6	0.000	0.000	0.000	-0.749	732 883
7	183.195	0.303	1.040	0 887	1439.146	7	0 000	0.303	1 040	-0 749	1438.535
8	613 158	120.504	41.990	367 887	1487.146	8	0 000	120 595	41 990	366 251	1486.535
9	0.000	276.914	527.523	192313.697	41375.326	9	0 000	276.914	527 835	192315 332	41375.625
10	-0.000	242.416	2549.999	0.000	0.000	10	-0.000	242.416	2549.999	0.000	0 000
11	158.480	450.923	566.018	0.000	2419.997	11	158.389	451.014	566.930	0.000	2419.997
12	0.894	0.072	0.081	0.000	128677.032	12	0.000	0.000	0.000	0.000	128674.785
13	0.033		336 202		98821929.000	13	0.000		336.514		98822565.000

LH2 TANK

PRESSURE (PSIA)

LOX TANK

PRESSURE (PSIA)

TIME FROM 90% THRUST (SEC)
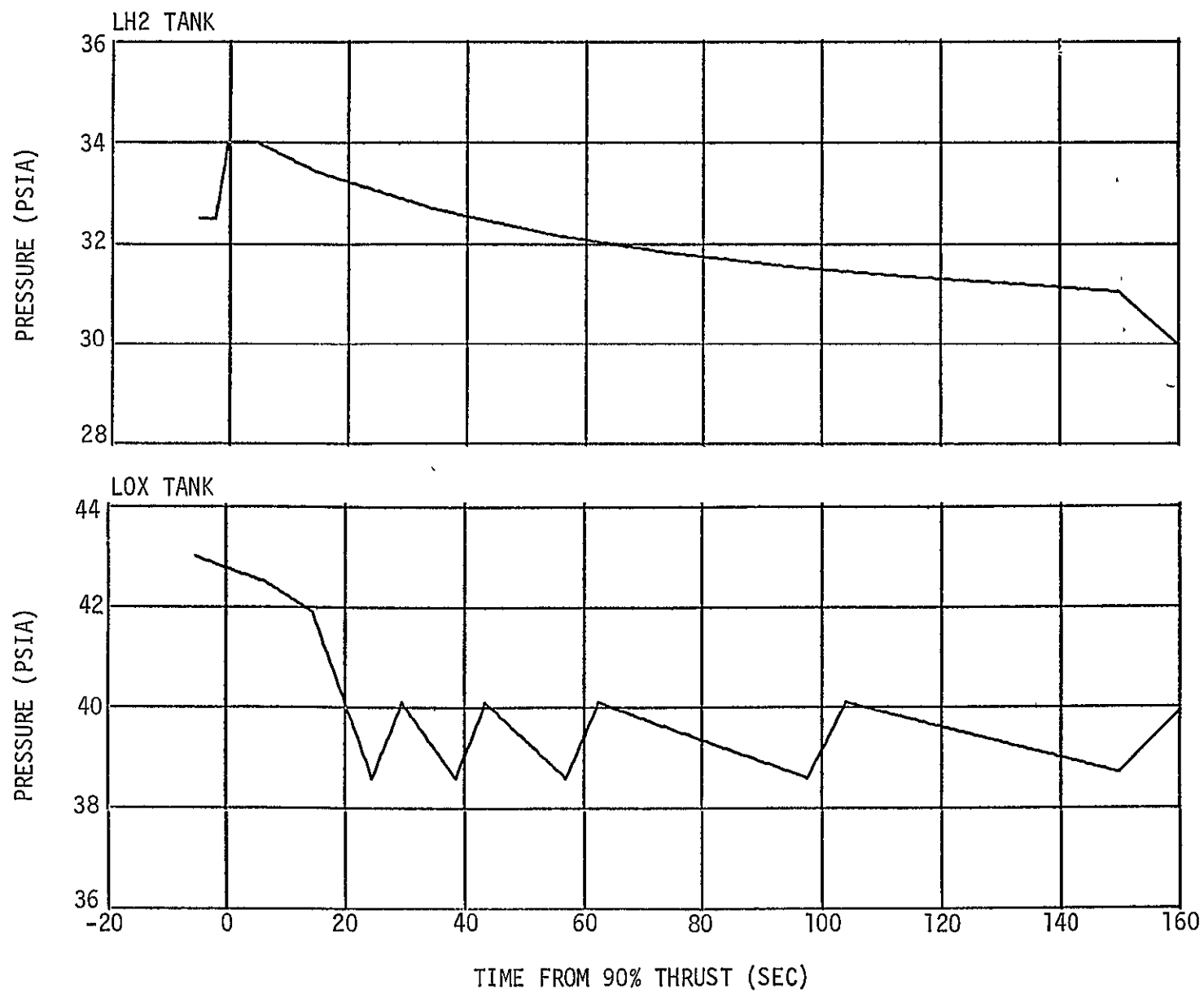
Figure AP 5-1. First Burn Tank Ullage Pressures
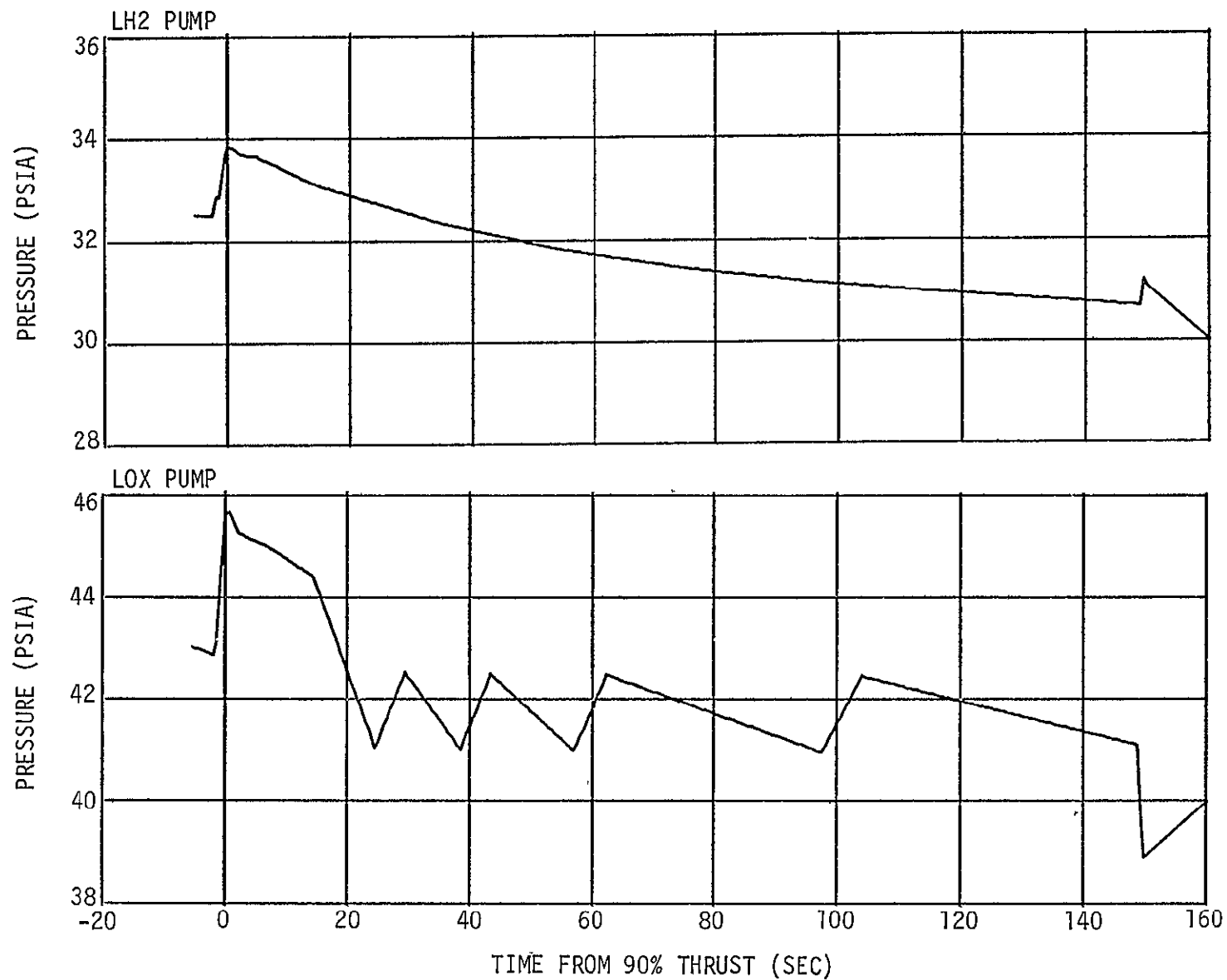
Figure AP 5-2. First Burn LH2 and LOX Pump Inlet Pressures
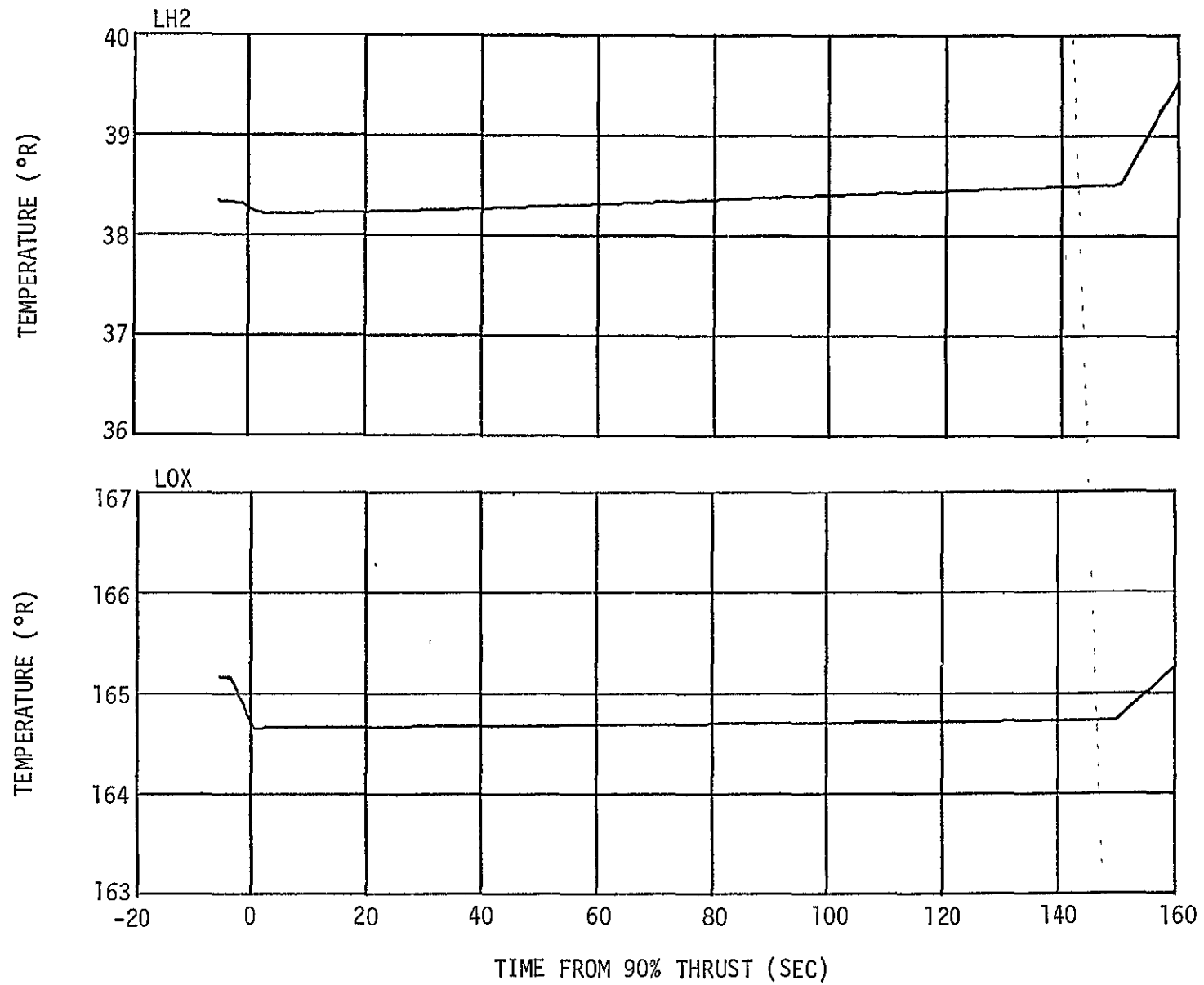
Figure AP 5-3. First Burn LH2 and LOX Pump Inlet Temperatures
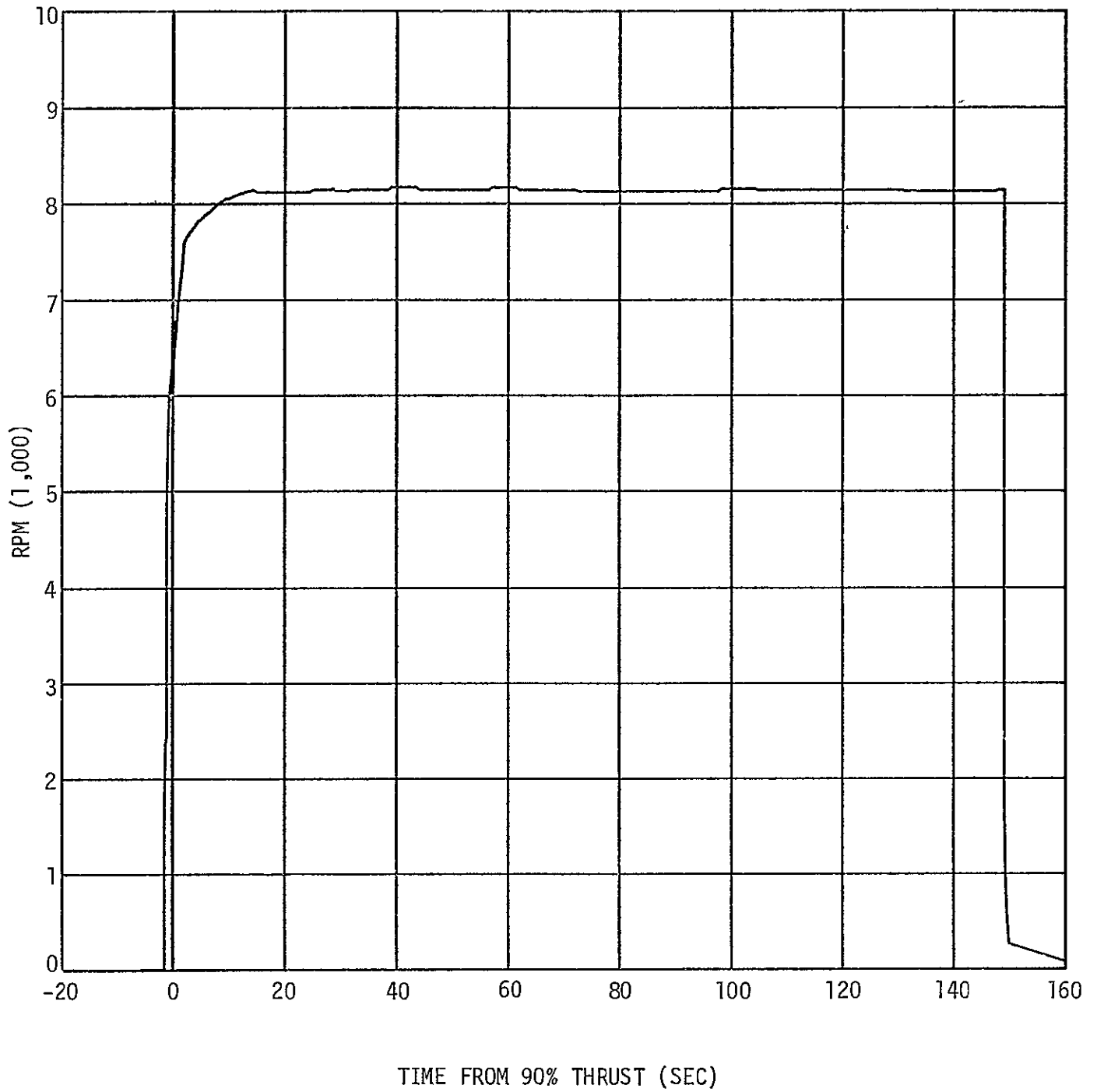
Figure AP 5-4. First Burn LOX Pump Speed
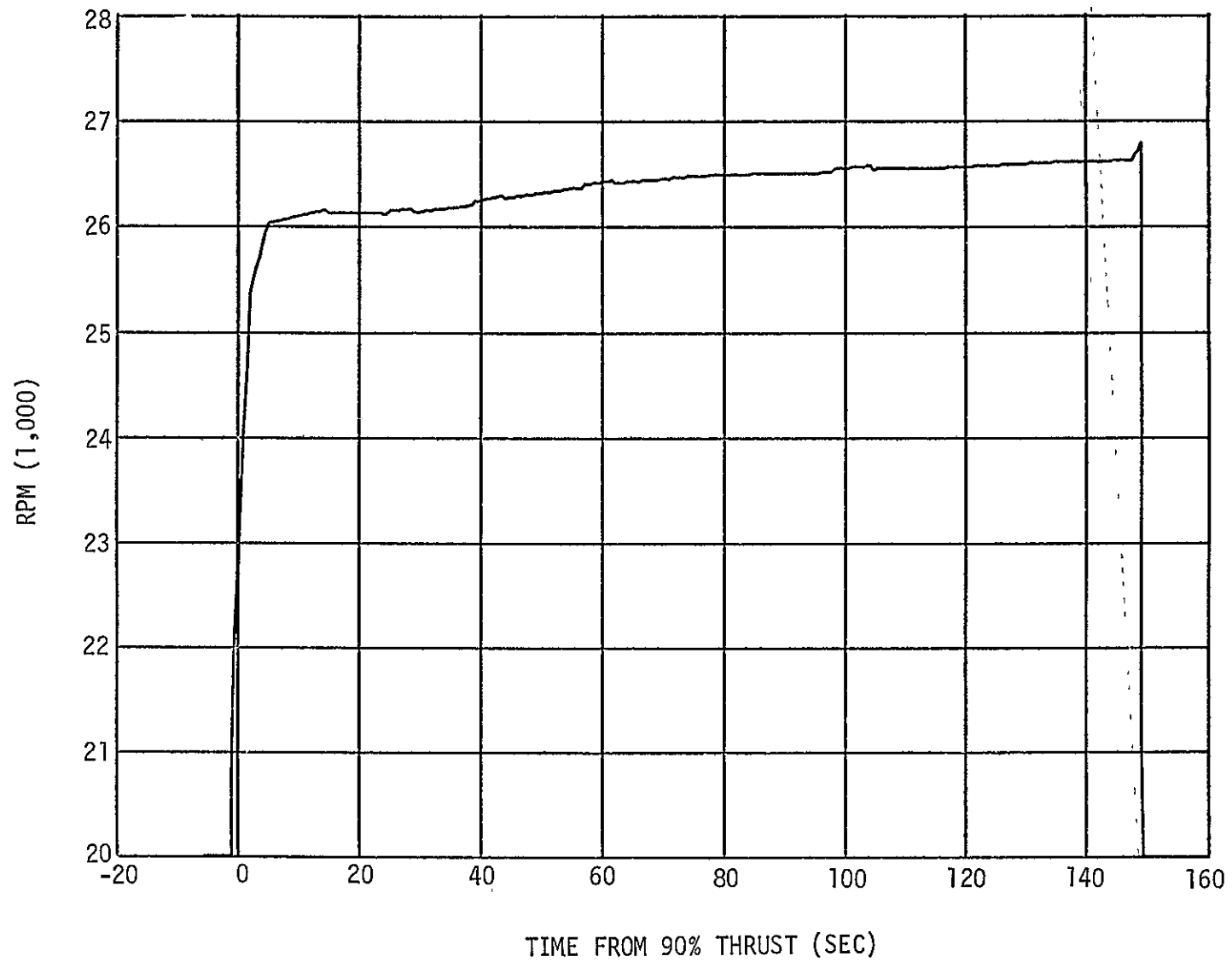
Figure AP 5-5. First Burn LH2 Pump Speed
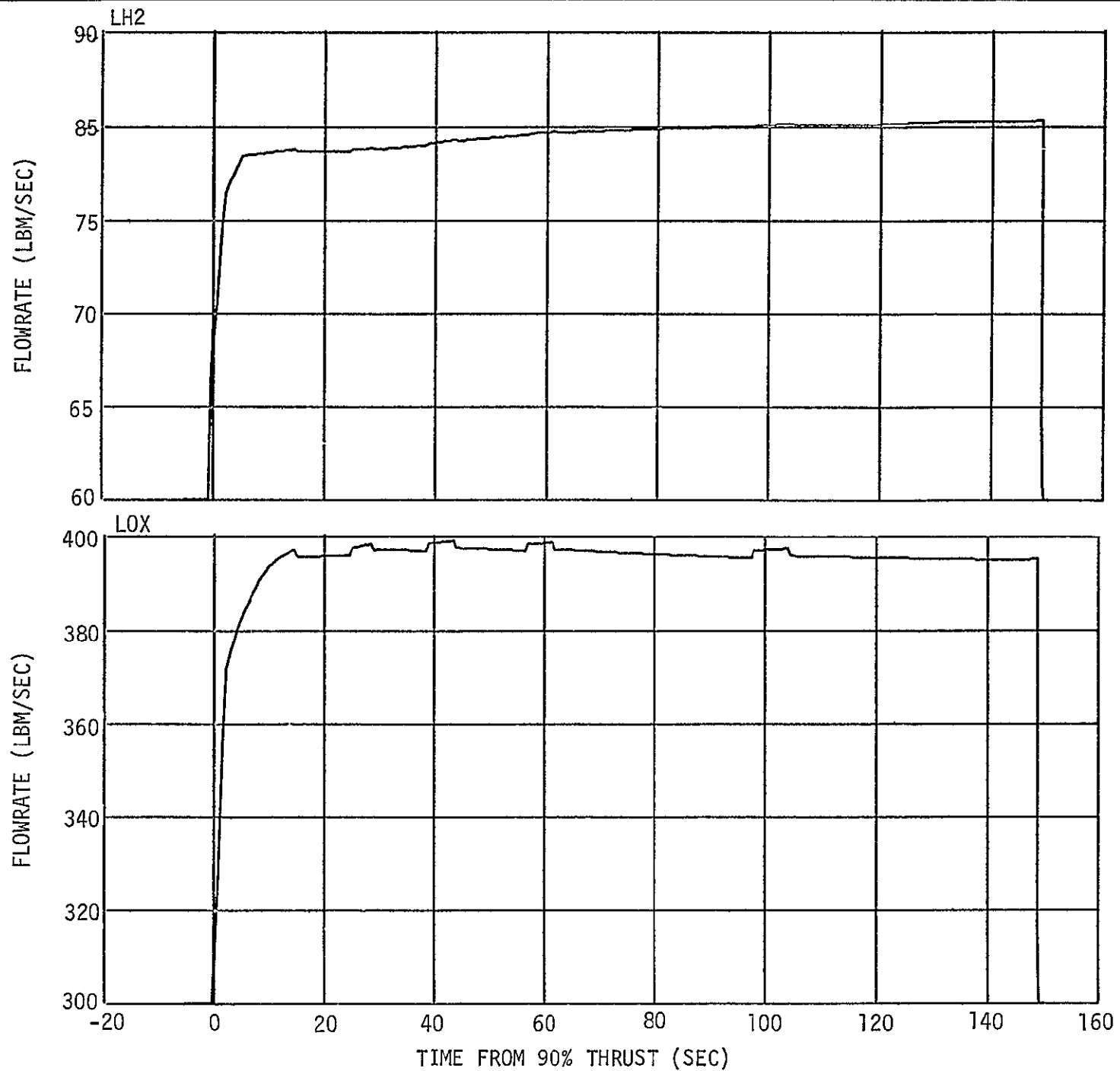
Figure AP 5-6. First Burn LH2 and LOX Flowrates, Pump Inlet
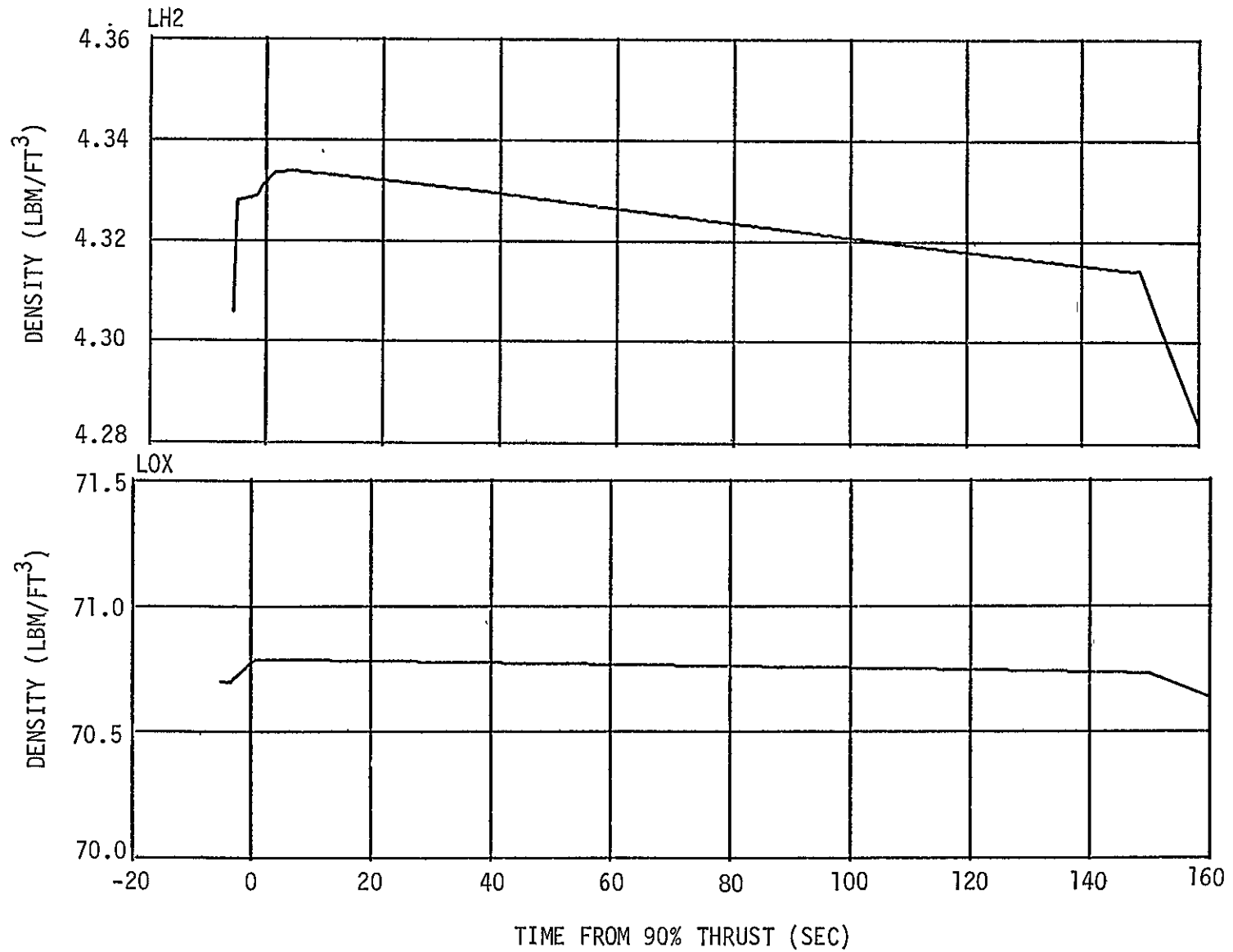
Figure AP 5-7.   First Burn LH2 and LOX Bulk Densities
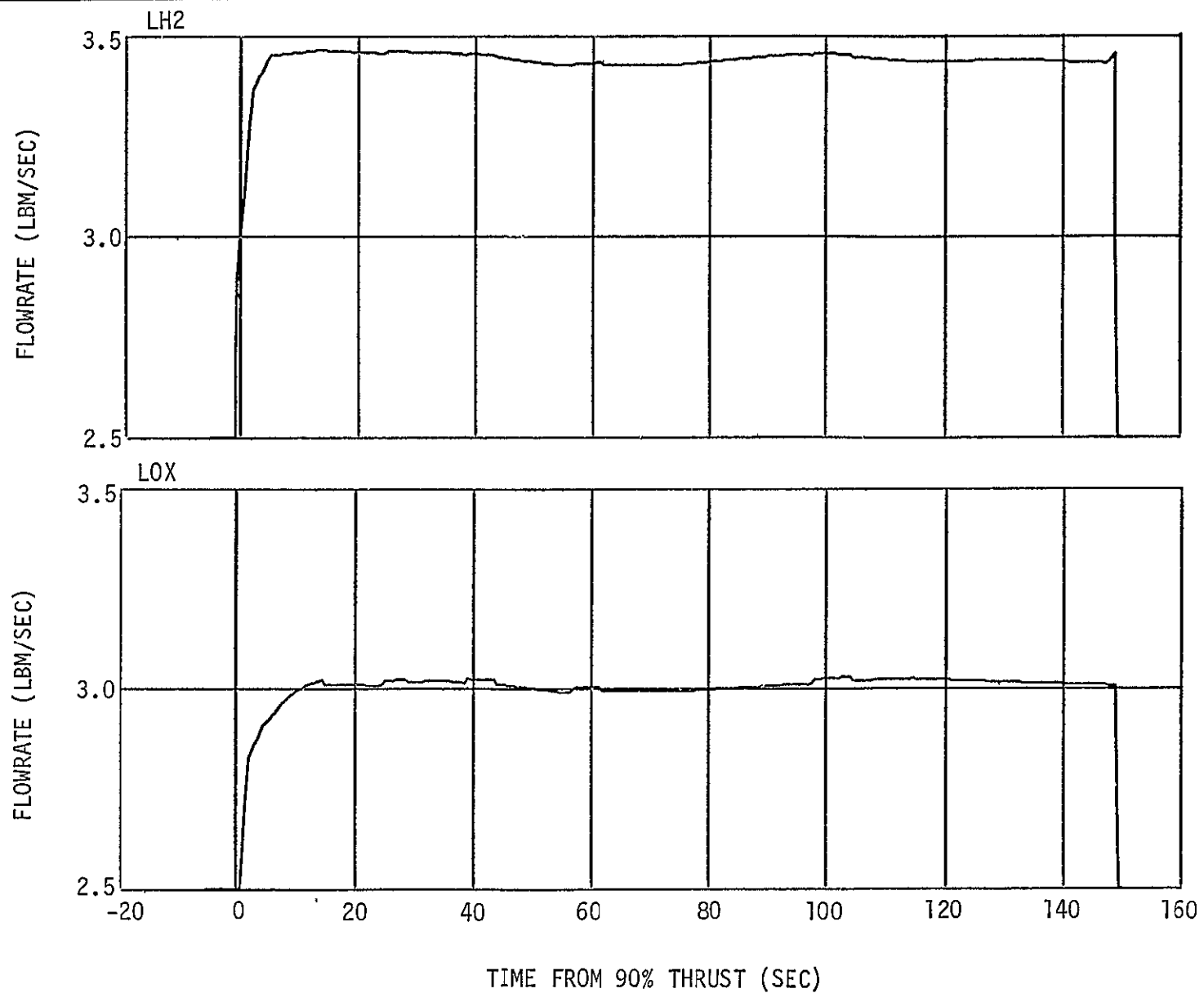
Figure AP 5-8. First Burn Gas Generator LH2 and LOX Flowrates
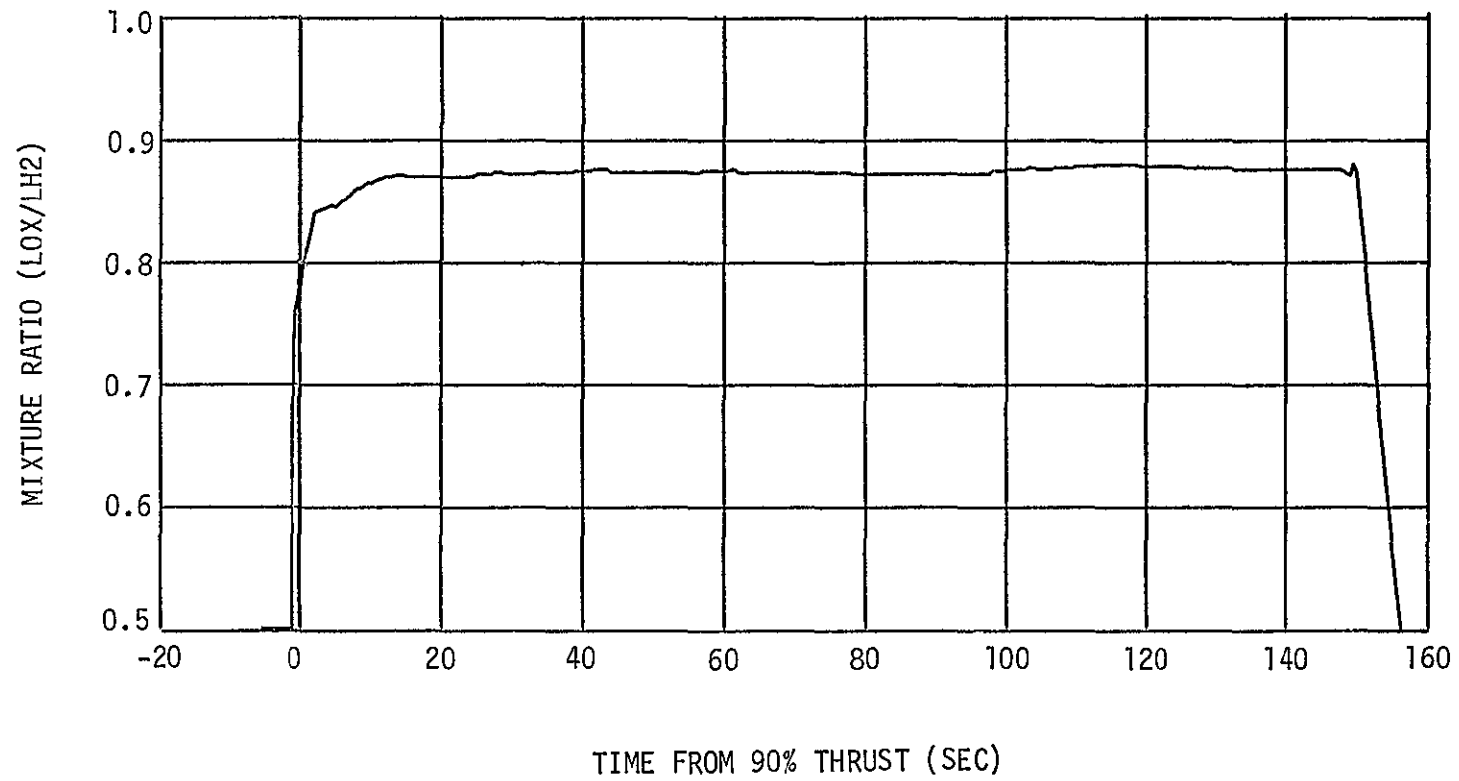
Figure AP 5-9. First Burn Gas Generator Mixture Ratio
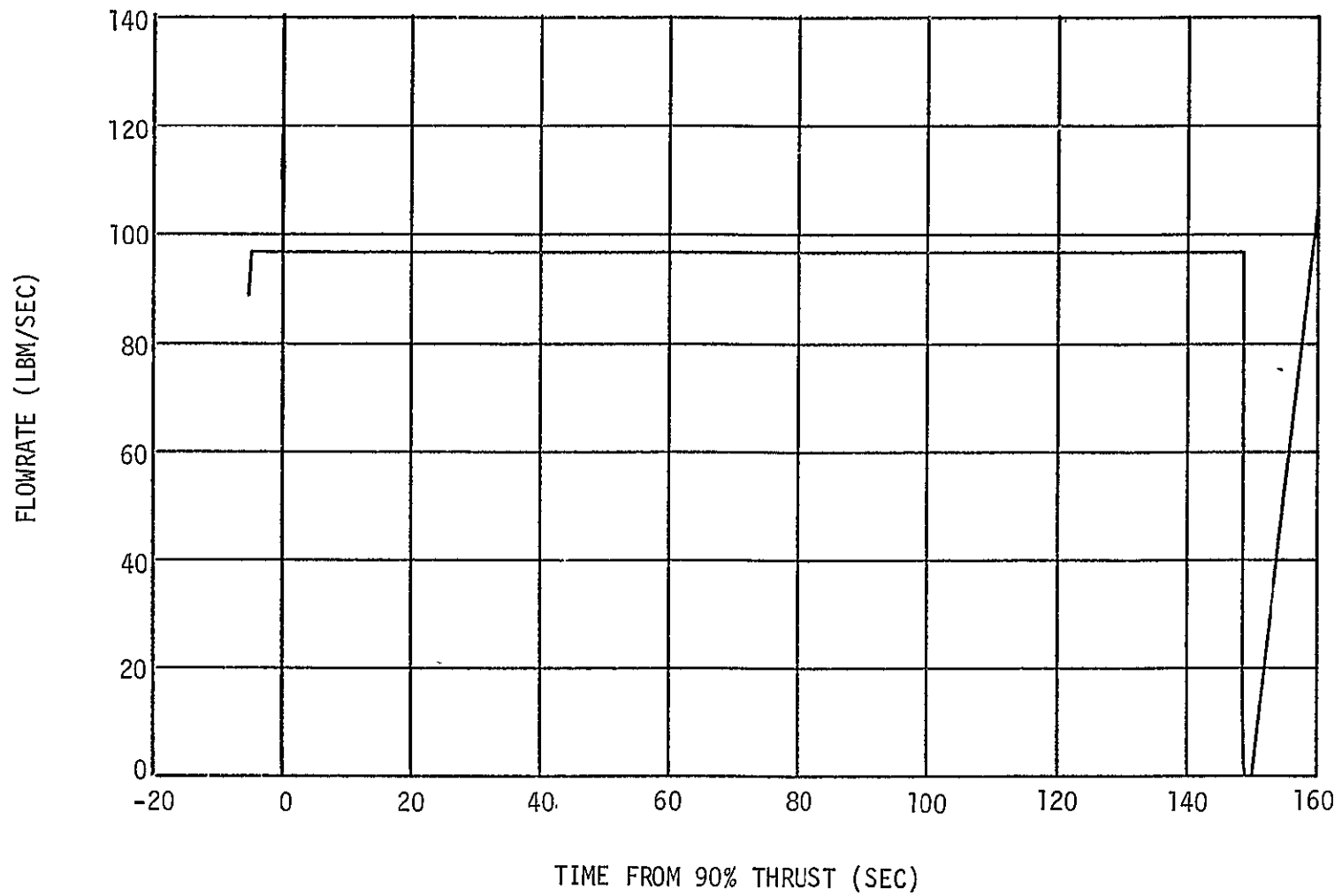
Figure AP 5-10. First Burn LOX Bypass Flowrate
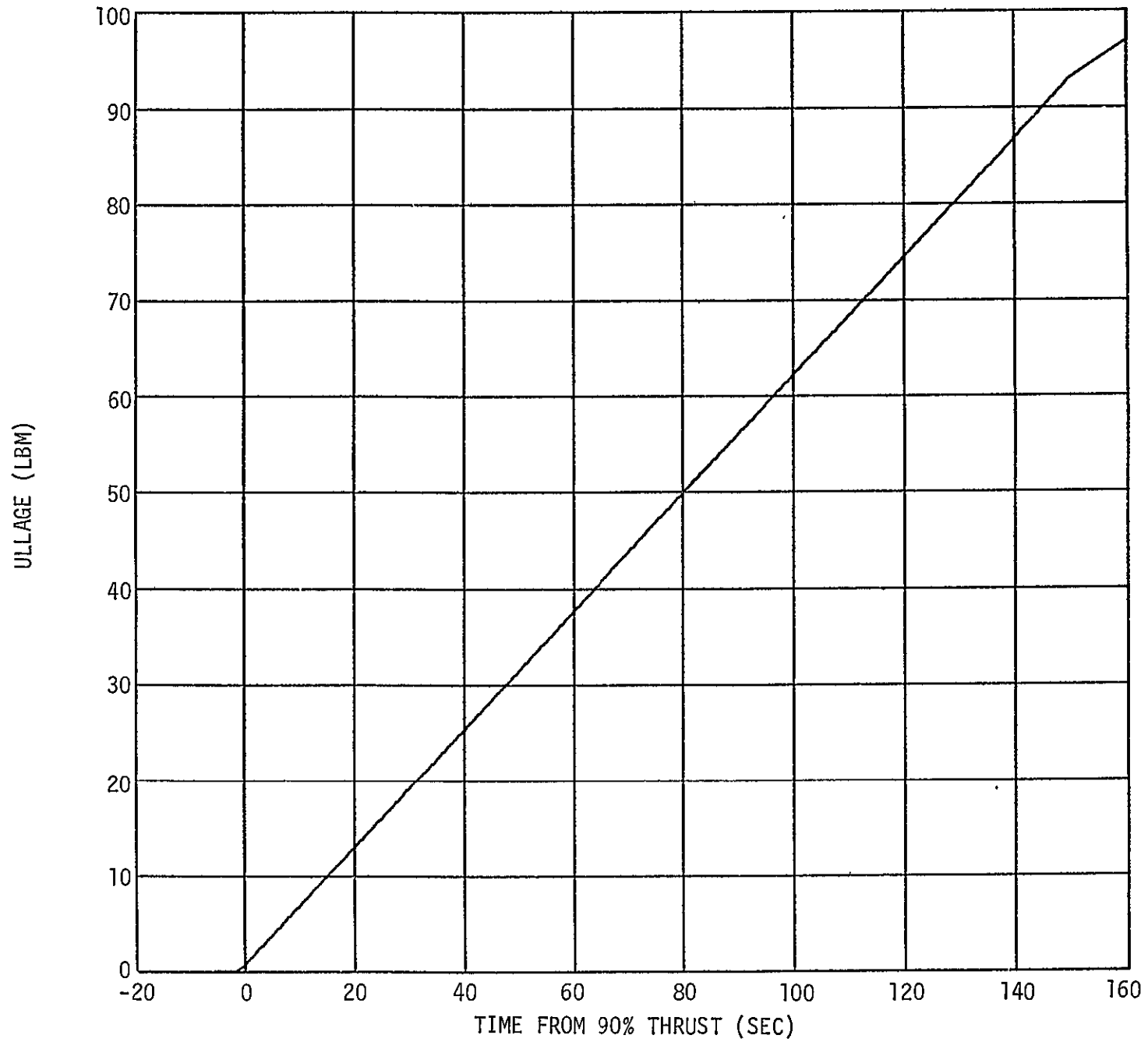
Figure AP 5-11. First Burn LH2 Pressurant Mass Ullage
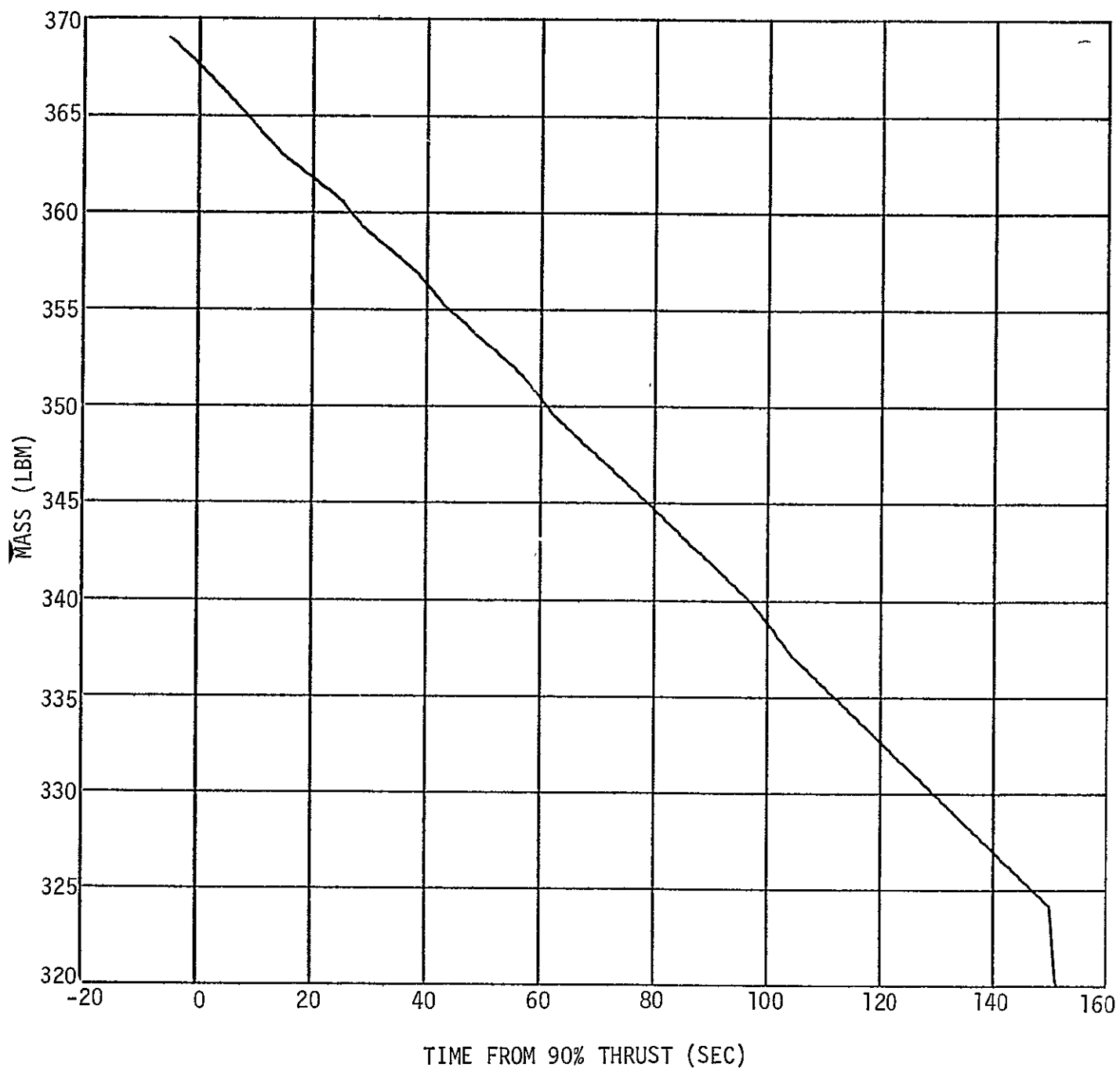
Figure AP 5-12. First Burn Helium Mass in Cold Spheres
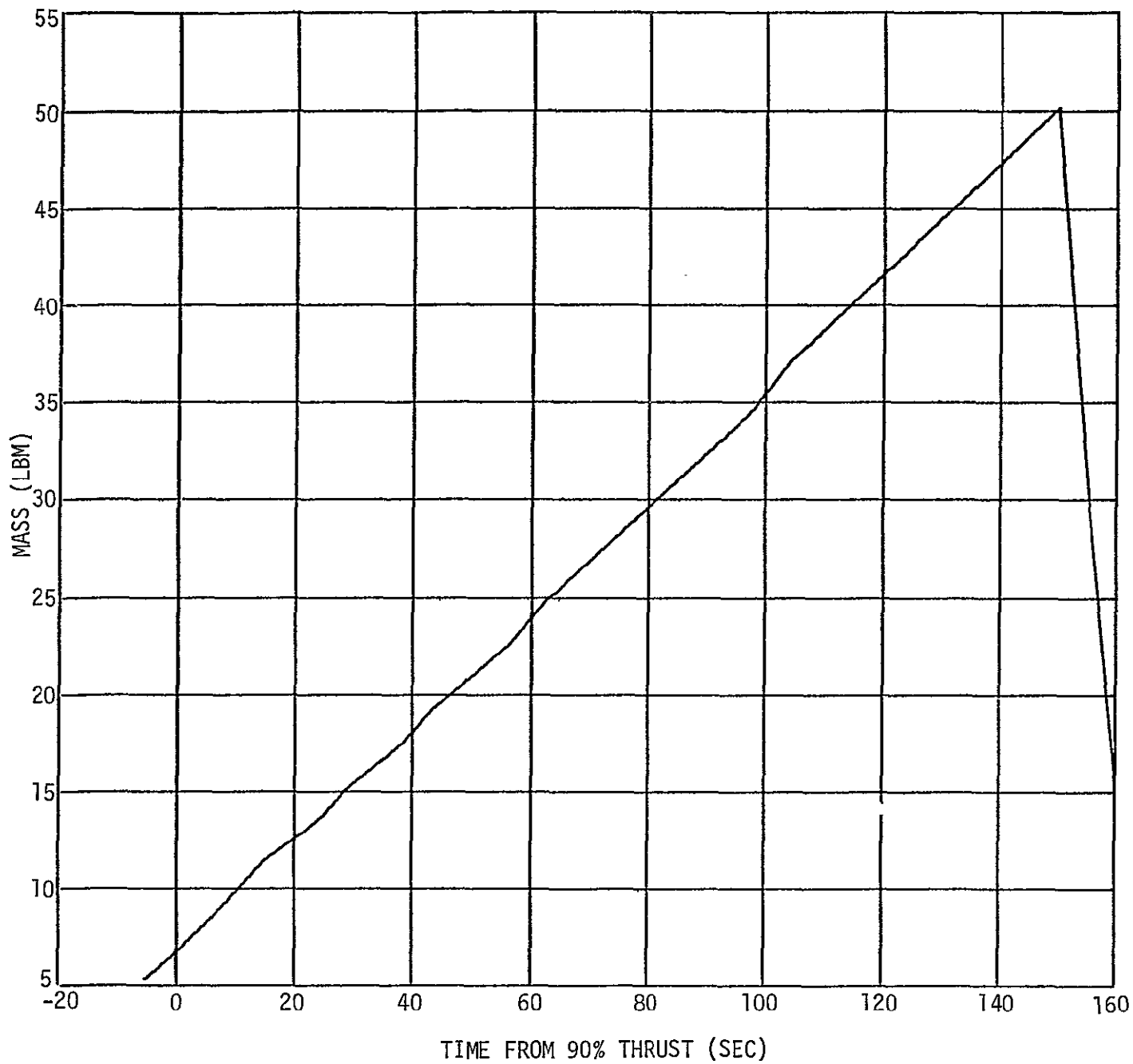
Figure AP 5-13.   First Burn Helium Mass in LOX Ullage
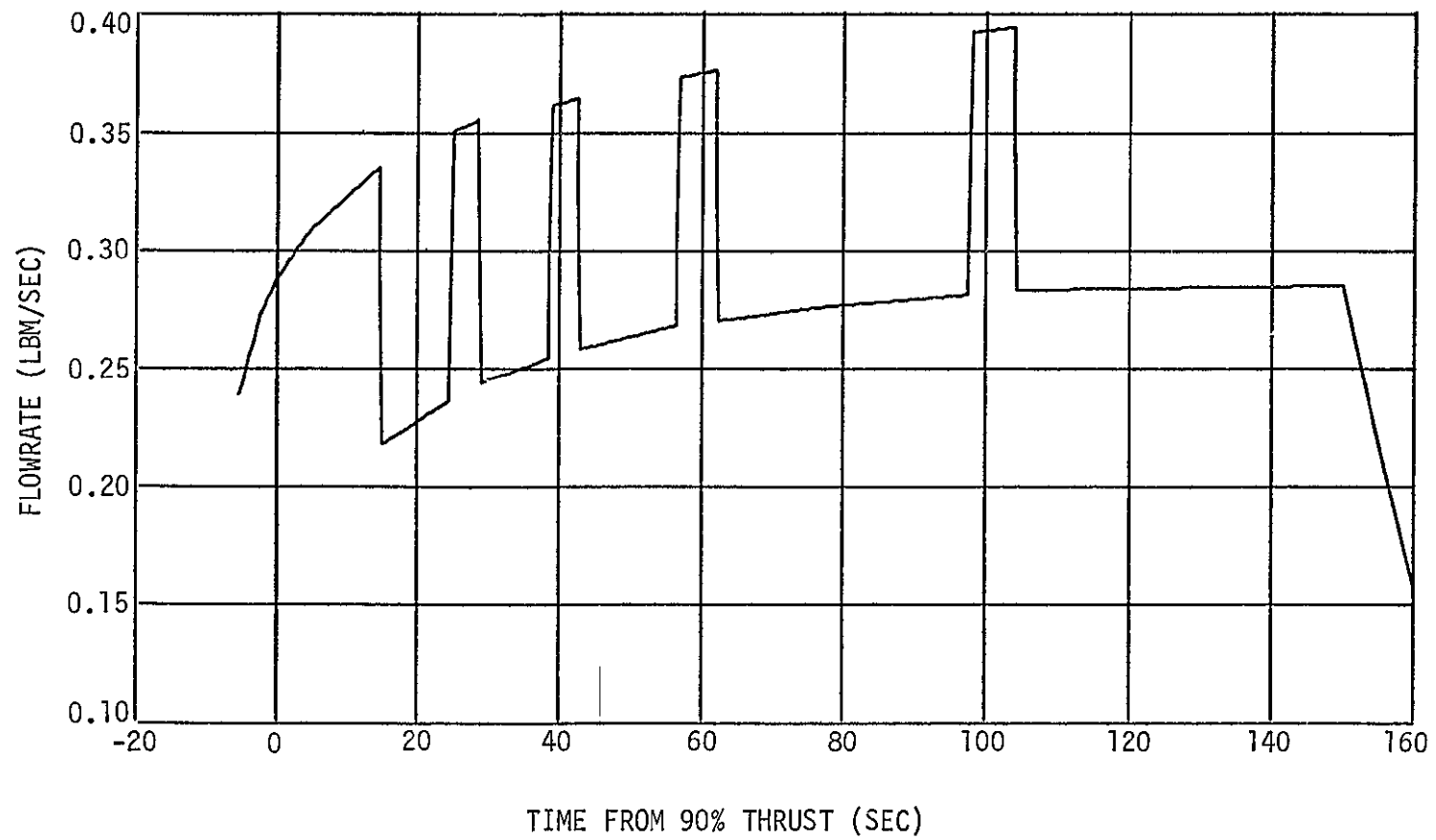
Figure AP 5-14. First Burn Total Helium Flowrate
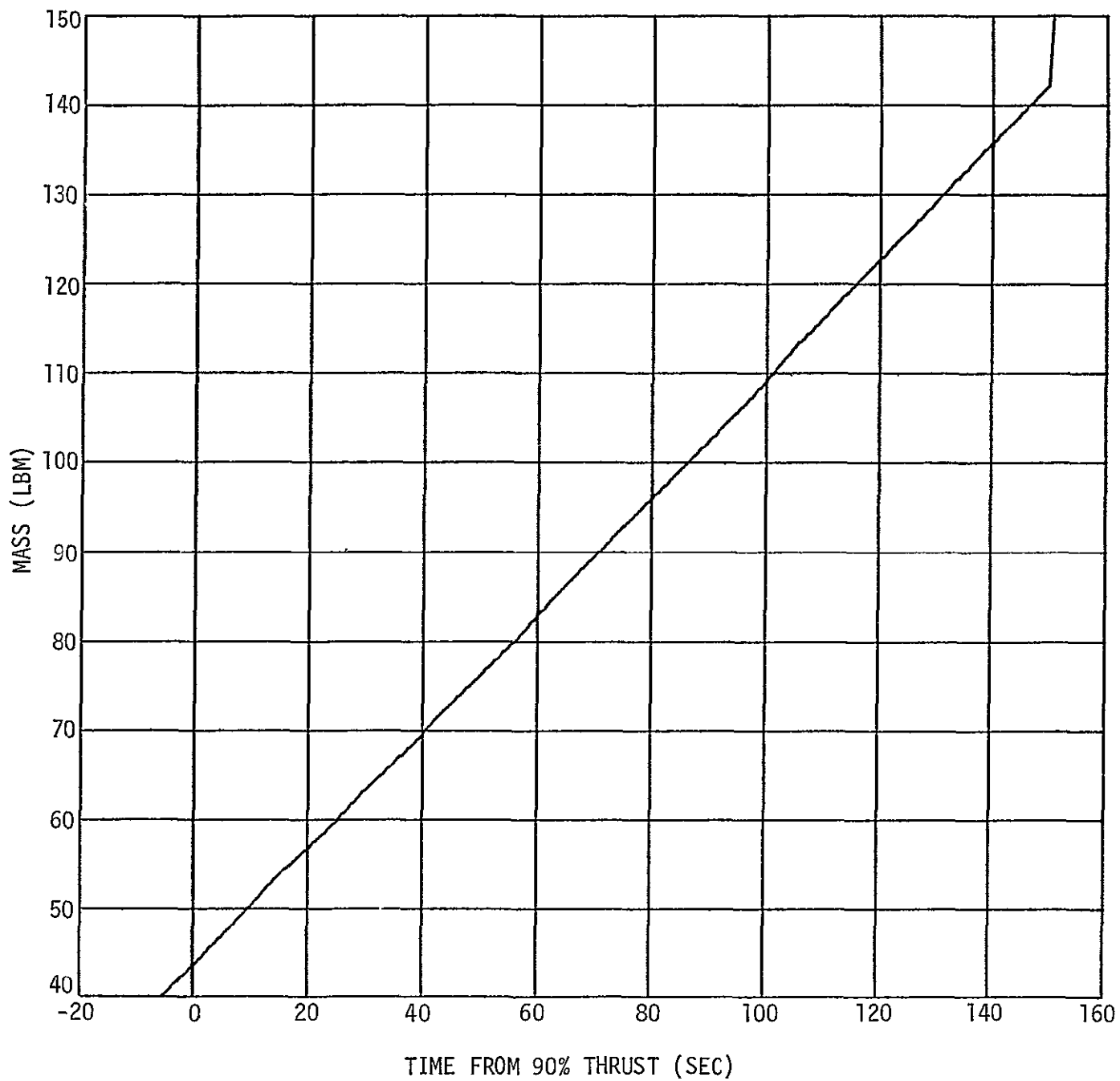
Figure AP 5-15. First Burn LOX Tank Ullage Mass
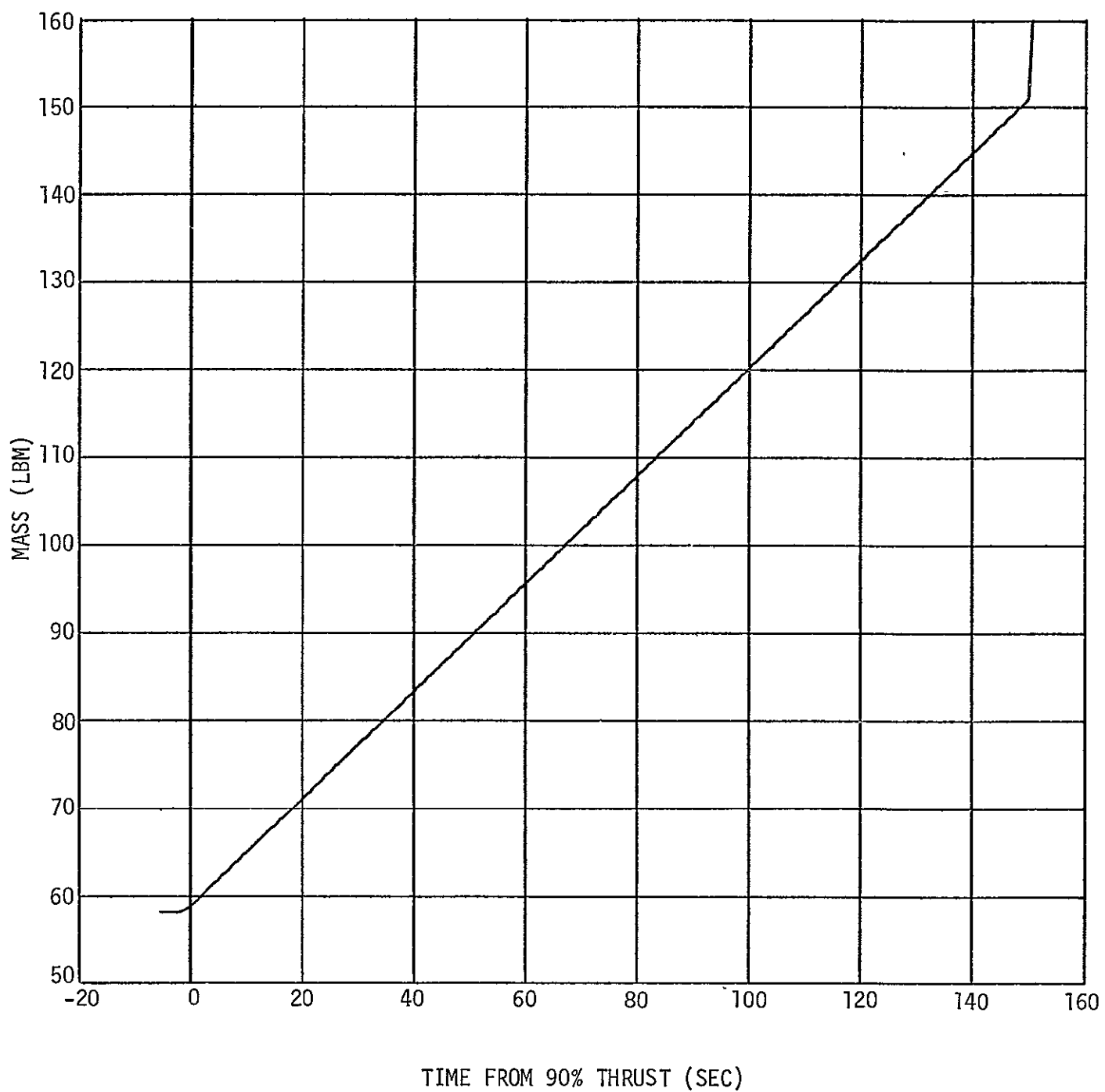
Figure AP 5-16. First Burn LH2 Tank Ullage Mass
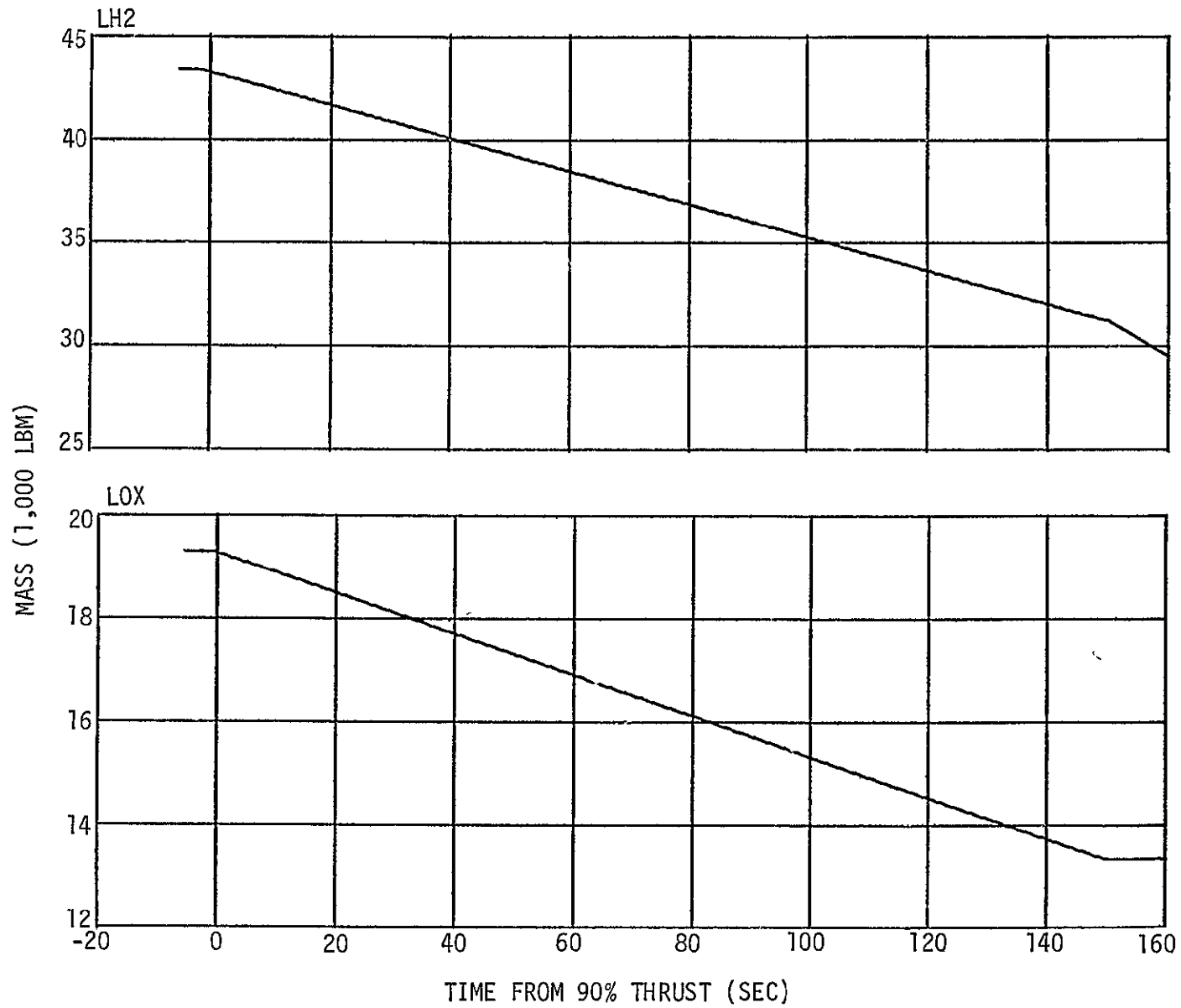
Figure AP 5-17. First Burn LH2 and LOX Mass Onboard
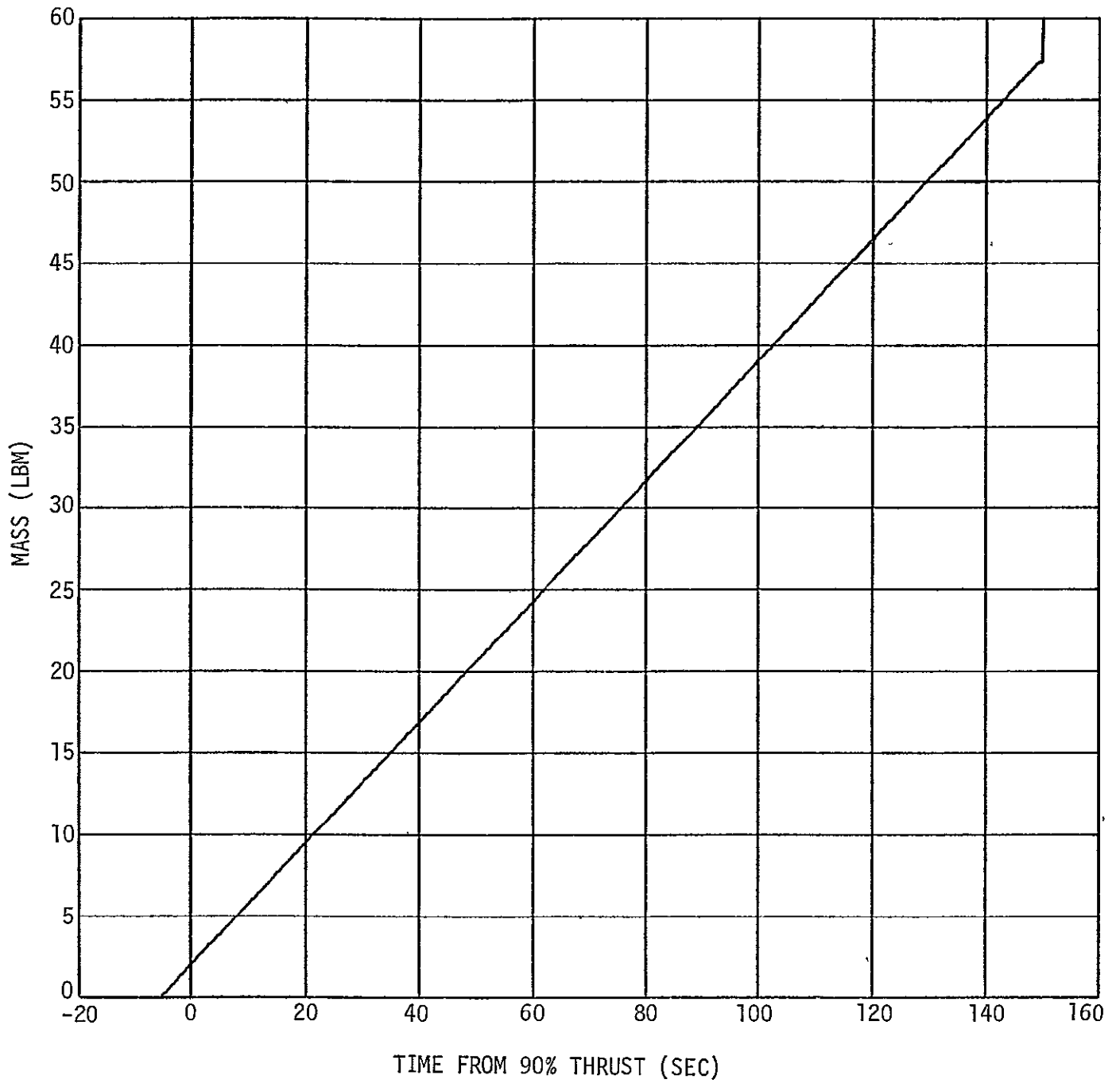
Figure AP 5-18.   First Burn LOX Mass Boiled-Off
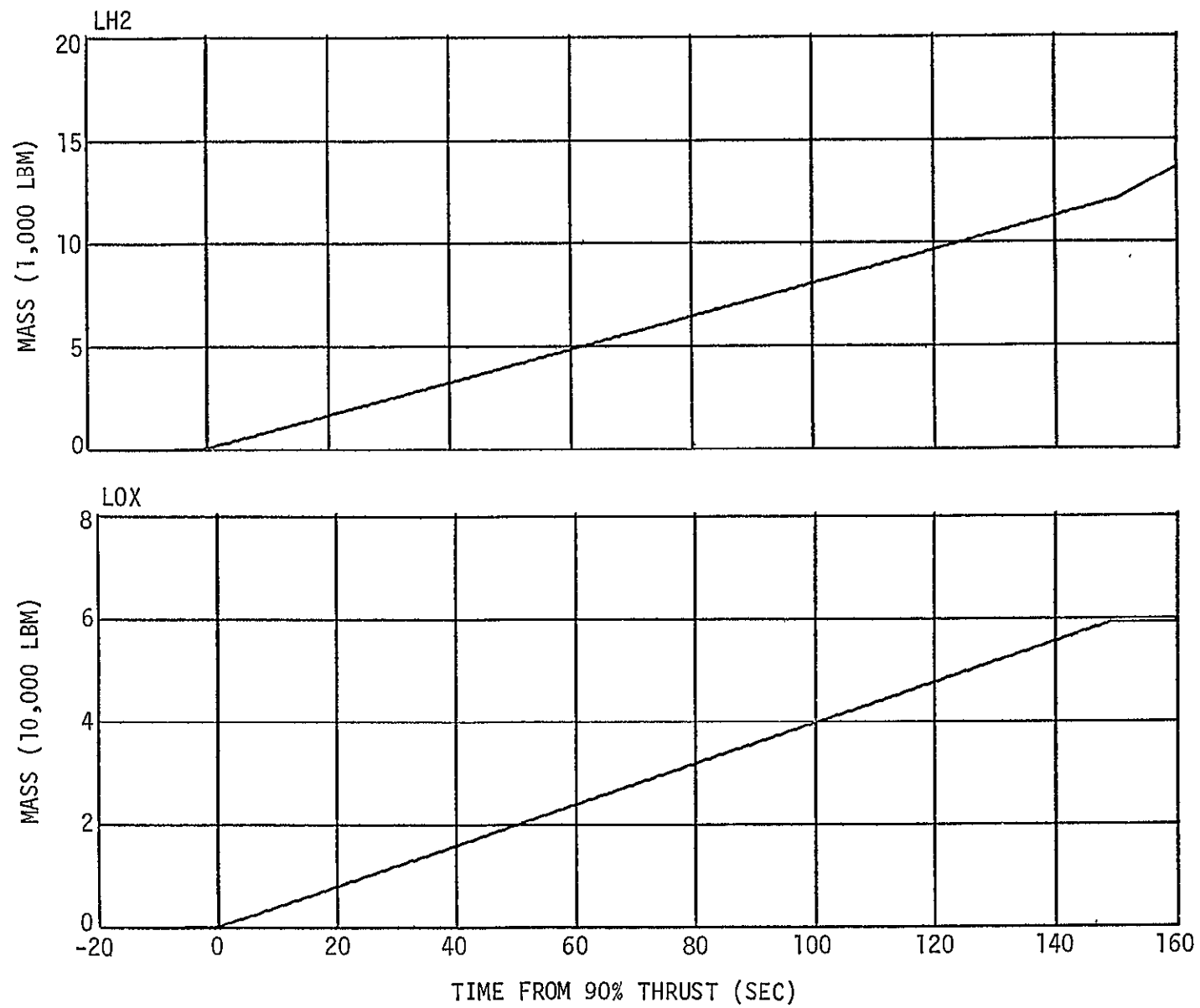
Figure AP 5-19.   First Burn LH2 and LOX Mass Overboard
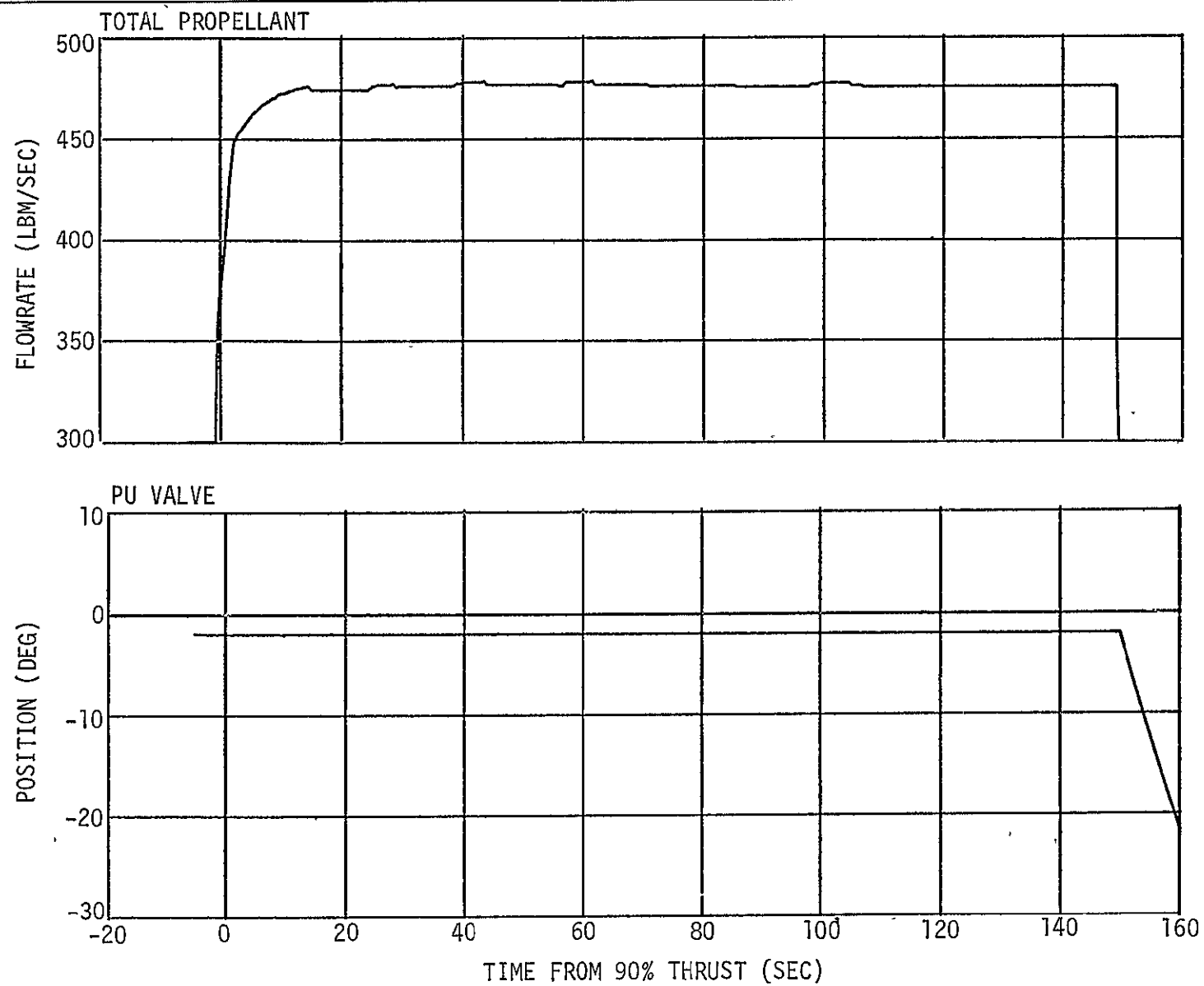
Figure AP 5-20. First Burn Total Propellant Flowrate and PU Valve Position
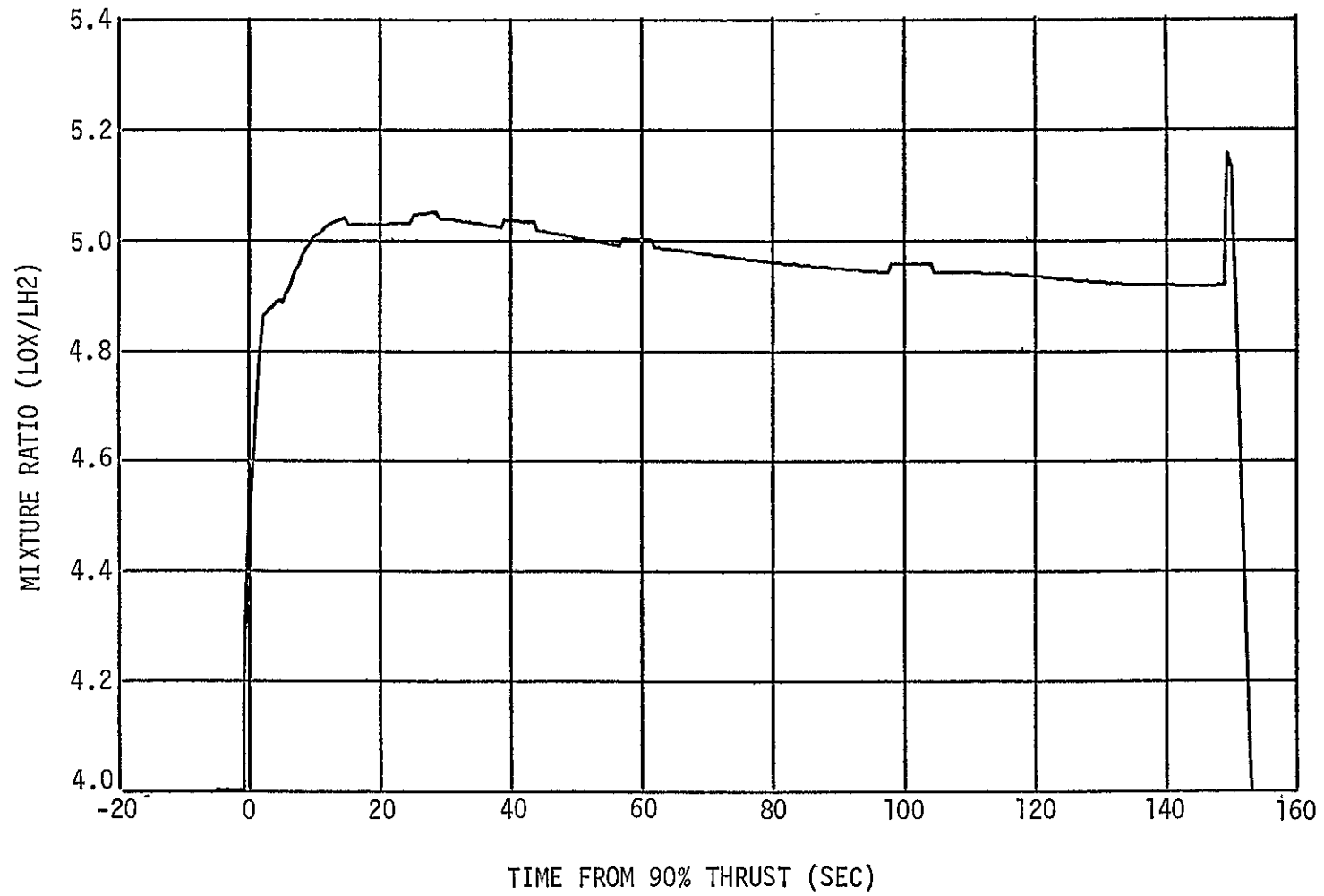
Figure AP 5-21. First Burn Engine Mixture Ratio
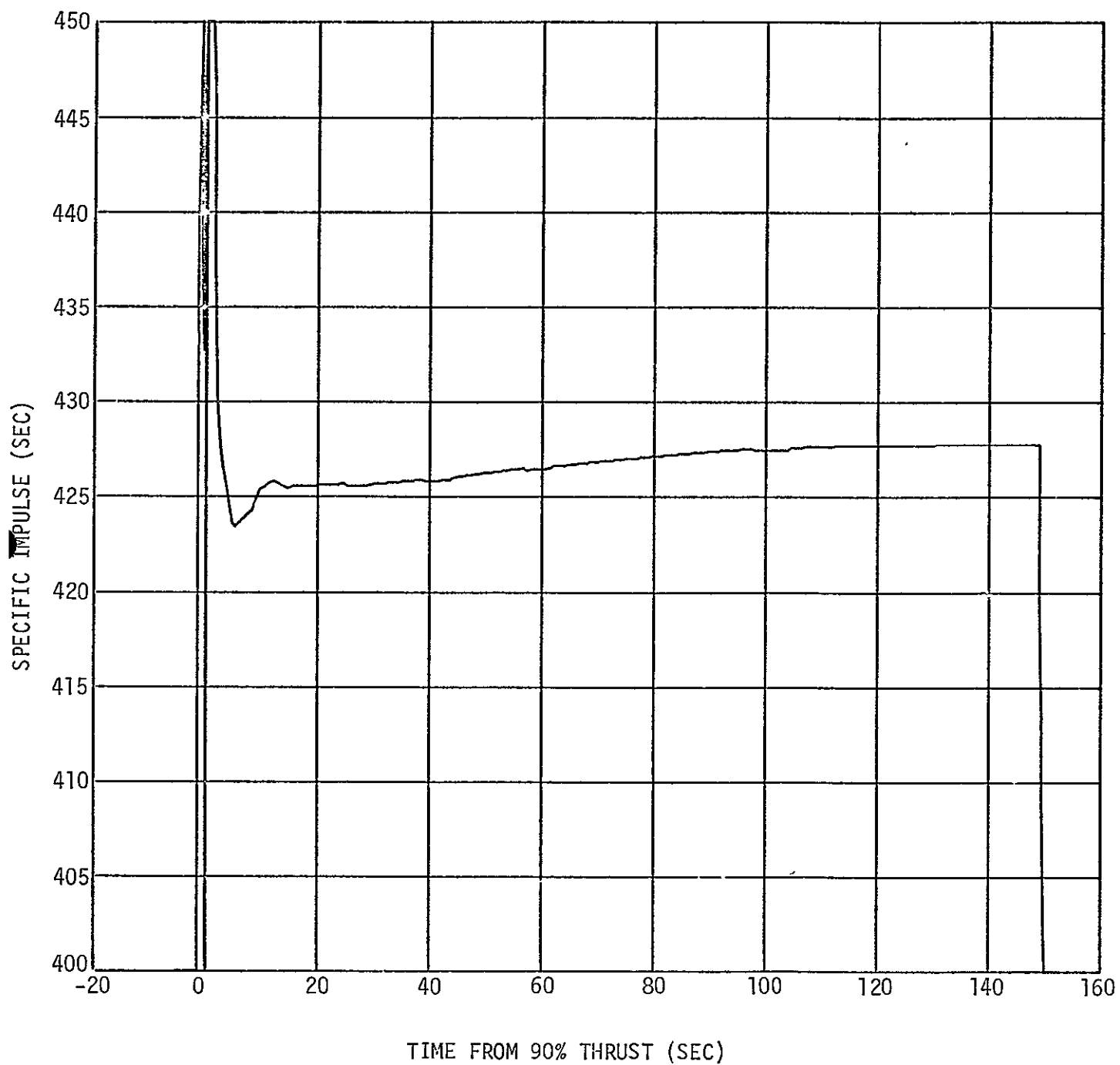
Figure AP 5-22. First Burn Engine Specific Impulse
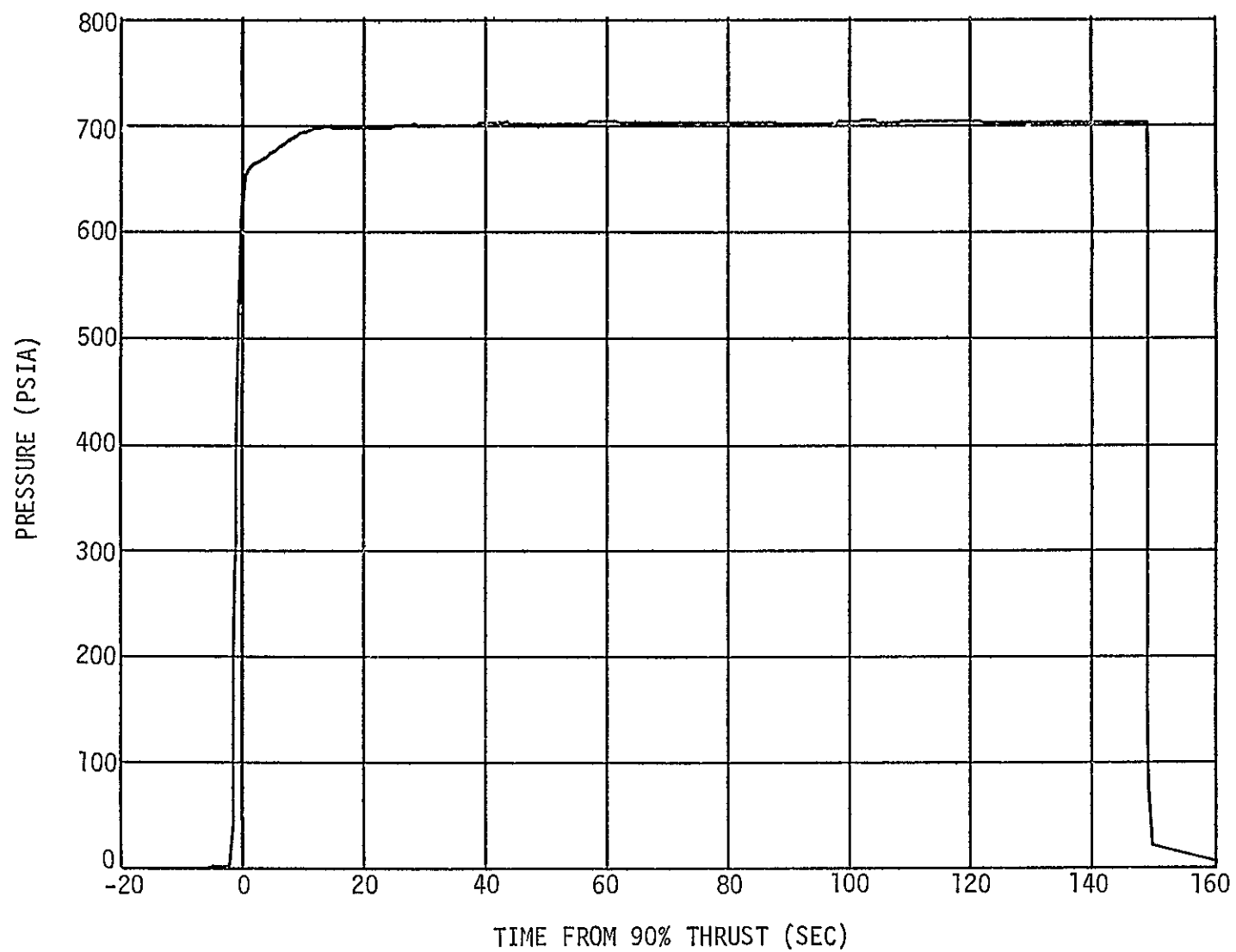
Figure AP 5-23. First Burn Thrust Chamber Pressure (Injector Face)
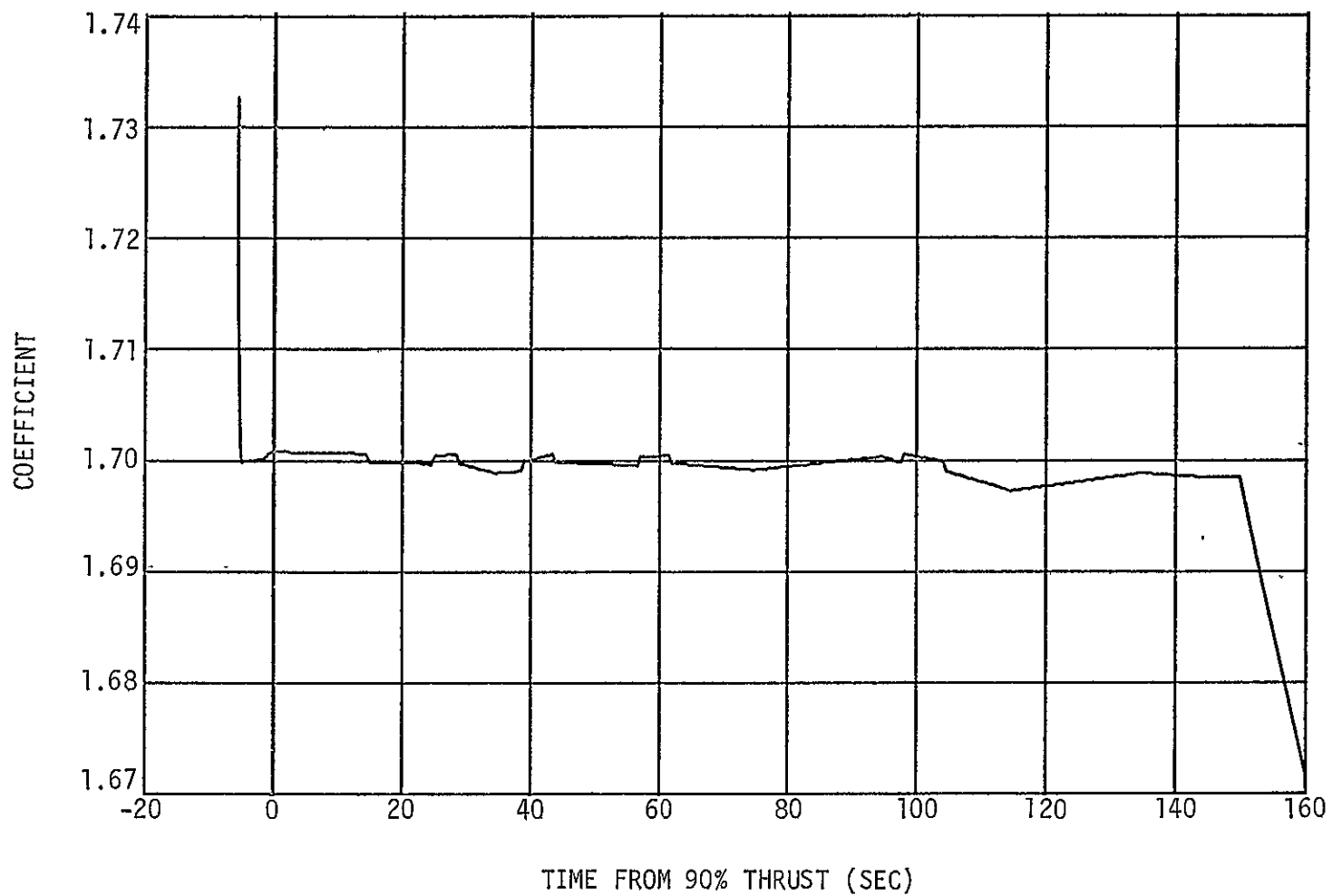
Figure AP 5-24. First Burn Vacuum Thrust Coefficient (Injector Face)
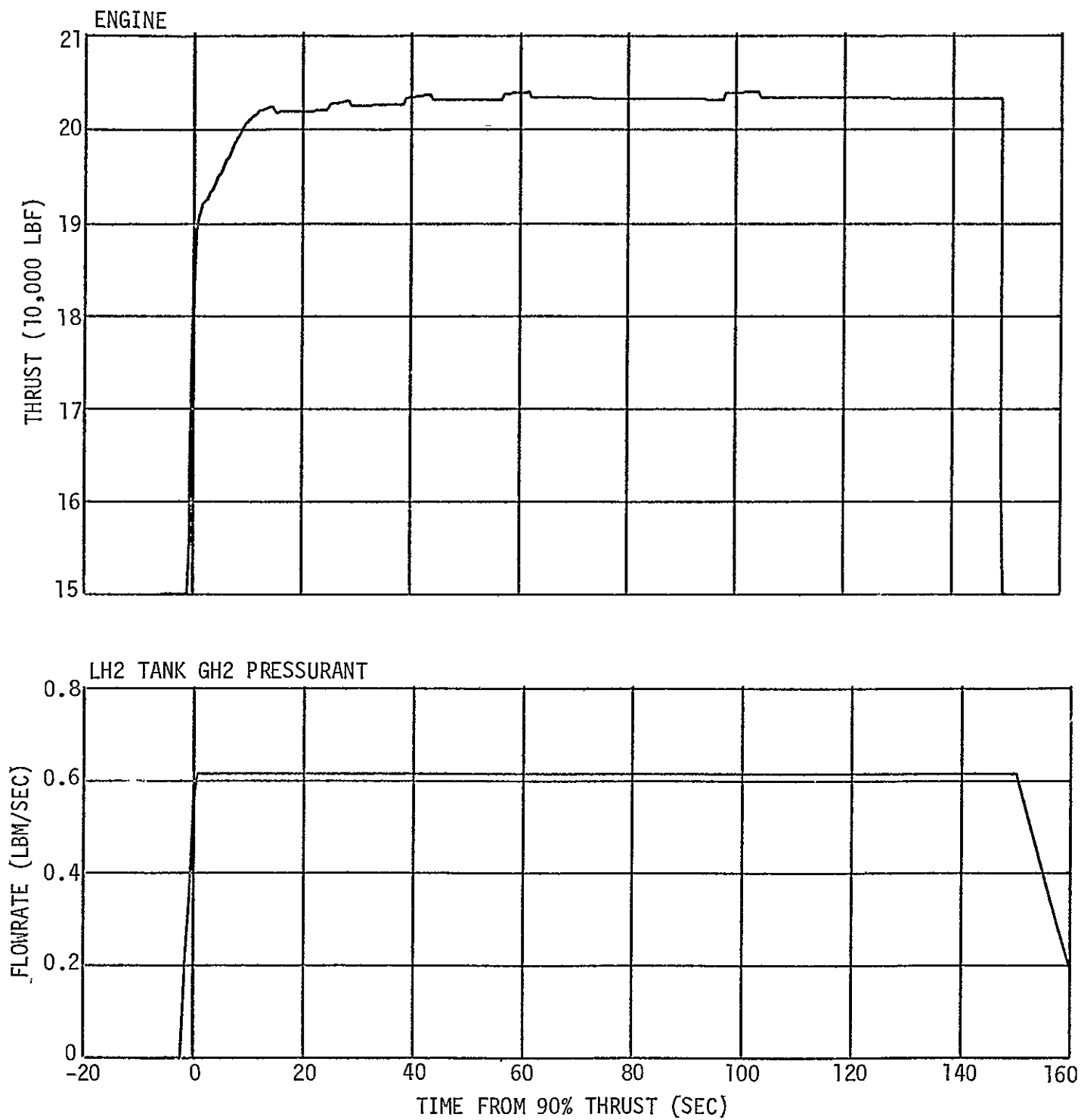
Figure AP 5-25. First Burn Engine Thrust and LH2 Tank GH2 Pressurant Flowrate
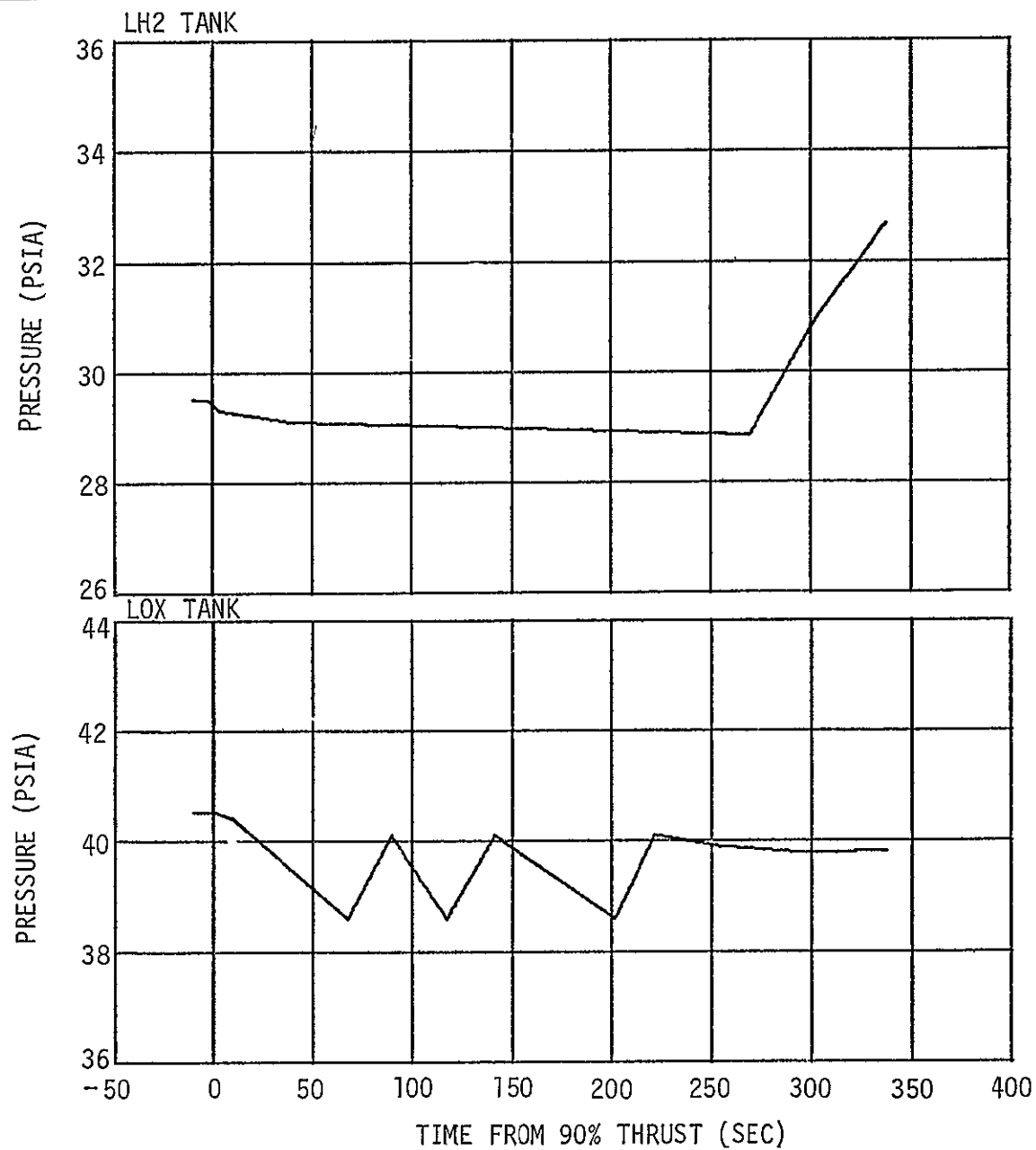
Figure AP 5-26. Second Burn LH2 and LOX Tank Ullage Pressures

LH2 PUMP

LOX PUMP

TIME FROM 90% THRUST (SEC)
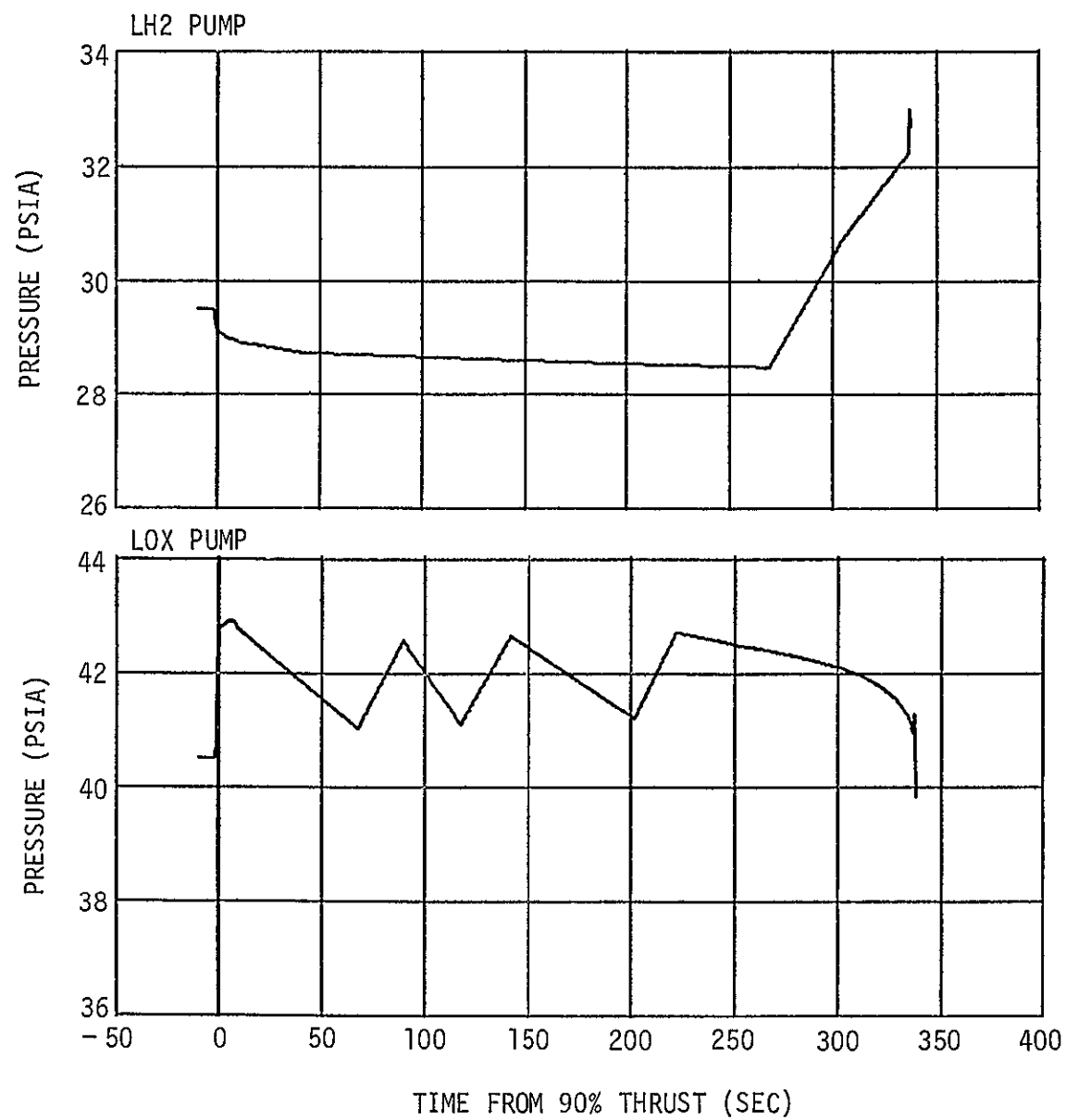
Figure AP 5-27. Second Burn LH2 and LOX Pump Inlet Pressures
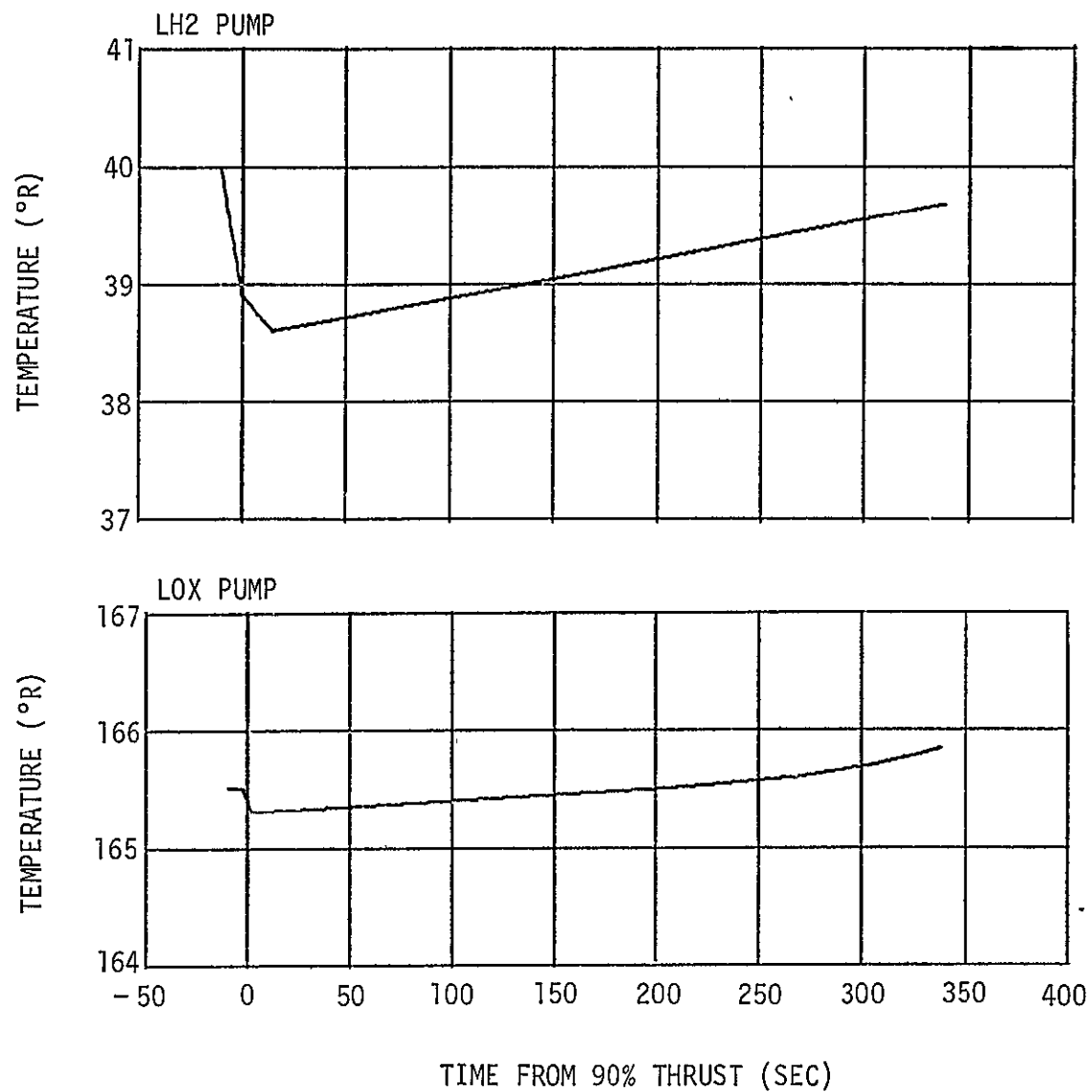
Figure AP 5-28.   Second Burn LH2 and LOX Pump Inlet Temperatures
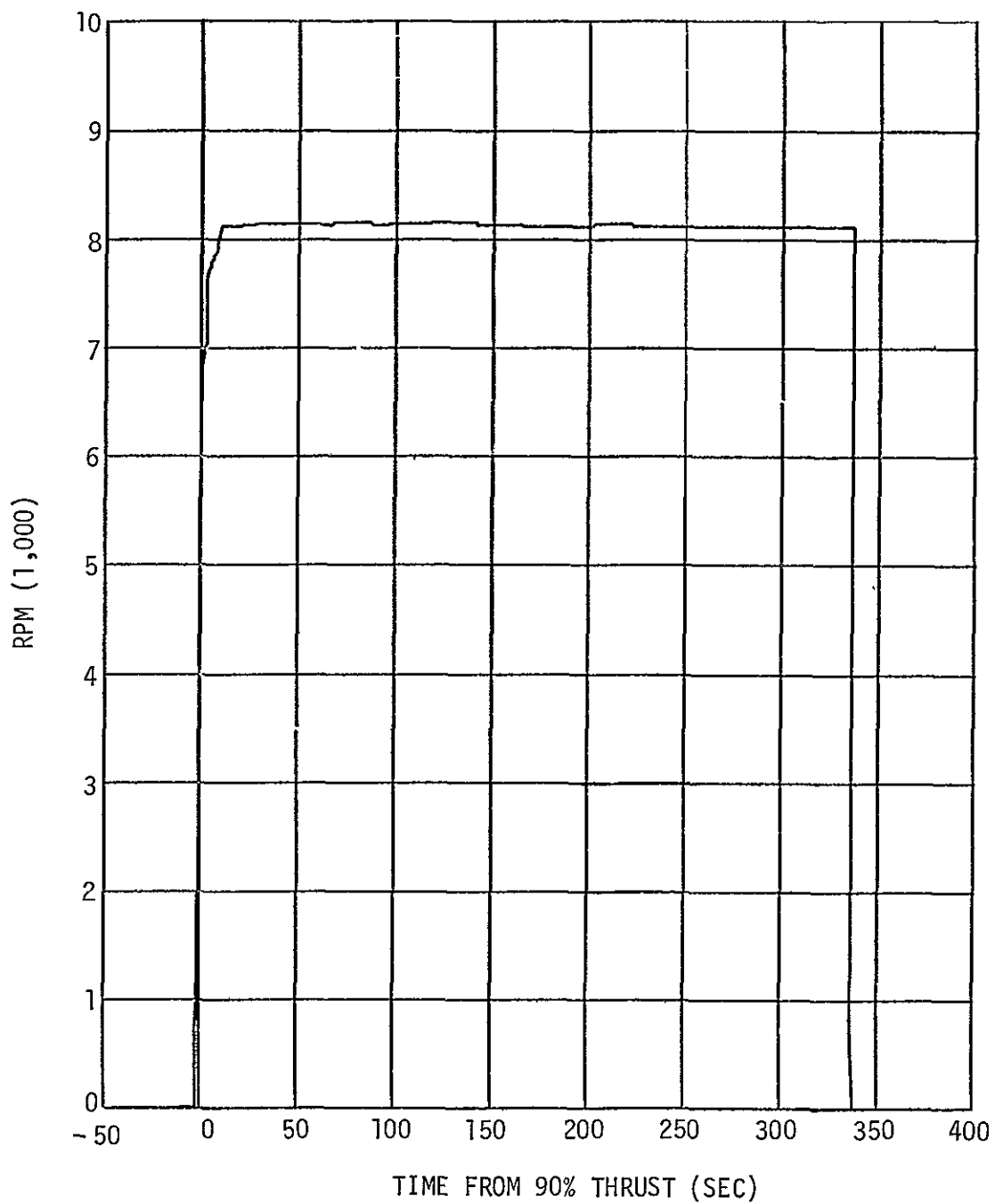
Figure AP 5-29.   Second Burn LOX Pump Speed
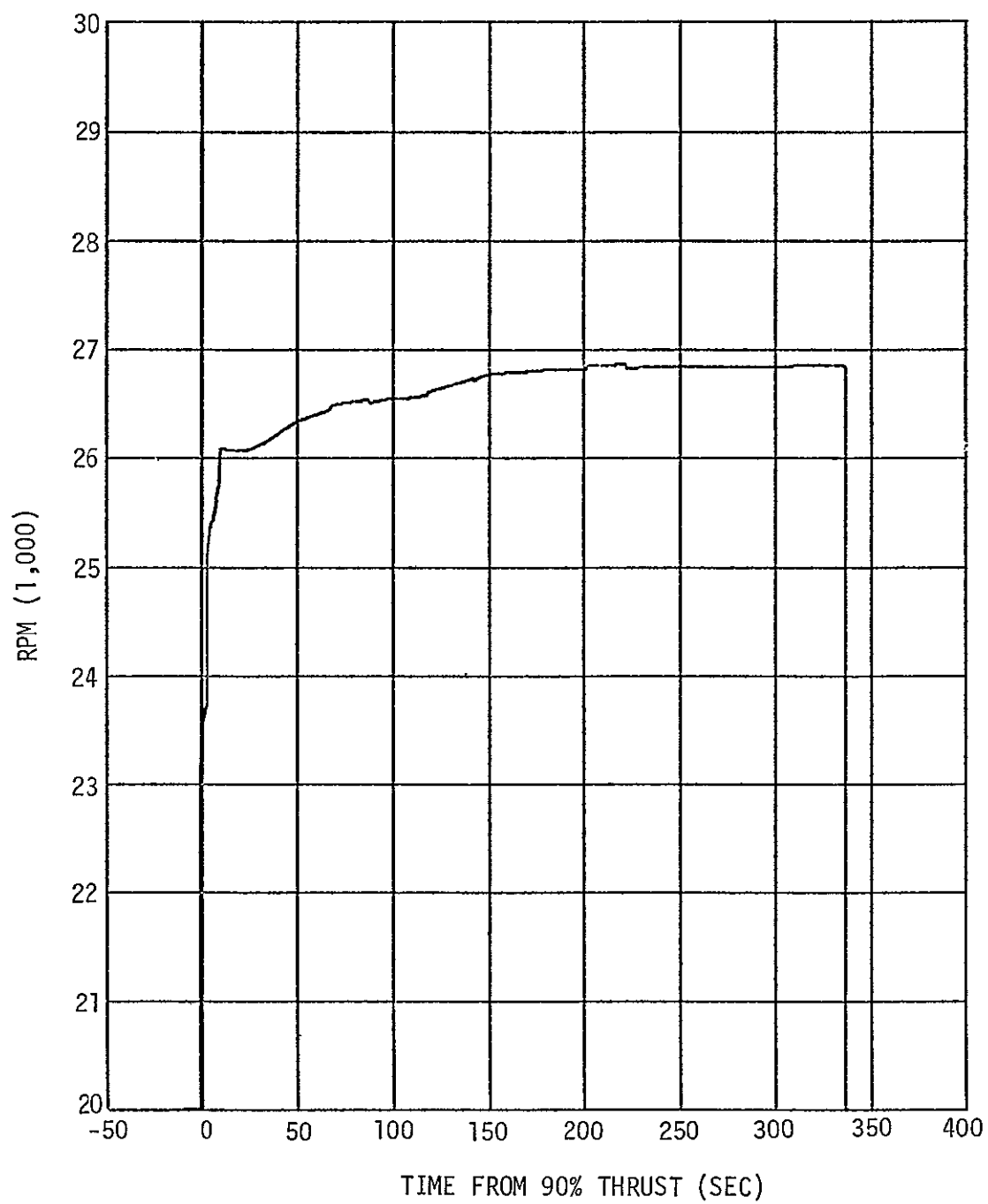
Figure AP 5-30. Second Burn LH2 Pump Speed
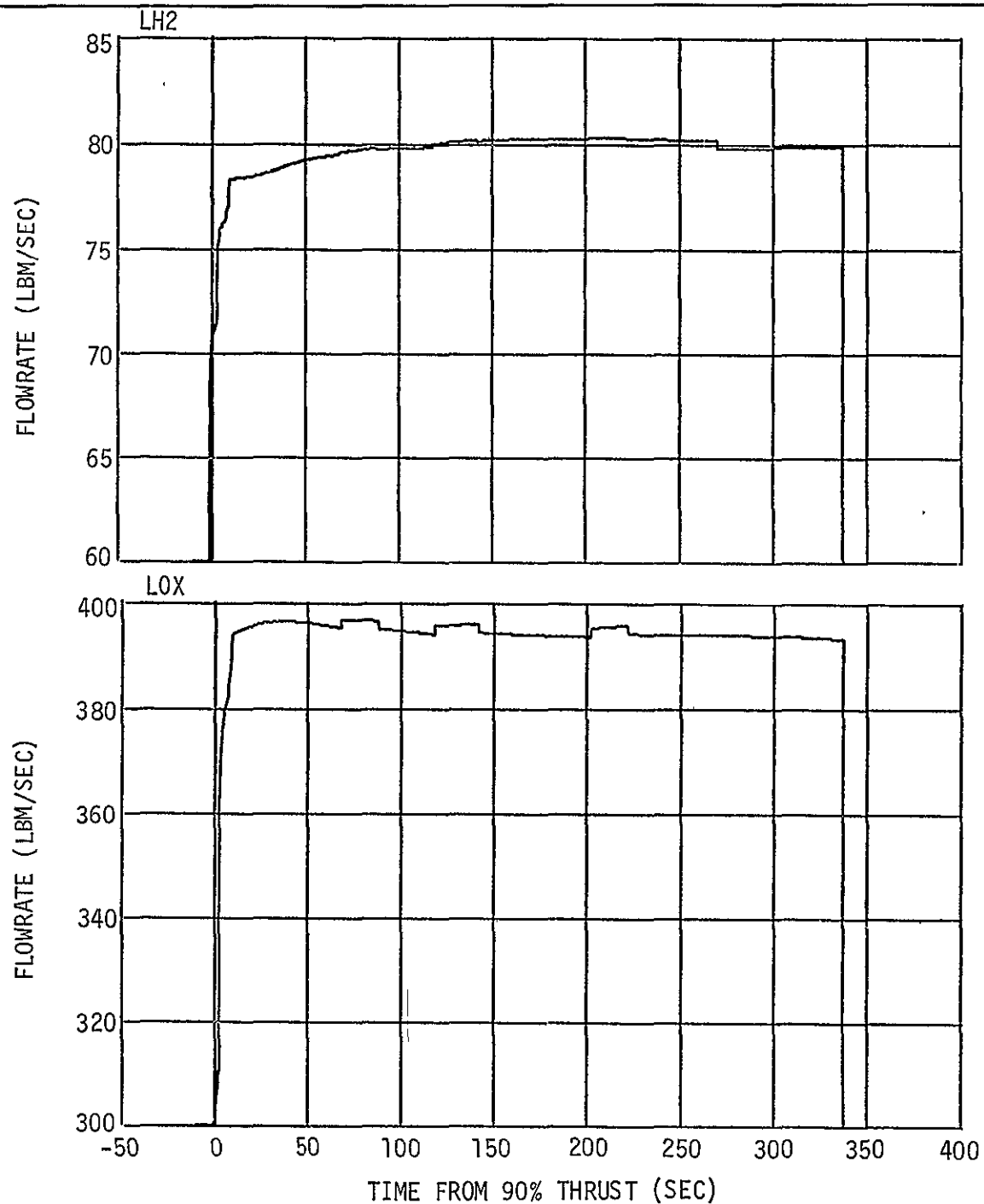
Figure AP 5-31.   Second Burn LH2 and LOX Flowrates, Inlet Pump
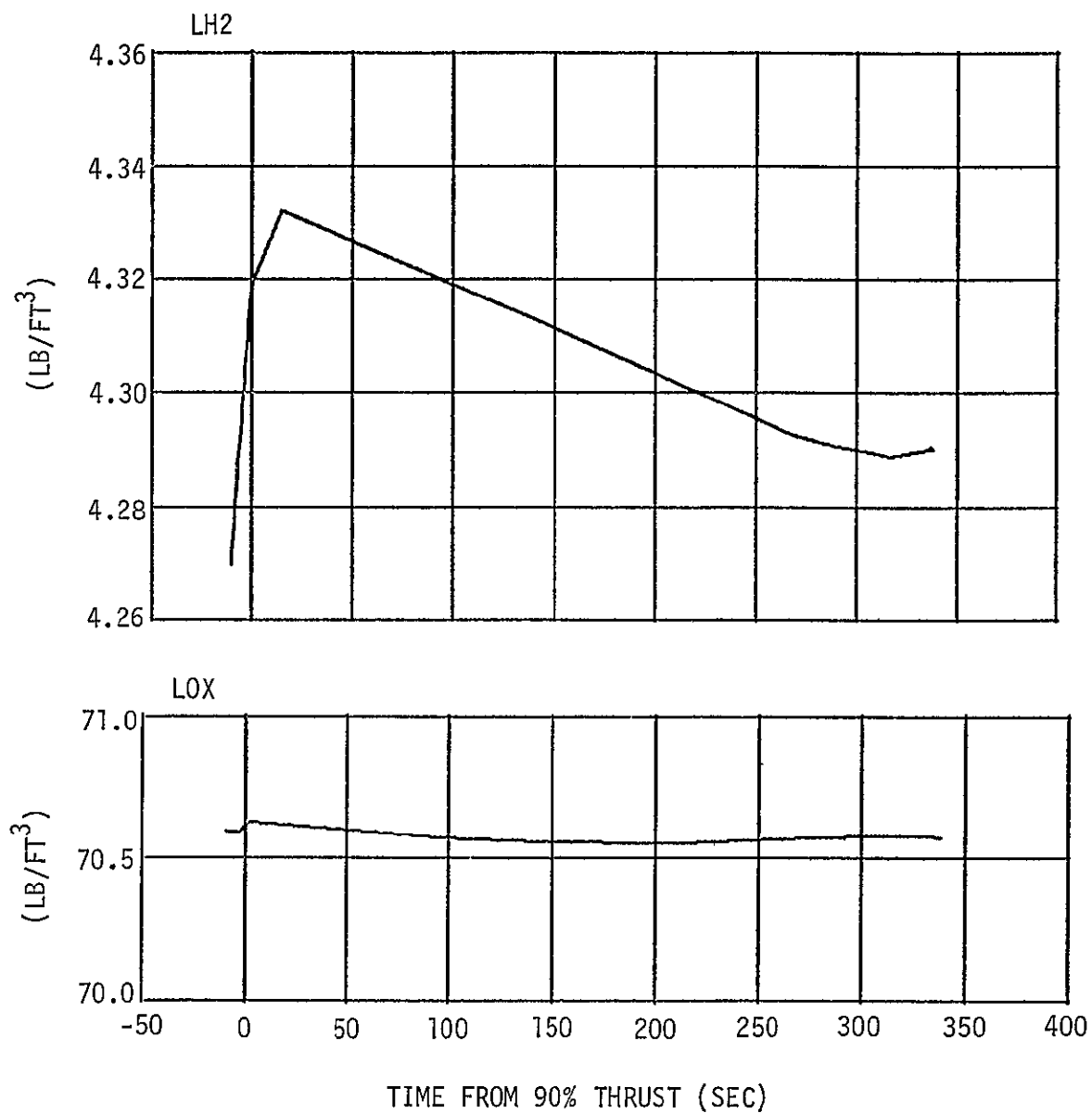
Figure AP 5-32. Second Burn LH2 and LOX Bulk Densities
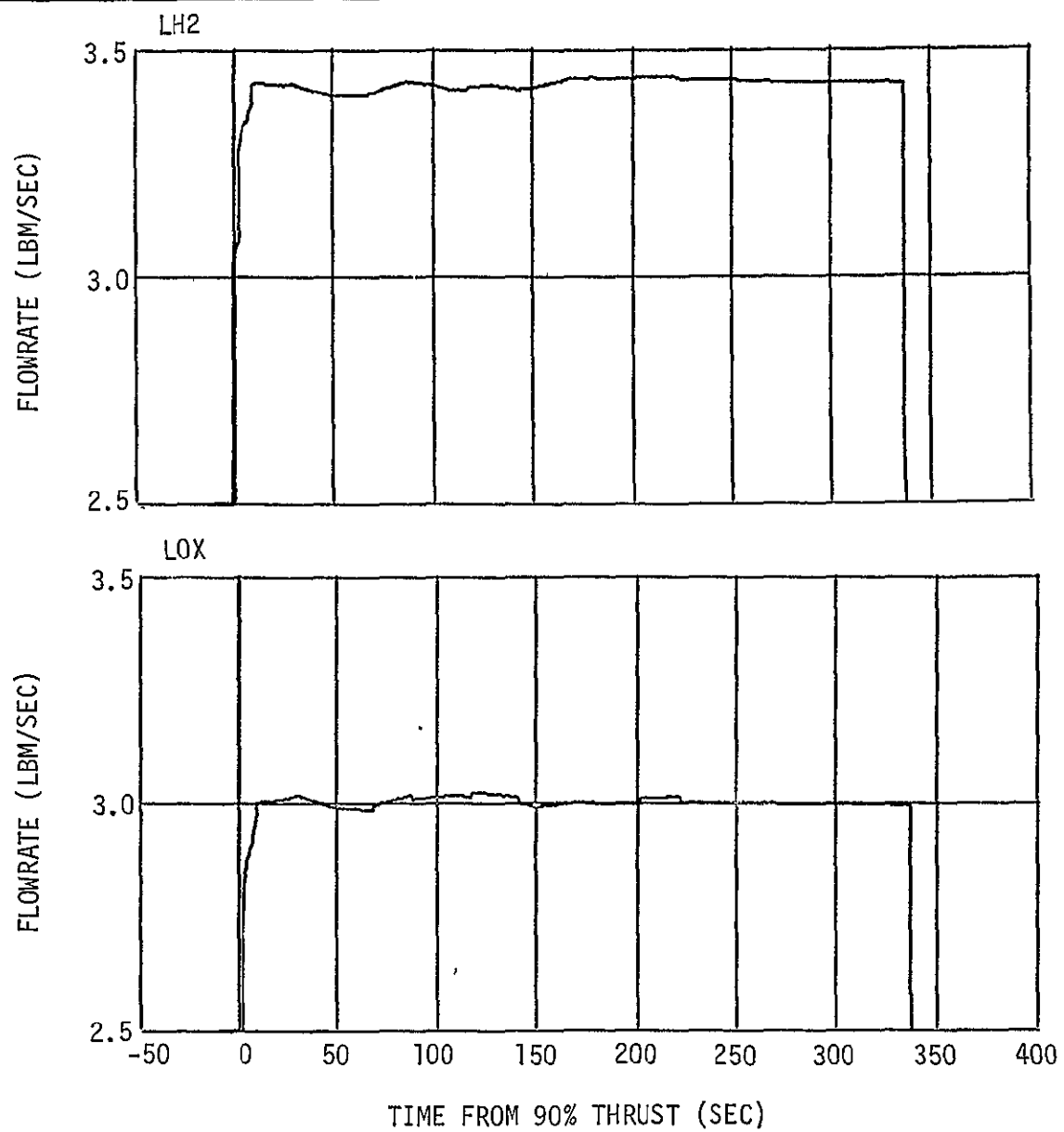
Figure AP 5-33. Second Burn Gas Generator LH2 and LOX Flowrates
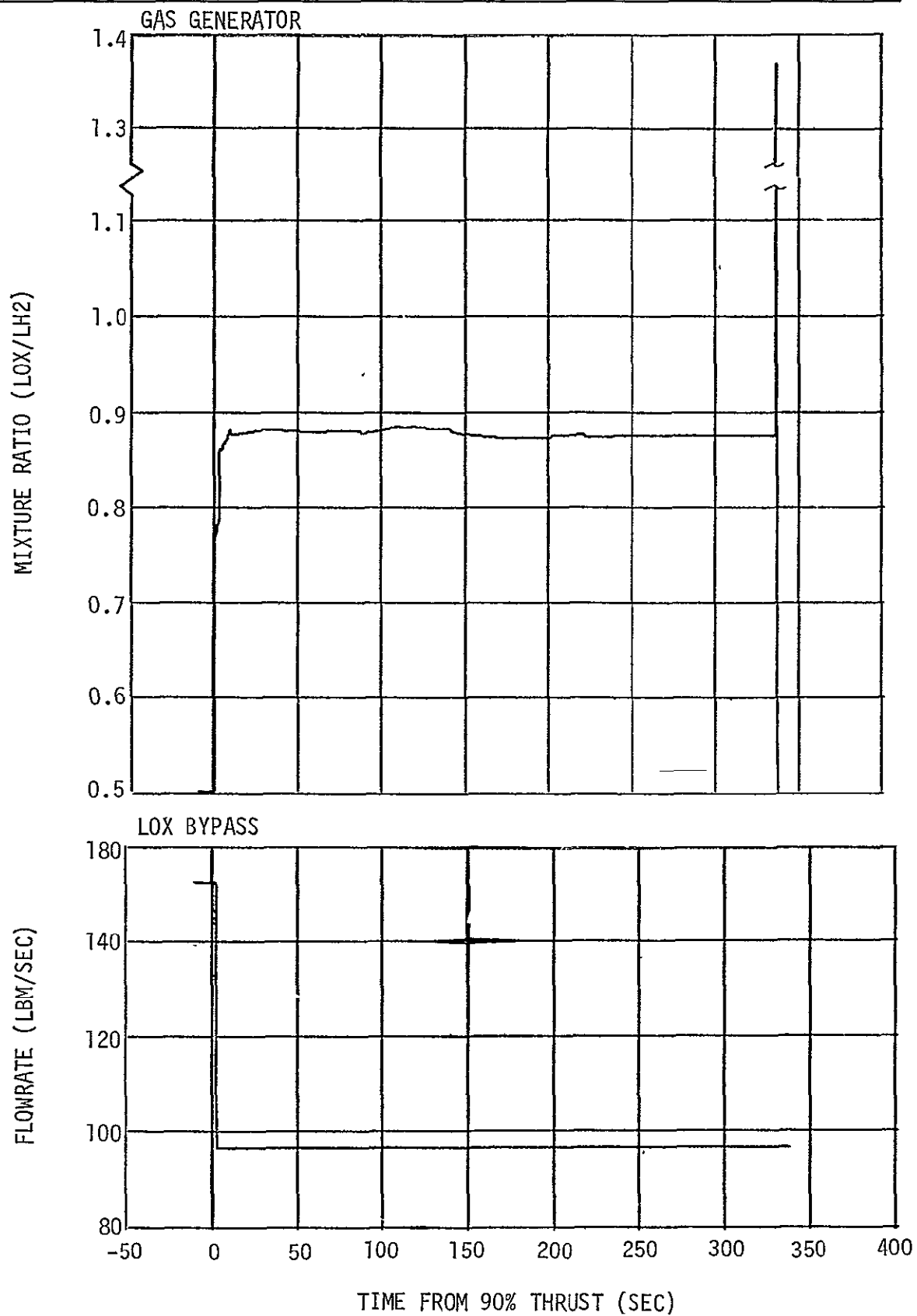
Figure AP 5-34. Second Burn Gas Generator Mixture Ratio and LOX Bypass Flowrate
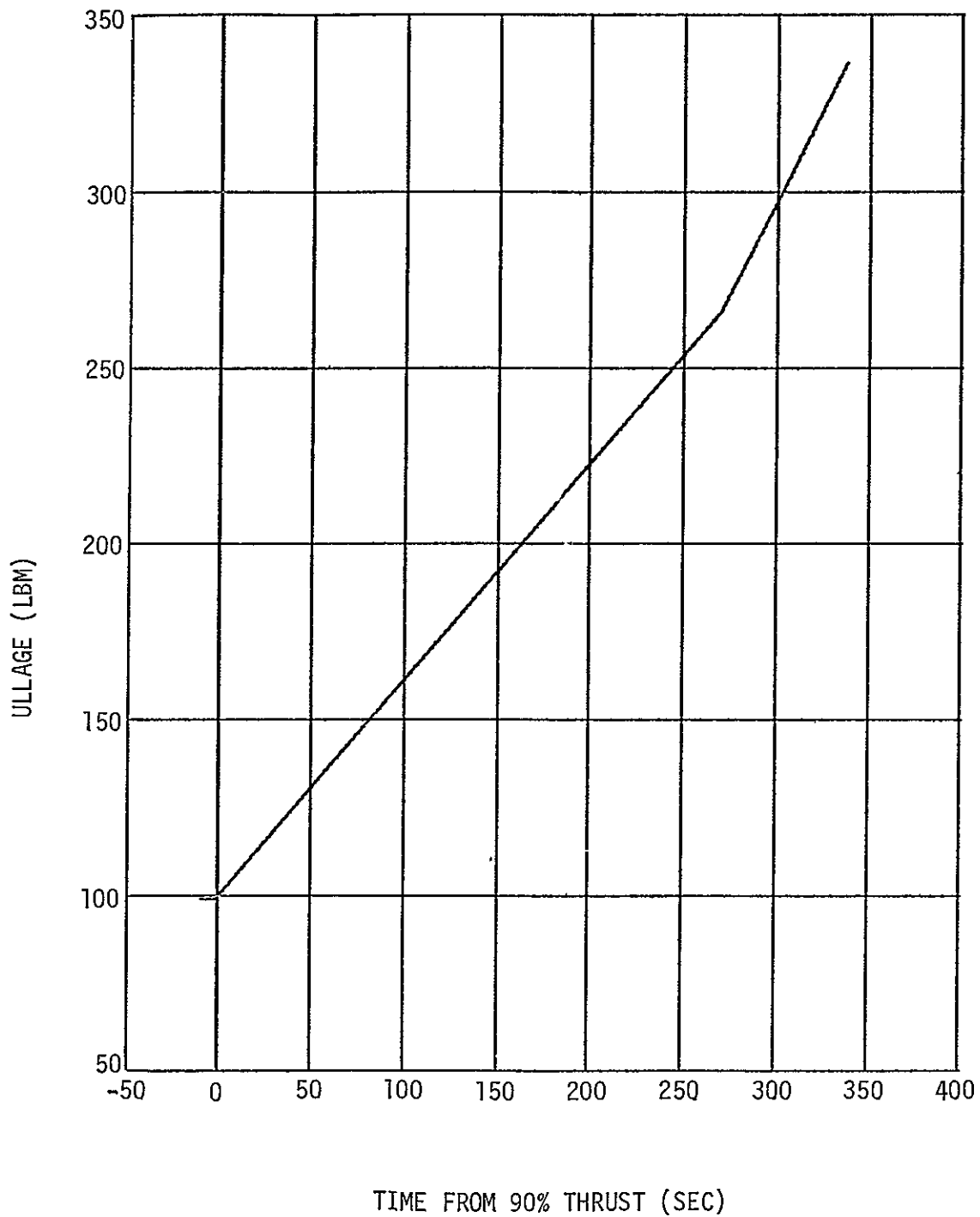
Figure AP 5-35. Second Burn LH2 Pressurant Mass in Ullage
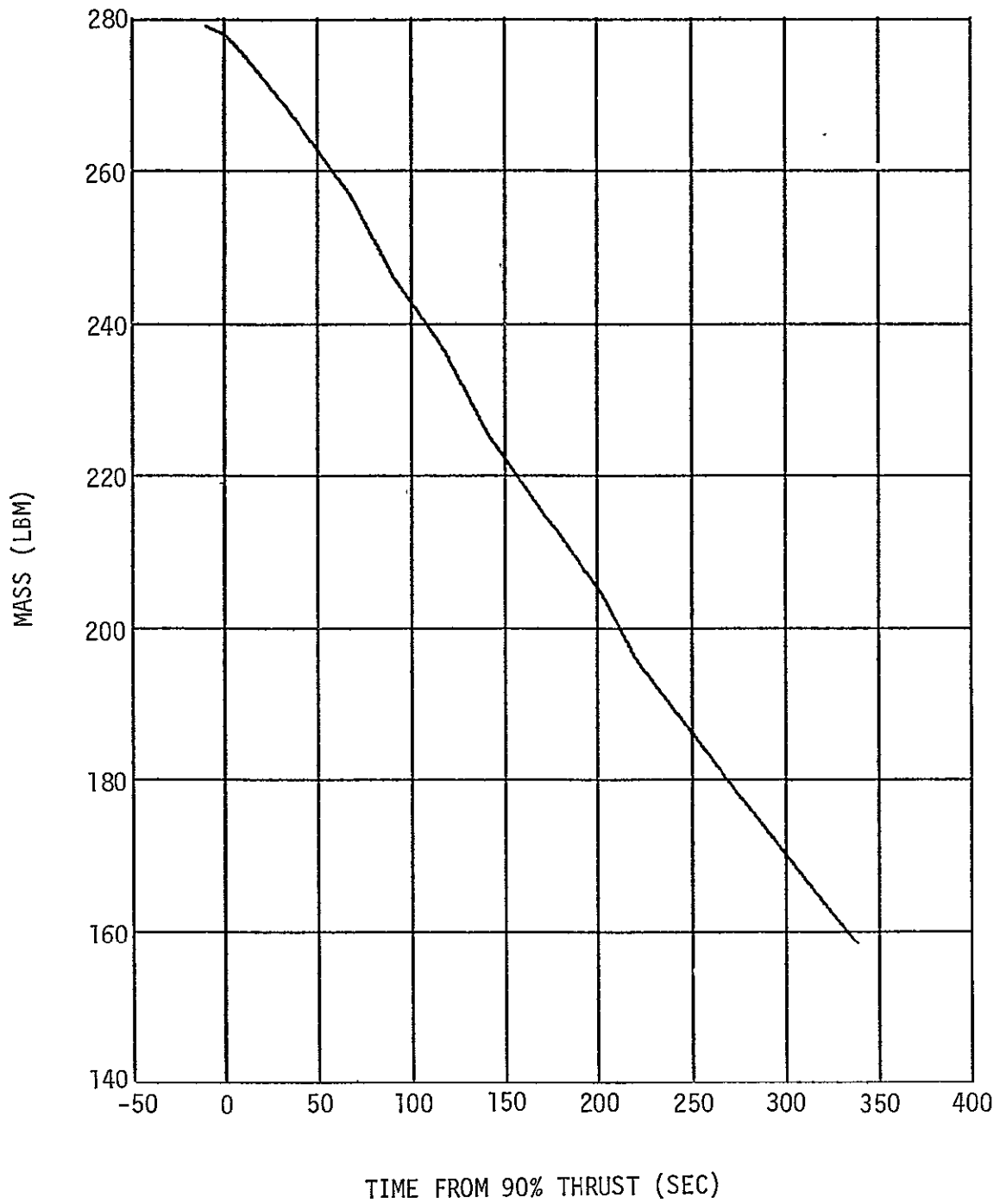
Figure AP 5-36. Second Burn Helium Mass in Cold Spheres
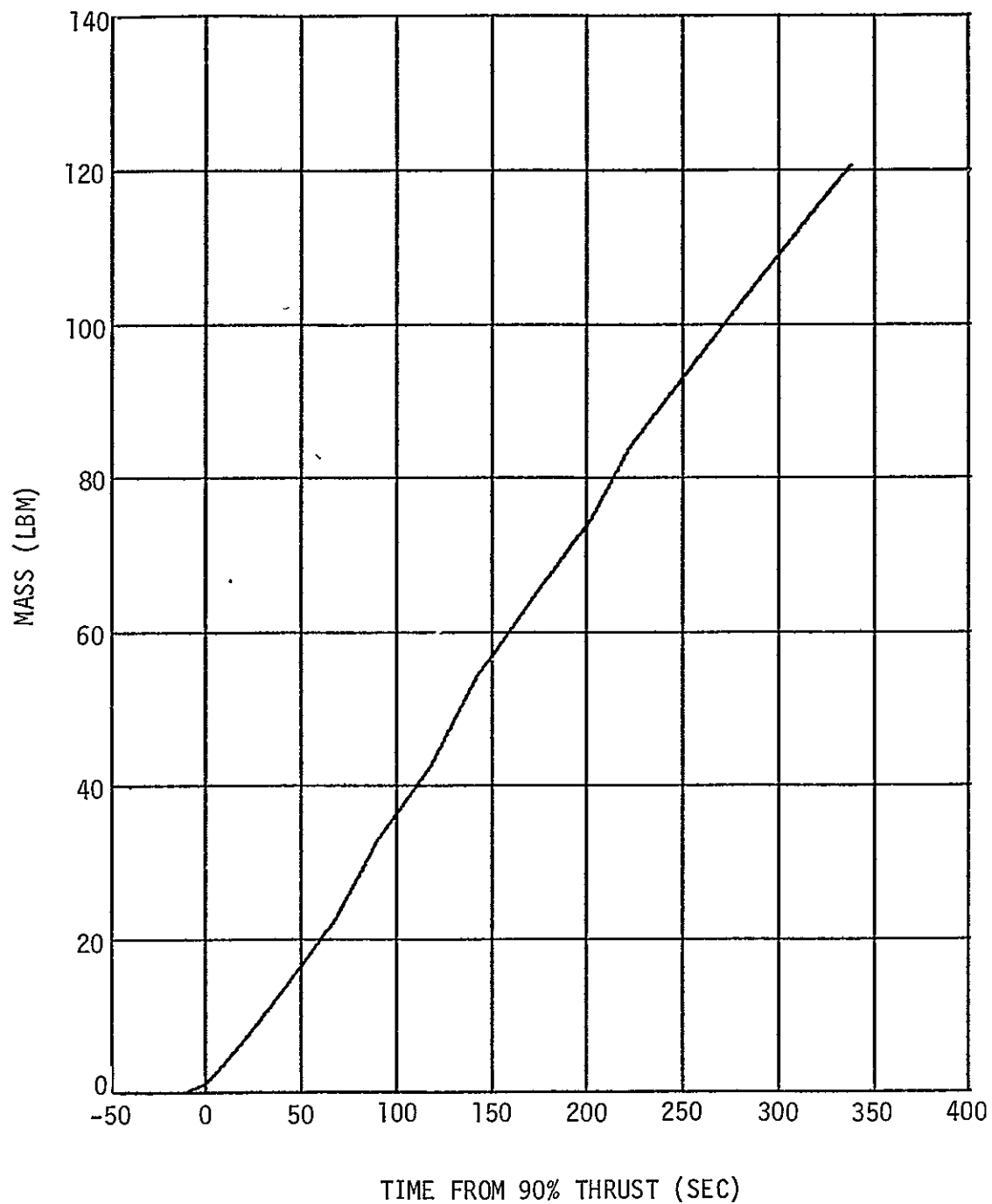
Figure AP 5-37.   Second Burn Helium Mass in LOX Ullage
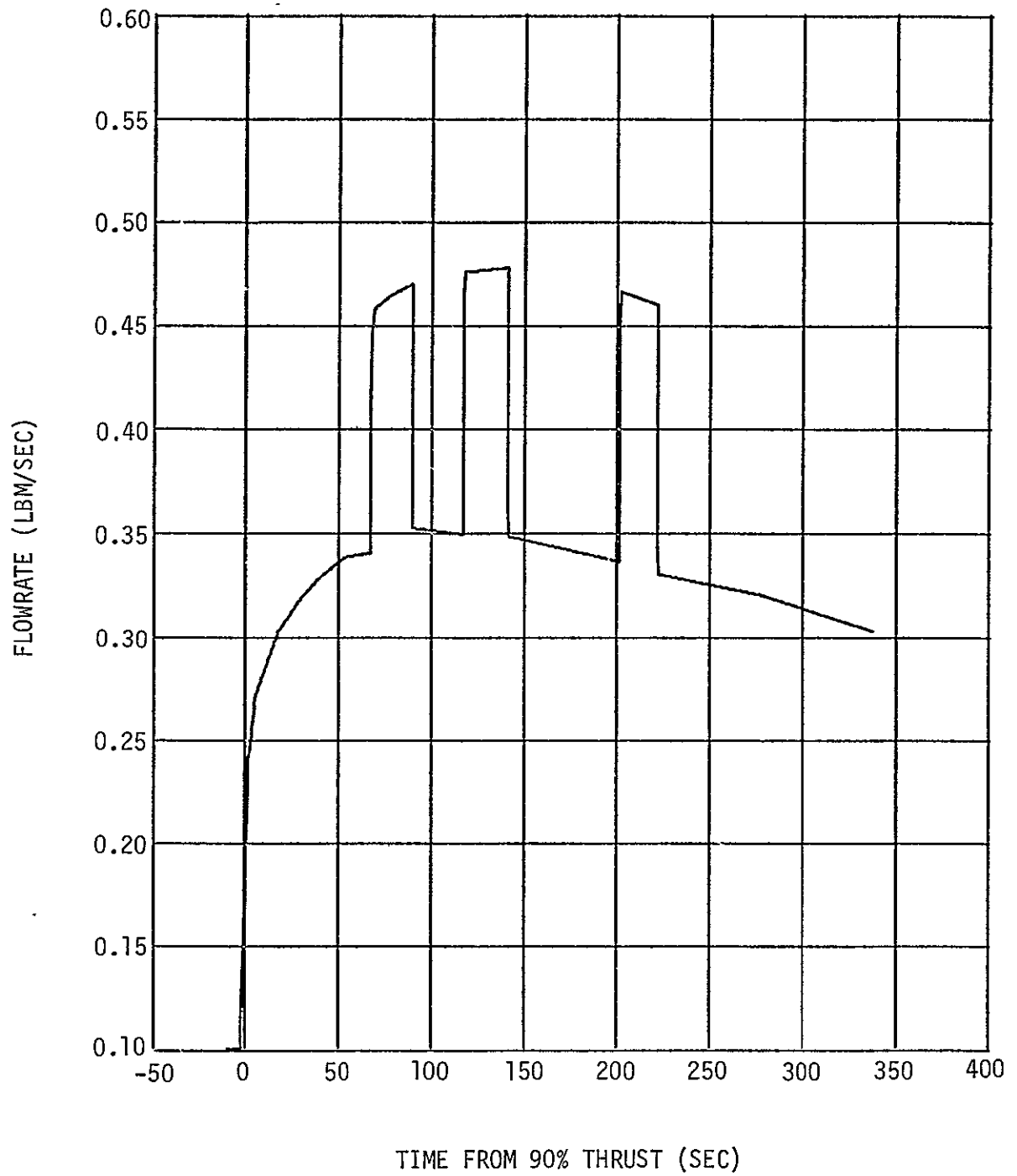
Figure AP 5-38. Second Burn Total Helium Flowrate
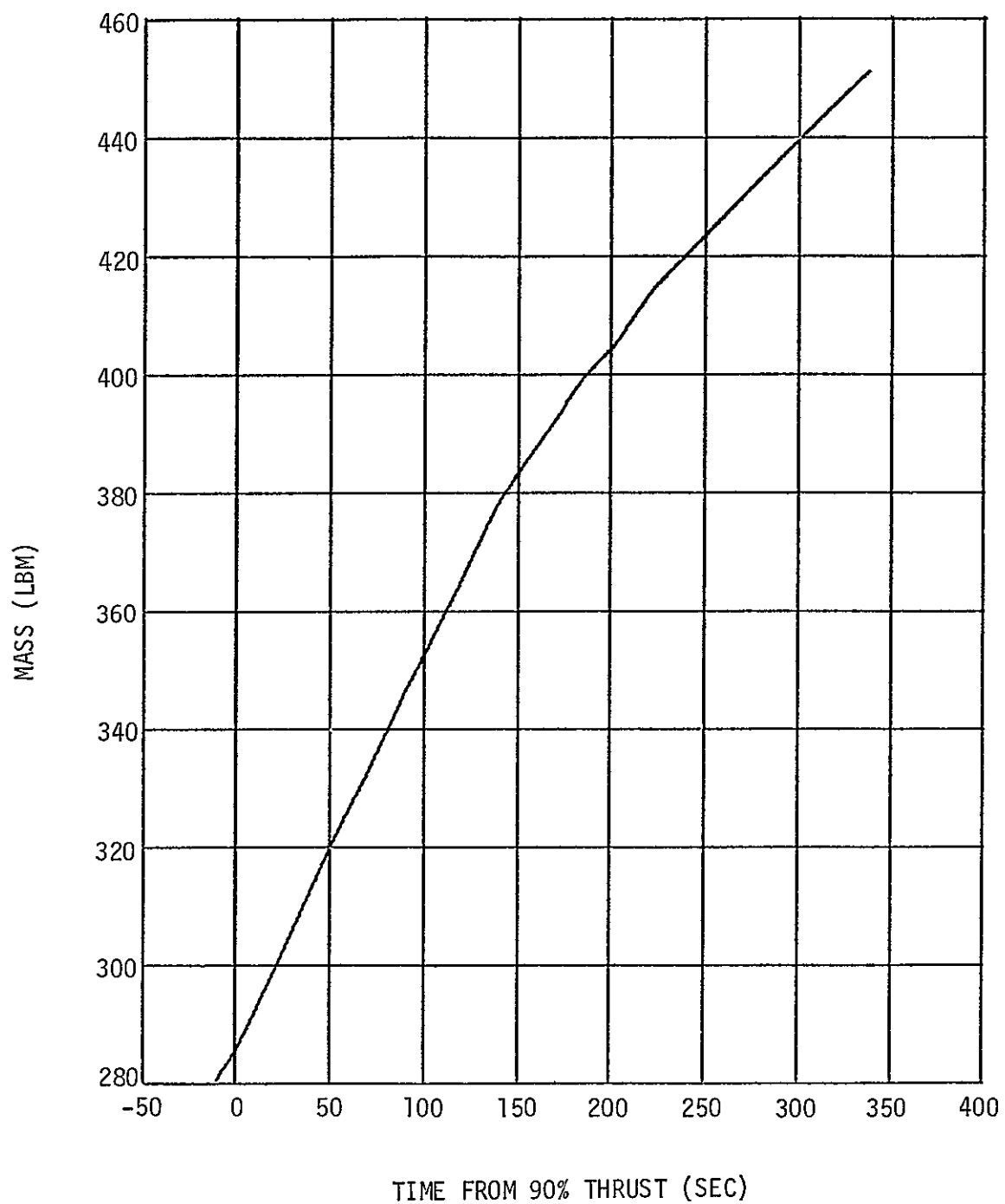
Figure AP 5-39. Second Burn LOX Tank Ullage Mass
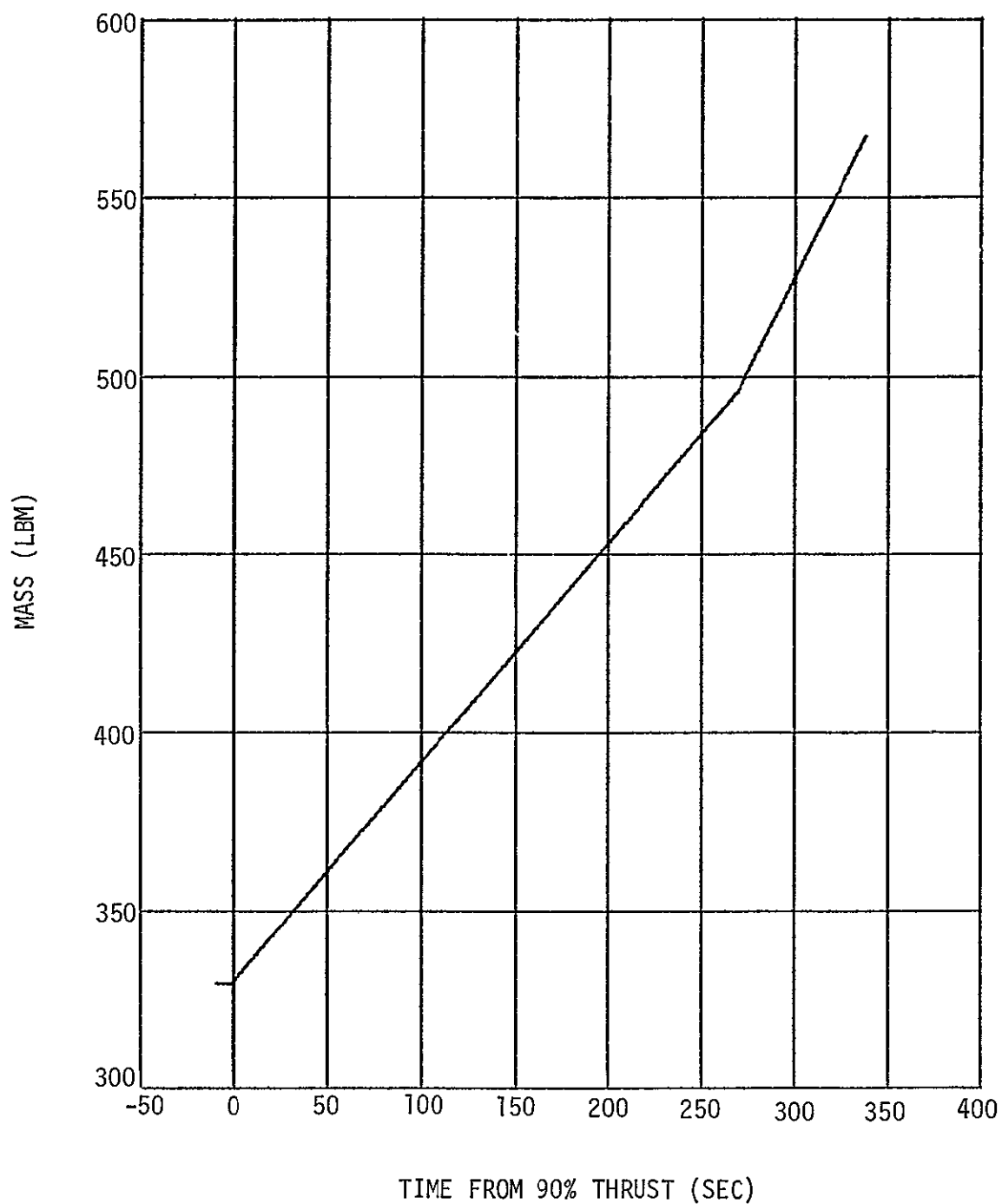
Figure AP 5-40. Second Burn LH2 Tank Ullage Mass
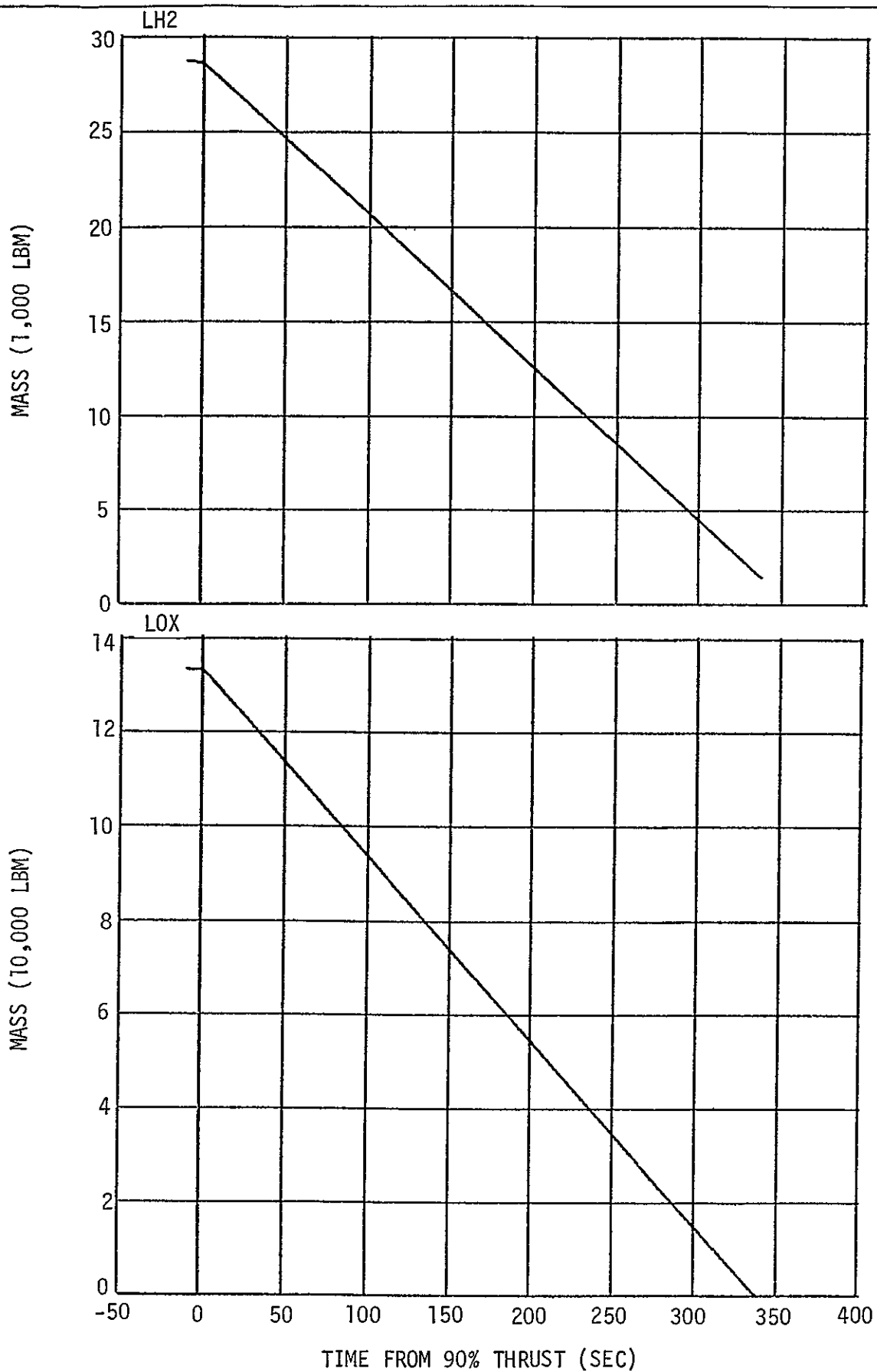
Figure AP 5-41.   Second Burn LH2 and LOX Mass Onboard
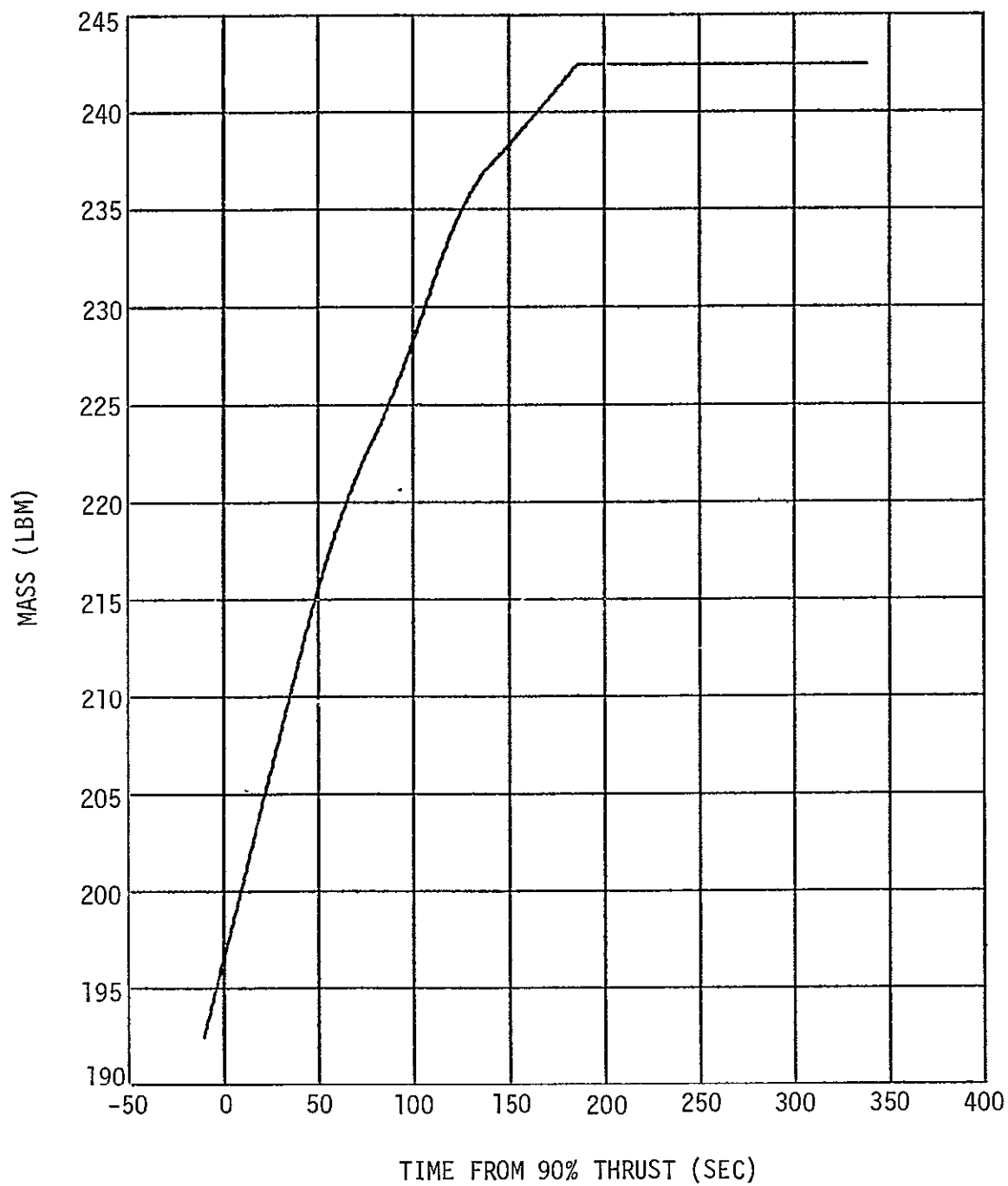
Figure AP 5-42. Second Burn LOX Mass Boiled-Off
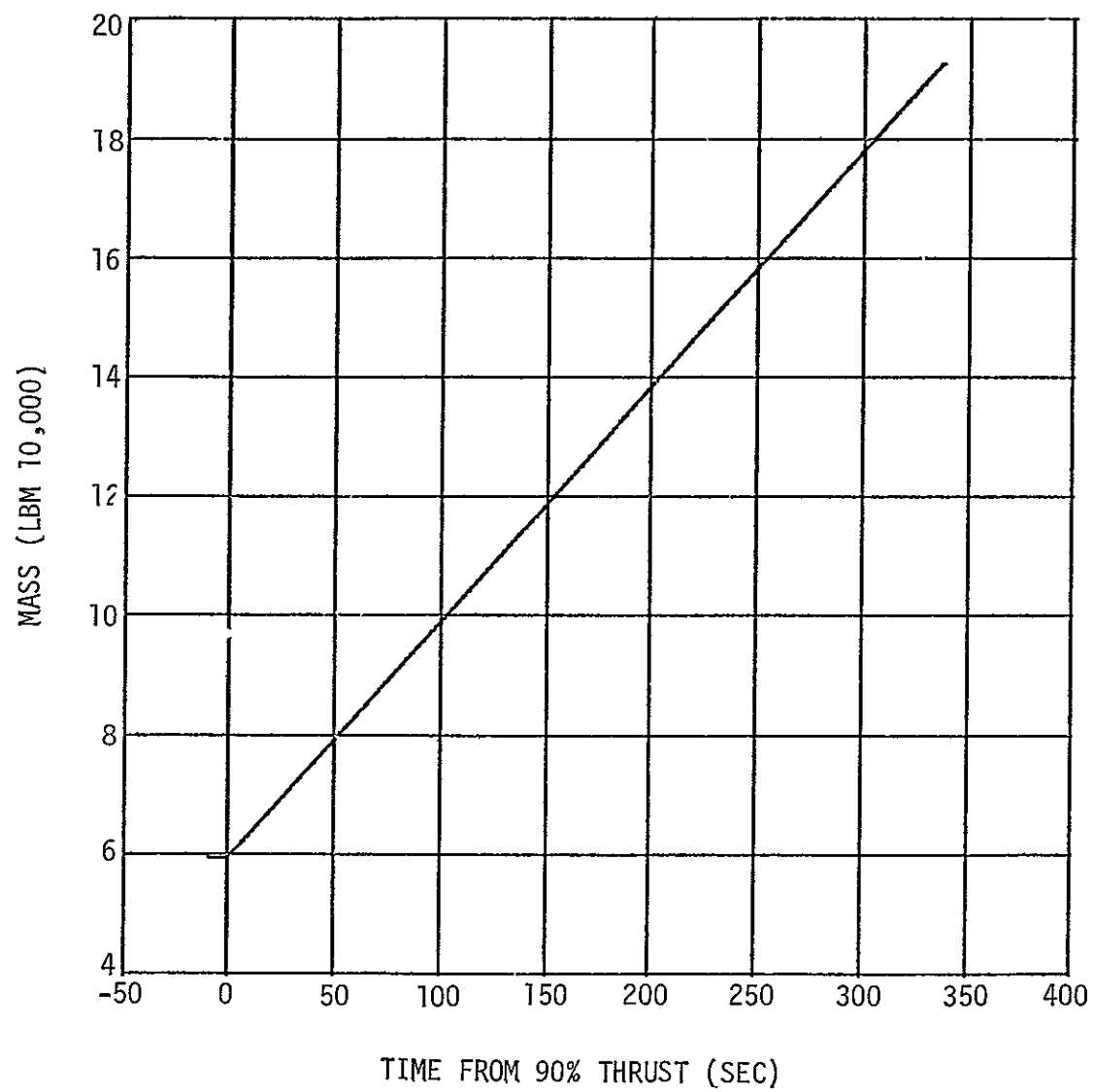
Figure AP 5-43. Second Burn LOX Mass Overboard
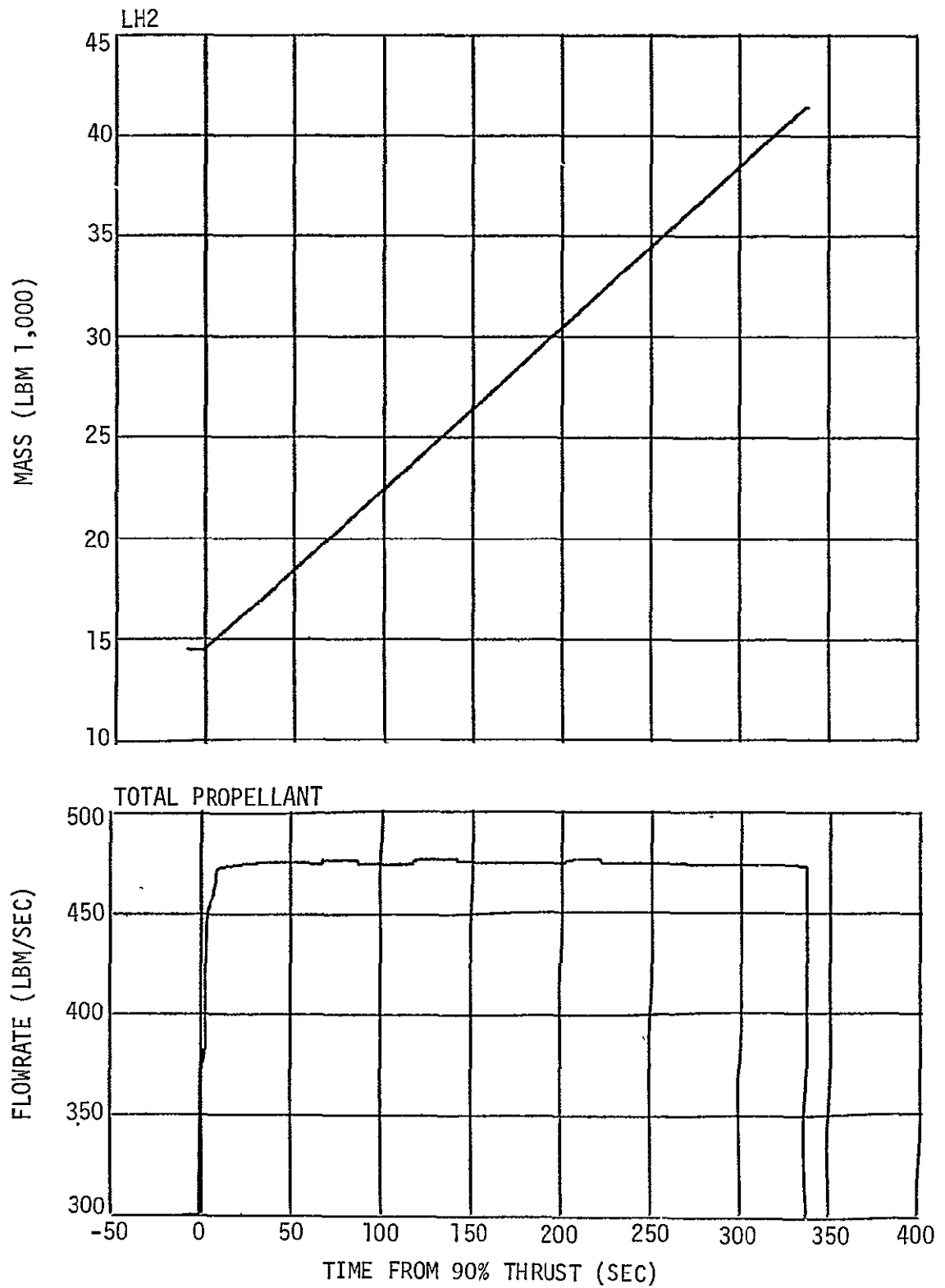
Figure AP 5-44. Second Burn LH2 Mass Overboard and Total Propellant Flowrate
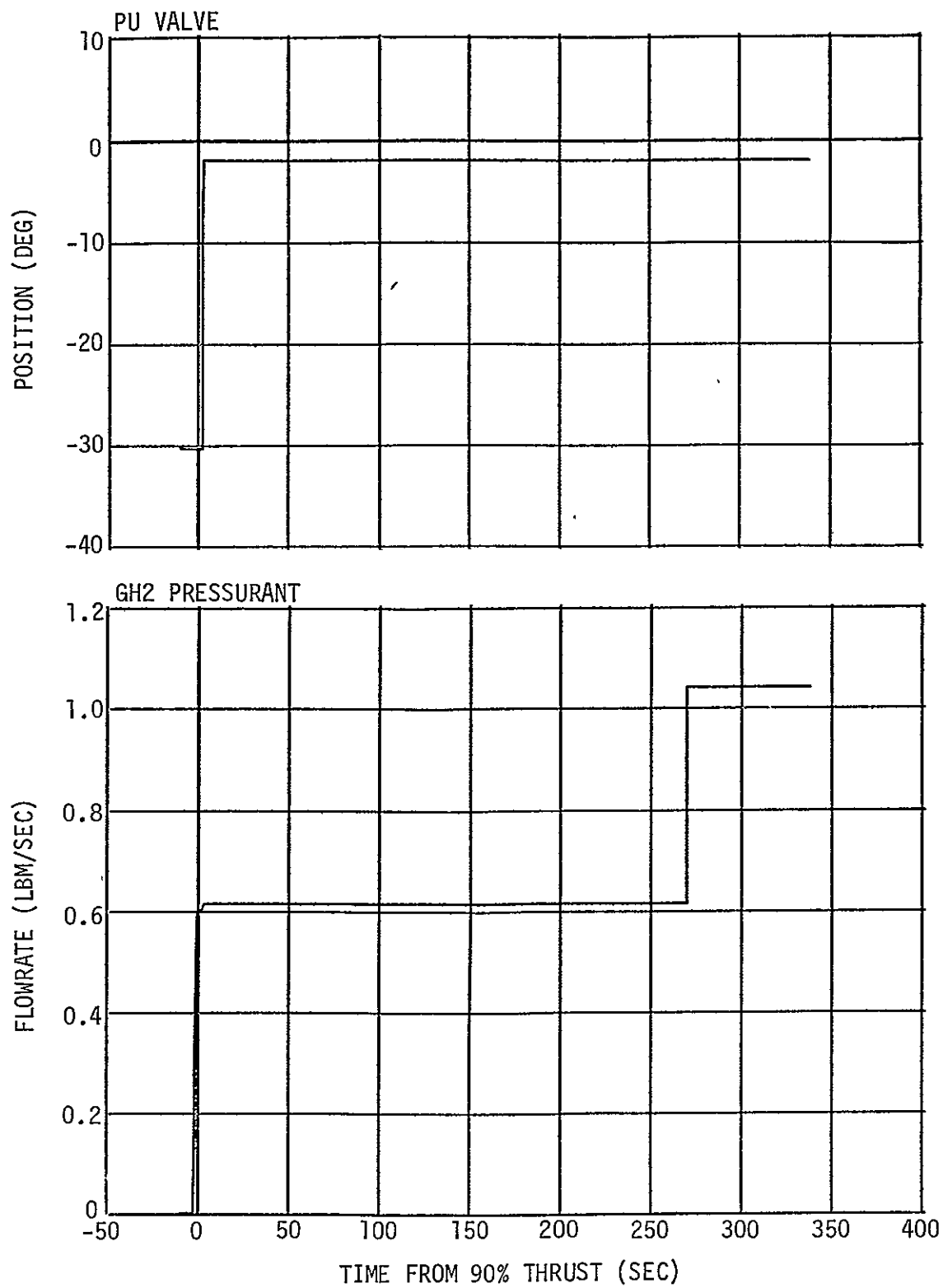
Figure AP 5-45. Second Burn PU Valve Position and LH2 Tank GH2 Pressurant
Flowrate
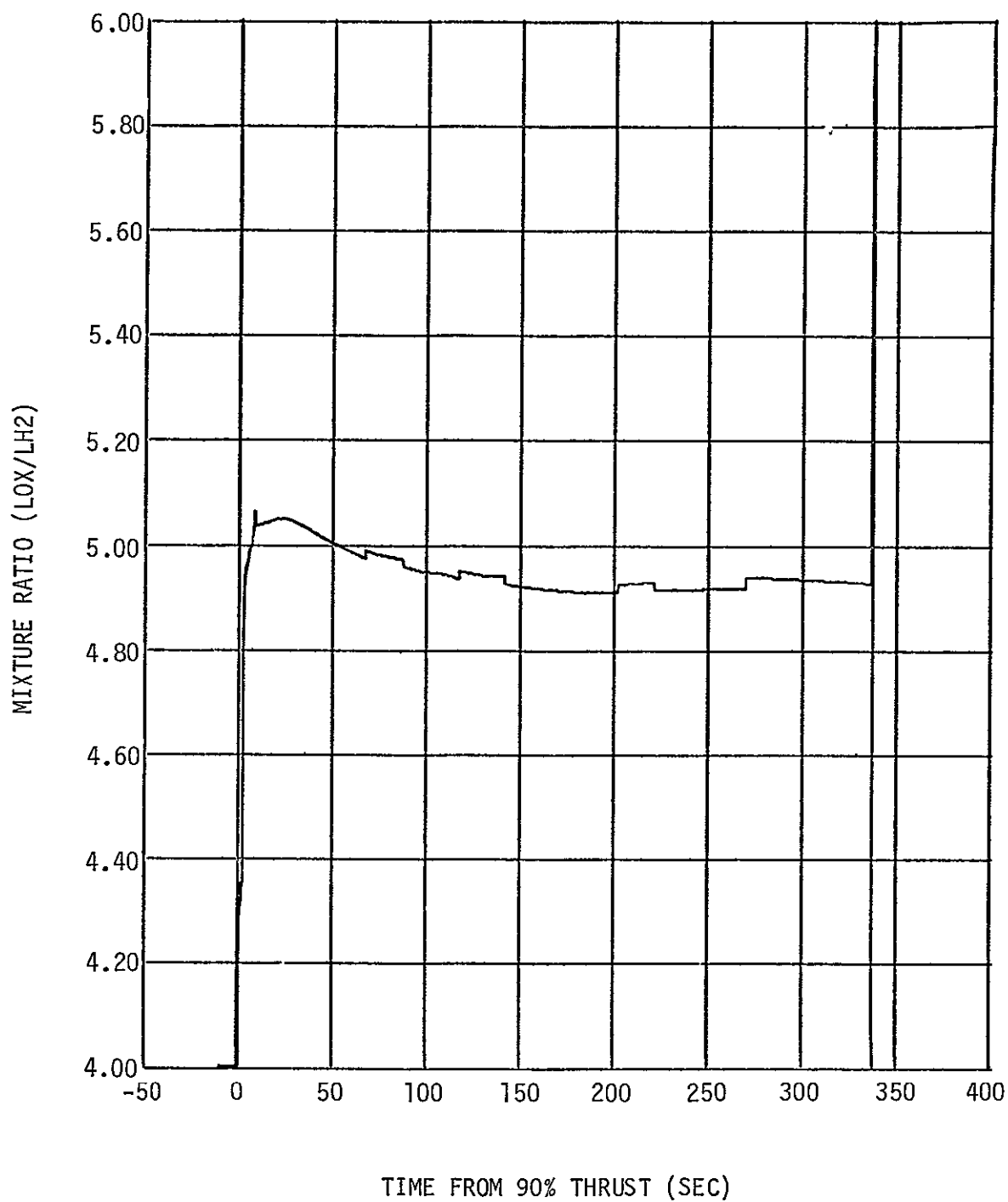
Figure AP 5-46. Second Burn Engine Mixture Ratio
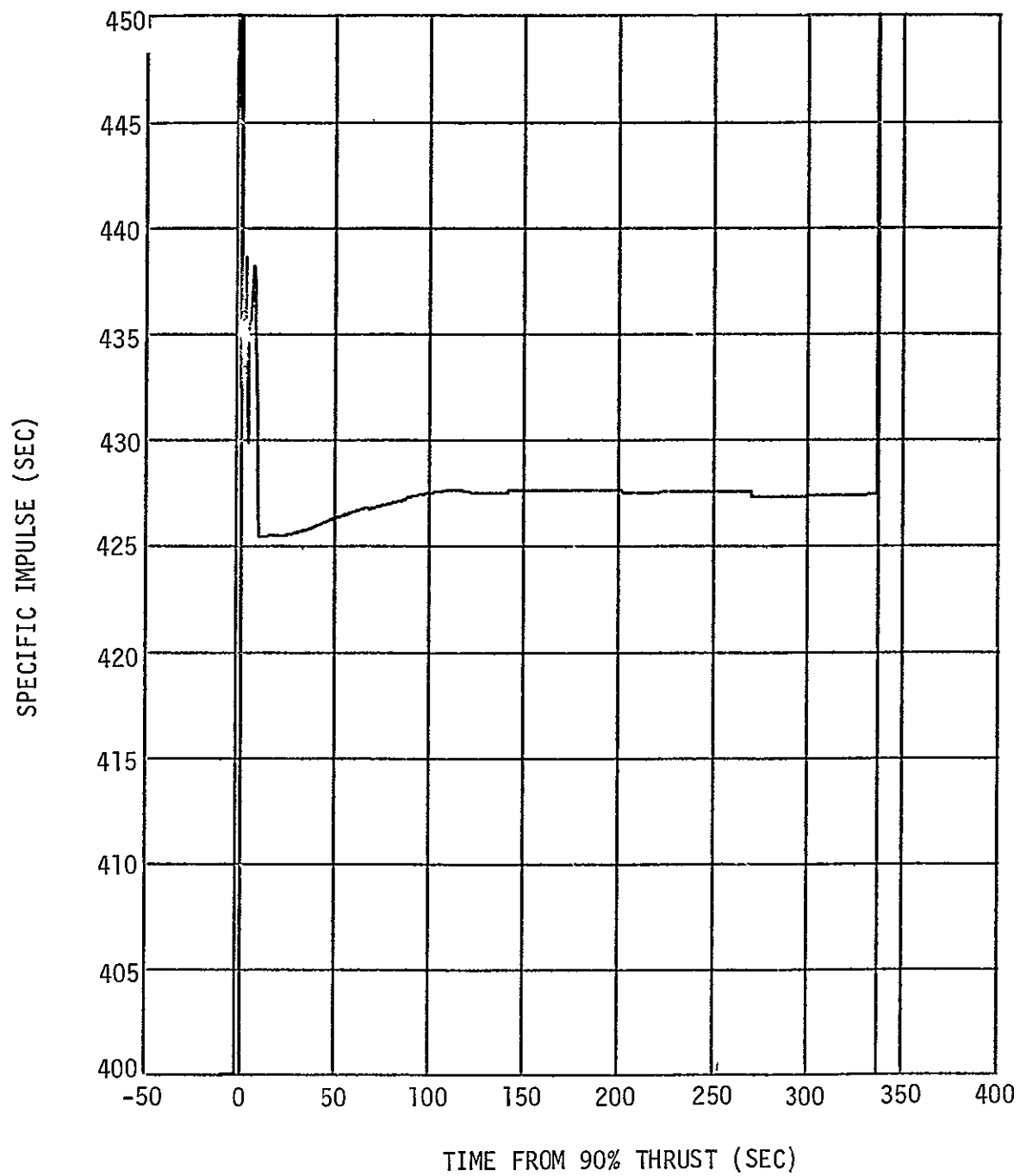
Figure AP 5-47. Second Burn Engine Specific Impulse
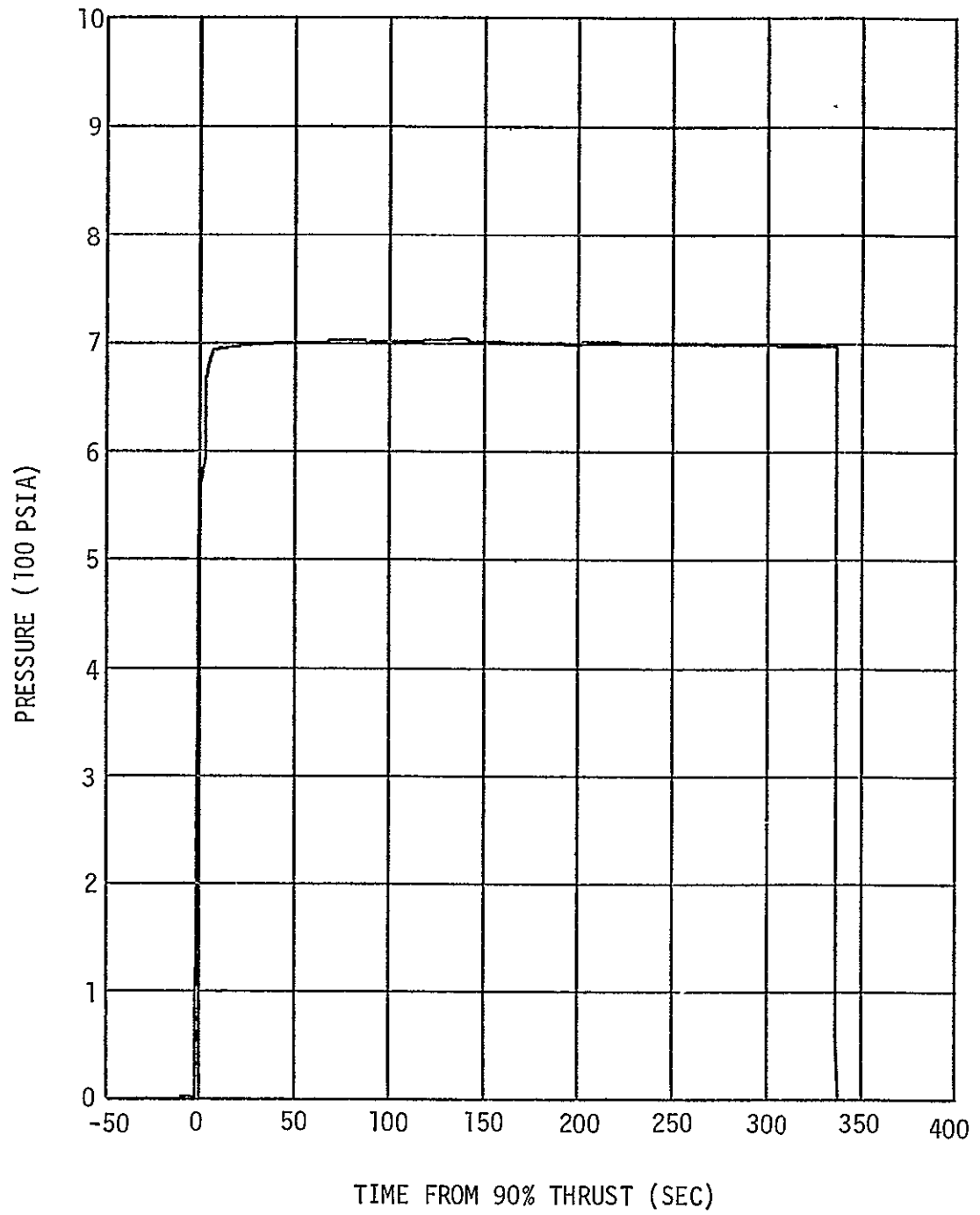
Figure AP 5-48. Second Burn Thrust Chamber Pressure (Injector Face)
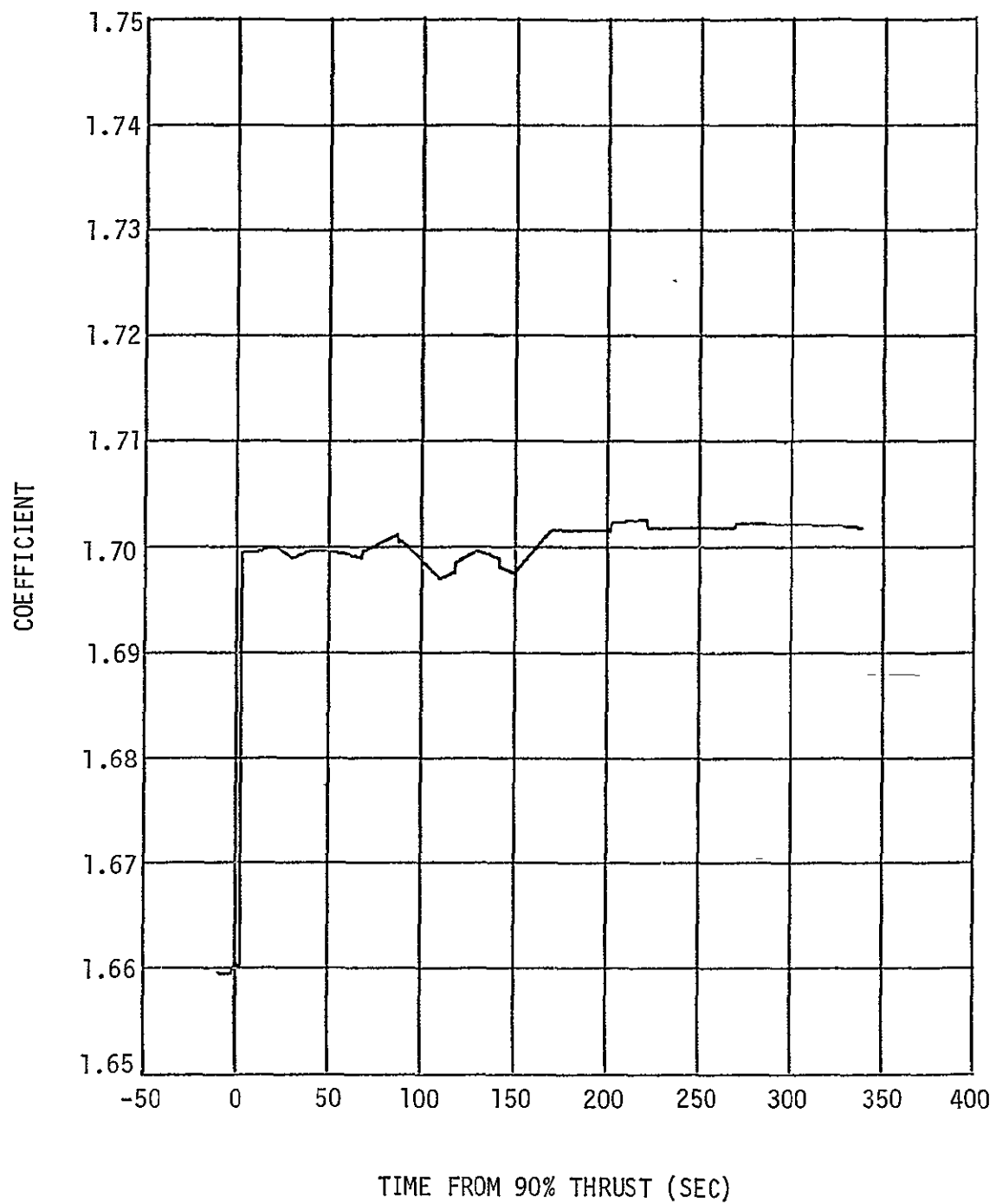
Figure AP 5-49.   Second Burn Vacuum Thrust Coefficient (Injector Face)
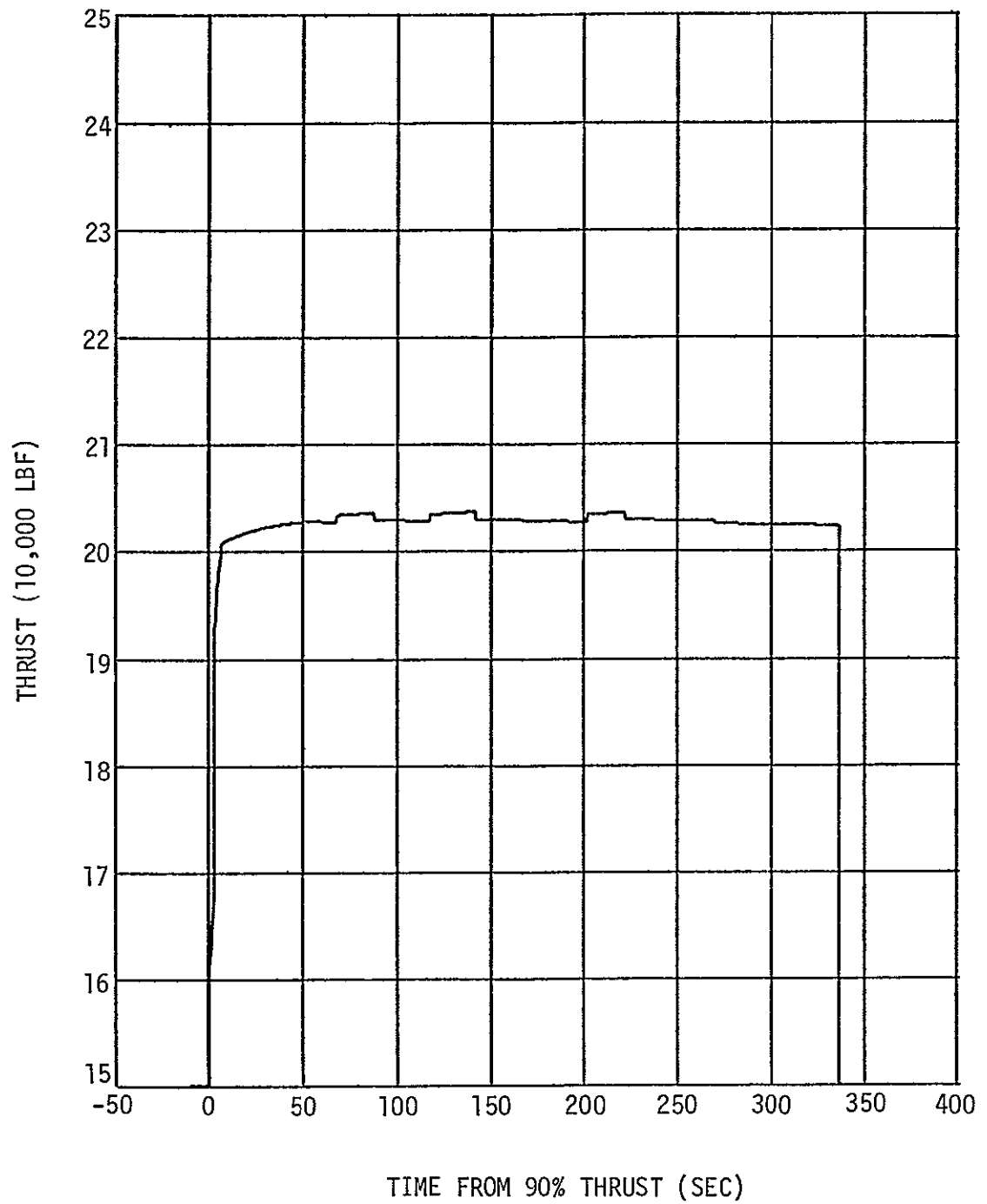
Figure AP 5-50. Second Burn Engine Thrust

APPENDIX 6

PROPELLANT UTILIZATION DATA

6. PROPELLANT UTILIZATION DATA

This appendix presents the data required for S-IVB stage propellant loading as well as data for flight control and evaluation. The propellant loading requirements for the S-IVB-503N stage are summarized in table AP 6-1. These requirements are based on the S-IVB final propulsion performance predictions (appendix 5) and on a programmed mixture ratio (PMR) mode of operation with depletion cutoff.

Propellant utilization (PU) system calibration data is presented in table AP 6-2.

The estimated PU analysis accuracies for ground loading and flight, based on the inflight mass characteristics (appendix 2), are presented in table AP 6-3. Table AP 6-4 presents estimated flight propellant residual accuracies.

Tabulations of the LH2 and LOX tank unique volume versus height data during ground loading, based on tank measurement data, are presented in tables AP 6-5 and AP 6-6. The predicted LOX and LH2 level histories for flight are shown in figures AP 6-1 and AP 6-2.

The actual propellant mass onboard is determined by adding the appropriate corrections to the indicated mass values. During loading operations, tank-to-sensor mismatch and manufacturing nonlinearities are added to the indicated value. During powered flight, tank-to-sensor mismatch, manufacturing nonlinearities, flight dynamics, and vehicle tilt corrections must all be added to determine actual mass. Figures AP 6-3 and AP 6-4 present the total predicted mass sensor corrections for flight, using the flow integral and volumetric calibration results.

Mass sensor nonlinearities resulting from tank-to sensor mismatch including mass sensor manufacturing nonlinearities are presented in figures AP 6-5 and AP 6-6 for the flow integral calibration. These corrections are based upon acceptance firing data and unique tank measurements as normalized to the desired liftoff and cutoff masses. The flow integral nonlinearities were used in the predictions presented in this report.

The volumetric data will be used in conjunction with the stage and interstage weight and balance logs, to provide vehicle mass evaluation within 24 hours after launch.

DESCRIPTION	LH2	LOX	REMARKS
Usable Propellants			
Total Usable Propellants	39,409	191,364	The propellant load for the S-IVB-503N flight was defined using a nominal first burn time of 154.5 sec, a two or three-orbit coast and a nominal second burn time of 346 sec.
Nominal Propellant Consumed	Note 3	Note 3	This quantity will normally be burned by the J-2 engine between the 90 percent thrust level at ignition and predicted guidance cutoff.
Total Available Flight Performance Reserve	Note 3	Note 3	This quantity is the nominal flight performance reserve and flight geometry reserve available following a predicted guidance cutoff.
LH2 Bias			This bias is included as a straight line bias to the empty and full calibration points to minimize residuals at depletion.
Unusable Propellants			
Total Unusable Propellants	3,941	1,560	The total unusable mainstage propellant is 5,501 lbm.
Powered Flight Boiloff		107	
Orbital Boiloff	2,550	135	
Engine Chilldown Boiloff	17	53	
O_2-H_2 Burner	15	13	This quantity is consumed by the O_2-H_2 burner during repressurization.

PROPELLANT LOADING REQUIREMENTS SUMMARY

DESCRIPTION	LH2	LOX	REMARKS
Unusable Propellants			
Start Bottle	8	--	
LH2 Tank Pressurant	321	--	This quantity is required to pressurize the LH2 tank during burn and to refill the engine start sphere.
J-2 Engine Start Transient	240	584	These are the propellants consumed during both J-2 engine start transients, from Engine Start Command to 90 percent thrust.
J-2 Engine Cutoff Transient	57	274	These are the propellants consumed during both J-2 engine cutoff transients, from Engine Cutoff Command to zero thrust.
J-2 Engine Trapped	10	108	These are the propellants trapped in the J-2 engine following the cutoff transients.
Unavailable	723	286	These are the unavailable propellants trapped in the tanks and lines, based upon depletion sensor cutoff and thrust decay.

NOTES: (1) The allowable indicated-to-desired propellant load mismatch in ± 0.5 percent of the desired propellant load in each tank.

(2) One of the mission criteria is to load for three orbits of propellant boiloff and restart at the end of two orbits.

(3) To be determined after the trajectory simulation has established the predicted cutoff time.

PROPELLANT UTILIZATION CALIBRATION DATA

Propellant Level	Capacitance (pf)	Mass (1bm)	Coarse Mass Ratio	Fine Mass Ratio (λ)
LOX Mass Sensor (D0005)				
Helium Calibration Point* (1)	282.01	1,932	.02198	TAP + .02154
Air Calibration Point (GN2)	282.16	2,145	.02295	TAP + .02249
Probe Bottom (Cryogenic)	281.63	1,368	.01943	TAP + .01904
Empty Calibration Point	278.73	-2,918	0.0	TAP
Full Calibration Point* (2)	413.74	196,505	.90389	TAP + .88581
Probe Calibration Point	411.55	193,273	.88924	TAP + .87145
Full Load (Pressurized)* (3)	411.31	192,924	.88765	TAP + .86990
Full Load (Unpressurized)* (4)	411.76	192,924	.89062	TAP + .87281
Ref Mix Ratio Calib Point	400.48	176,920	.81511	TAP + .79881
Probe Immersed	413.20	195,710	.90028	TAP + .88228

NOTES: (1) When LOX tank is empty of propellant and filled only with GHe at one atmosphere.

(2) The delta capacitance (full calibration point minus the helium calibration point) is 131.73 pf which will give an indication of a coarse mass ratio (CMR) of .90389 and a LOX mass of 196,505 lbm.

(3) The loading computer (L/C) will be programmed to load to a CMR of .88765, which is equal to a LOX mass of 192,924 (pressurized). The maximum acceptable deviation from the nominal load is +0.5 percent; i.e., a minimum CMR of .88321 and a maximum of .89209.

(4) The L/C will be programmed to load to a CMR of .89062 which is equal to a LOX mass of 192,924 lbm (unpressurized). An L/C tolerance of +0.5 percent of the desired load will yield a minimum CMR of .88617 and a maximum of .89507. The nominal CMR of .89062 will be used as the initial 100 percent value for the propellant loading test. This value was based upon data obtained from the previous propellant loading tests and launch countdowns. Additional adjustments to the CMR (unpressurized) may be required after the AS-503 Countdown Demonstration Test (CDDT).

The above data are valid only when probe is immersed in GHe at ambient room conditions.

Propellant Level	Capacitance (pf)	Mass (1bm)	Coarse Mass Ratio	Fine Mass Ratio (λ)
LH2 Mass Sensor (E0011)				
Helium Calibration Point* (1)	972.70	-2	-.00687	TAP - .00673
Air Calibration Point (GN2)	973.21	101	-.00456	TAP - .00447
Probe Bottom (Cryogenic)	973.72	206	-.00220	TAP - .00215
Empty Calibration Point	974.20	304	0	TAP
Full Calibration Point (2)	1,170.69	40,514	.90389	TAP + .88581
Probe Calibration Point	1,181.01	42,625	.95134	TAP + .93231
Full Load (Pressurized) (3)	1,184.55	43,350	.96764	TAP + .94828
Full Load (Unpressurized) (4)	1,186.14	43,350	.97494	TAP + .95544
Ref Mix Ratio Calib Point	1.170.69	40,514	.90389	TAP + .88581
Probe Immersed	1,188.54	44,166	.98598	TAP + .96626

NOTES: (1) When LH2 tank is empty of propellant and filled only with GHe at one atmosphere.

(2) The delta capacitance (full calibration point minus the helium calibration point) is 197.99 pf, which will give an indication of a coarse mass ratio (CMR) of .90389 and an LH2 mass of 40,514 lbm.

(3) The loading computer (L/C) will be programmed to load to a CMR of .96764, which is equal to an LH2 mass of 43,350 lbm (pressurized). The maximum acceptable deviation from the nominal load is +0.5 percent; i.e., a minimum CMR of .96280 and a maximum of .917248.

(4) The L/C will be programmed to load to a CMR of .97494, which is equal to an LH2 mass of 43,350 (unpressurized). An L/C tolerance of +0.5 percent of the desired load will yield a minimum CMR of .97007 and a maximum of .97981. The nominal CMR of .97494 will be used as the initial 100 percent value for the KSC propellant loading test. This value was based upon data obtained from previous loading tests and launch countdowns. Additional adjustments to the CMR (unpressurized) may be required after the AS-205 Countdown Demonstration Test (CDDT).

The above data are valid only when probe is immersed in GHe at ambient room conditions.

Mass and Capacitance Reduction Formulae

LOX Mass $= \lambda \ (225,131) \ + \ (-7,421)$
LH2 Mass $= \lambda \ (45,394) \ + \ (-604)$
LOX Capacitance $= \lambda \ (152.41) \ + \ (275.68)$
LH2 Capacitance $= \lambda \ (221.83) \ + \ (969.76)$

$$\lambda = \frac{LEG}{20} = \text{Fine Mass Ratio}$$

LEG = Total integral number plus fractional
part of fine mass LEGS traversed
expressed as a decimal.

Example: LEG = 18.49 indicates 18 full
LEGS have been traversed plus
49/100 of the nineteenth LEG.

Reference Mixture Ratio Adjustment to

a. Calibrate bridges as shown in table.

b. Put in ΔC = 197.99 pf on LH2 bridge.

c. Put in ΔC = 131.73 pf on LOX bridge.

d. Adjust bias potentiometers for 0.000
± 0.01 volts at the empty calibration
point and with the above ΔC's in the
bridges.

TABLE AP 6-3
ESTIMATED PROPELLANT UTILIZATION ANALYSIS ACCURACIES

ITEM	DESCRIPTION	TEST	CDDT AND SECOND BURN					
			LOX TANK (± LBM)			LH2 TANK (± LBM)		
			LEVEL SENSOR NO.			LEVEL SENSOR NO.		
			L0014	L0015	L0016	L0017	L0018	L0019
1	Predicted accuracies of level sensors.	Second burn CDDT**	* 181	420 255	535 315	* 41	* 54	116 59
2	Predicted accuracy of PU mass sensor at level sensor activation.	Second burn and CDDT	497	497	498	128	131	132
3	Probable deviation between level sensor and PU mass sensor (RSS of items 1 and 2).	Second burn CDDT	* 529	651 559	731 589	* 134	* 142	176 145
4	Predicted accuracy of propellant residuals at ECC as determined by individual level sensor.	Second burn	*	421	543	*	*	116
5	Probable deviation between mass sensor and level sensor determined residuals at ECC (RSS of item 4 of this table and item 1 in table AP 6-4).	Second burn	*	646	731	*	*	174

* These level sensors are not expected to deactivate during flight because the predicted residuals are higher than these levels.

** Countdown Demonstration Test (CDDT) predictions are valid only if propellant is maintained at a minimum of 2 deg R below saturation and at nominal tank pressurization.

TABLE AP 6-4
ACCURACY OF DETERMINING PROPELLANT RESIDUALS AT ECC

ITEM	DESCRIPTION	FIRST BURN			SECOND BURN		
		LOX (± LBM)	LH2 (± LBM)	TOTAL (± LBM)	LOX (± LBM)	LH2 (± LBM)	TOTAL (± LBM)
1	PU system mass sensor accuarcy of propellant residuals based upon a predicted residual, above the main propellant valves, of 131,401 lbm LOX and 31,056 lbm LH2 (first burn) and 7,162 lbm LOX and 3,122 lbm LH2 (second burn).	707	225	742	490	130	507
2	Estimated overall level sensor accuracy of propellant residuals as determined by the weighted average technique baséd upon predicted residuals noted in item 1.	N/A	N/A	N/A	333	116	353
3	Combining the estimated level sensor residual accuracy (item 2) with the mass sensor residual accuracy (item 1) using the weighted average technique.	N/A	N/A	N/A	275	87	288

NOTE: Totals represent root-sum-square (RSS) values of individual propellant tank accuracies.

HEIGHT* (in.)	VOLUME (ft^3)	HEIGHT* (in.)	VOLUME (ft^3)	HEIGHT* (in.)	VOLUME (ft^3)
1.00	.000	48.00	342.736	95.00	1440.807
2.00	.000	49.00	357.339	96.00	1470.958
3.00	.000	50.00	372.285	97.00	1501.117
4.00	.710	51.00	387.579	98.00	1531.285
5.00	1.835	52.00	403.224	99.00	1561.461
6.00	3.320	53.00	419.222	100.00	1591.644
7.00	5.155	54.00	435.577	101.00	1621.834
8.00	7.330	55.00	452.293	102.00	1652.031
9.00	9.837	56.00	469.374	103.00	1682.234
10.00	12.668	57.00	486.822	104.00	1712.442
11.00	15.818	58.00	504.641	105.00	1742.656
12.00	19.281	59.00	522.835	106.00	1772.875
13.00	23.052	60.00	541.406	107.00	1803.098
14.00	27.127	61.00	560.359	108.00	1833.326
15.00	31.505	62.00	579.696	109.00	1863.557
16.00	36.182	63.00	599.422	110.00	1893.792
17.00	41.157	64.00	619.539	111.00	1924.031
18.00	46.428	65.00	640.051	112.00	1954.272
19.00	51.996	66.00	660.962	113.00	1984.517
20.00	57.860	67.00	682.274	114.00	2014.763
21.00	64.021	68.00	703.992	115.00	2045.012
22.00	70.478	69.00	726.119	116.00	2075.263
23.00	77.233	70.00	748.657	117.00	2105.515
24.00	84.286	71.00	771.612	118.00	2135.769
25.00	91.638	72.00	794.985	119.00	2166.024
26.00	99.291	73.00	818.781	120.00	2196.280
27.00	107.245	74.00	843.002	121.00	2226.537
28.00	115.502	75.00	867.653	122.00	2256.795
29.00	124.061	76.00	892.736	123.00	2287.053
30.00	132.924	77.00	918.256	124.00	2317.311
31.00	142.091	78.00	944.215	125.00	2347.569
32.00	151.561	79.00	970.617	126.00	2377.828
33.00	161.334	80.00	997.466	127.00	2408.086
34.00	171.409	81.00	1024.764	128.00	2438.344
35.00	181.784	82.00	1052.516	129.00	2468.602
36.00	192.458	83.00	1080.724	130.00	2498.859
37.00	203.427	84.00	1109.393	131.00	2529.115
38.00	214.687	85.00	1138.525	132.00	2559.371
39.00	226.205	86.00	1168.124	133.00	2589.626
40.00	237.870	87.00	1198.193	134.00	2619.880
41.00	249.847	88.00	1228.736	135.00	2650.133
42.00	262.141	89.00	1260.118	136.00	2680.385
43.00	274.754	90.00	1290.205	137.00	2710.636
44.00	287.691	91.00	1320.304	138.00	2740.885
45.00	300.954	92.00	1350.414	139.00	2771.134
46.00	314.547	93.00	1380.535	140.00	2801.381
47.00	328.473	94.00	1410.666	141.00	2831.627

*NOTE: Height is the distance above the LH2 tank reference station 248.574.

HEIGHT VERSUS VOLUME LH2 TANK-GROUND
LOADING CONDITION

HEIGHT* (in.)	VOLUME (ft^3)	HEIGHT* (in.)	VOLUME (ft^3)	HEIGHT* (in.)	VOLUME (ft^3)
142.00	2861.871	189.00	4278.758	236.00	5695.981
143.00	2892.114	190.00	4308.787	237.00	5726.068
144.00	2922.356	191.00	4338.815	238.00	5756.150
145.00	2952.596	192.00	4368.842	239.00	5786.227
146.00	2982.835	193.00	4398.869	240.00	5816.300
147.00	3013.072	194.00	4428.894	241.00	5846.367
148.00	3043.307	195.00	4459.684	242.00	5876.429
149.00	3073.542	196.00	4489.875	243.00	5906.485
150.00	3103.774	197.00	4520.064	244.00	5936.537
151.00	3134.006	198.00	4550.253	245.00	5966.582
152.00	3164.235	199.00	4580.441	246.00	5996.622
153.00	3194.463	200.00	4610.627	247.00	6026.657
154.00	3224.690	201.00	4640.813	248.00	6056.685
155.00	3254.916	202.00	4670.997	249.00	6086.708
156.00	3285.139	203.00	4701.180	250.00	6116.725
157.00	3315.362	204.00	4731.362	251.00	6146.736
158.00	3345.583	205.00	4761.543	252.00	6176.741
159.00	3375.802	206.00	4791.721	253.00	6206.739
160.00	3406.021	207.00	4821.899	254.00	6236.732
161.00	3436.237	208.00	4852.075	255.00	6266.718
162.00	3466.453	209.00	4882.249	256.00	6296.699
163.00	3496.667	210.00	4912.422	257.00	6326.673
164.00	3526.880	211.00	4942.593	258.00	6356.641
165.00	3557.092	212.00	4972.762	259.00	6386.603
166.00	3587.302	213.00	5002.928	260.00	6416.559
167.00	3617.512	214.00	5033.093	261.00	6446.508
168.00	3647.720	215.00	5063.256	262.00	6476.452
169.00	3677.926	216.00	5093.416	263.00	6506.390
170.00	3708.064	217.00	5123.574	264.00	6536.321
171.00	3738.108	218.00	5153.730	265.00	6566.247
172.00	3768.151	219.00	5183.883	266.00	6596.167
173.00	3798.194	220.00	5214.033	267.00	6626.082
174.00	3828.235	221.00	5244.181	268.00	6655.991
175.00	3858.275	222.00	5274.325	269.00	6685.895
176.00	3888.315	223.00	5304.467	270.00	6715.794
177.00	3918.354	224.00	5334.606	271.00	6745.687
178.00	3948.392	225.00	5364.741	272.00	6775.576
179.00	3978.429	226.00	5394.873	273.00	6805.460
180.00	4008.465	227.00	5425.001	274.00	6835.341
181.00	4038.501	228.00	5455.126	275.00	6865.217
182.00	4068.536	229.00	5485.247	276.00	6895.089
183.00	4098.570	230.00	5515.364	277.00	6924.958
184.00	4128.603	231.00	5545.478	278.00	6954.824
185.00	4158.636	232.00	5575.587	279.00	6984.687
186.00	4188.667	233.00	5605.692	280.00	7014.548
187.00	4218.698	234.00	5635.793	281.00	7044.407
188.00	4248.729	235.00	5665.889	282.00	7074.265

*NOTE: Height is the distance above the LH2 tank reference station 248.574.

HEIGHT* (in.)	VOLUME (ft^3)	HEIGHT* (in.)	VOLUME (ft^3)	HEIGHT* (in.)	VOLUME (ft^3)
283.00	7104.121	330.00	8511.010	377.00	9737.438
284.00	7133.977	331.00	8540.315	378.00	9758.936
285.00	7163.833	332.00	8569.526	379.00	9780.184
286.00	7193.690	333.00	8598.641	380.00	9801.178
287.00	7223.548	334.00	8627.657	381.00	9821.914
288.00	7253.408	335.00	8656.570	382.00	9842.388
289.00	7283.270	336.00	8685.378	383.00	9862.597
290.00	7313.135	337.00	8714.078	384.00	9882.535
291.00	7343.005	338.00	8742.667	385.00	9902.200
292.00	7372.878	339.00	8771.142	386.00	9921.588
293.00	7402.757	340.00	8799.500	387.00	9940.693
294.00	7432.643	341.00	8827.739	388.00	9959.513
295.00	7462.535	342.00	8855.854	389.00	9978.043
296.00	7492.436	343.00	8883.844	390.00	9996.279
297.00	7522.346	344.00	8911.704	391.00	10014.217
298.00	7552.266	345.00	8939.433	392.00	10031.852
299.00	7582.197	346.00	8967.026	393.00	10049.181
300.00	7612.140	347.00	8994.481	394.00	10066.199
301.00	7642.096	348.00	9021.795	395.00	10082.903
302.00	7672.067	349.00	9048.964	396.00	10099.287
303.00	7702.054	350.00	9075.985	397.00	10115.347
304.00	7732.057	351.00	9102.855	398.00	10131.080
305.00	7762.079	352.00	9129.571	399.00	10146.481
306.00	7792.121	353.00	9156.130	400.00	10161.545
307.00	7822.184	354.00	9182.528	401.00	10176.269
308.00	7852.270	355.00	9208.762	402.00	10190.647
309.00	7878.703	356.00	9234.828	403.00	10204.675
310.00	7909.364	357.00	9260.724	404.00	10218.349
311.00	7939.985	358.00	9286.445	405.00	10231.665
312.00	7970.565	359.00	9311.990	406.00	10244.617
313.00	8001.101	360.00	9337.353	407.00	10257.202
314.00	8031.590	361.00	9362.532	408.00	10269.415
315.00	8062.029	362.00	9387.523	409.00	10281.251
316.00	8092.417	363.00	9412.323	410.00	10292.705
317.00	8122.752	364.00	9436.929	411.00	10303.774
318.00	8153.029	365.00	9461.336	412.00	10314.452
319.00	8183.248	366.00	9485.541	413.00	10324.734
320.00	8213.405	367.00	9509.540	414.00	10334.617
321.00	8243.497	368.00	9533.331	415.00	10344.094
322.00	8273.523	369.00	9556.909	416.00	10353.163
323.00	8303.480	370.00	9580.271	417.00	10361.816
324.00	8333.364	371.00	9603.413	418.00	10370.051
325.00	8363.174	372.00	9626.331	419.00	10377.862
326.00	8392.907	373.00	9649.022	420.00	10385.244
327.00	8422.559	374.00	9671.482	421.00	10392.193
328.00	8452.129	375.00	9693.707	422.00	10398.703
329.00	8481.613	376.00	9715.694	423.00	10404.770

*NOTE: Height is the distance above the LH2 tank reference station 248.574.

HEIGHT* (in.)	VOLUME (ft^3)		
424.00	10410.388		
425.00	10415.552		
426.00	10420.259		
427.00	10424.502		
428.00	10428.276		
429.00	10431.577		
430.00	10434.400		
431.00	10436.738		
432.00	10438.588		
433.00	10439.943		
434.00	10440.800		
435.00	10441.151		
436.00	10441.451		

*NOTE: Height is the distance above the LH2 tank reference station 248.574.

TABLE AP 6-6 (Sheet 1 of 2)
HEIGHT VERSUS VOLUME LOX TANK-GROUND
LOADING CONDITION

HEIGHT* (in.)	VOLUME (ft^3)	HEIGHT* (in.)	VOLUME (ft^3)	HEIGHT* (in.)	VOLUME (ft^3)
1.00	.000	47.00	458.084	93.00	1545.720
2.00	.451	48.00	476.369	94.00	1572.146
3.00	1.532	49.00	494.950	95.00	1598.400
4.00	3.092	50.00	513.822	96.00	1624.479
5.00	5.271	51.00	532.982	97.00	1650.380
6.00	7.631	52.00	552.426	98.00	1676.097
7.00	10.598	53.00	572.151	99.00	1701.629
8.00	14.023	54.00	592.153	100.00	1726.970
9.00	17.901	55.00	612.430	101.00	1752.118
10.00	22.227	56.00	632.976	102.00	1777.068
11.00	26.996	57.00	653.788	103.00	1801.817
12.00	32.203	58.00	674.864	104.00	1826.361
13.00	37.844	59.00	696.199	105.00	1850.697
14.00	43.913	60.00	717.789	106.00	1874.821
15.00	50.407	61.00	739.631	107.00	1898.728
16.00	57.321	62.00	761.722	108.00	1922.416
17.00	64.650	63.00	784.058	109.00	1945.881
18.00	72.390	64.00	806.634	110.00	1969.119
19.00	80.537	65.00	829.448	111.00	1992.126
20.00	89.088	66.00	852.496	112.00	2014.899
21.00	98.036	67.00	875.774	113.00	2037.433
22.00	107.379	68.00	899.279	114.00	2059.726
23.00	117.113	69.00	923.006	115.00	2081.773
24.00	127.234	70.00	946.953	116.00	2103.572
25.00	137.737	71.00	971.115	117.00	2125.117
26.00	148.619	72.00	995.489	118.00	2146.406
27.00	159.876	73.00	1020.071	119.00	2167.434
28.00	171.505	74.00	1044.857	120.00	2188.198
29.00	183.501	75.00	1069.844	121.00	2208.695
30.00	195.860	76.00	1095.027	122.00	2228.921
31.00	208.580	77.00	1120.404	123.00	2248.871
32.00	221.656	78.00	1145.971	124.00	2268.543
33.00	235.084	79.00	1171.723	125.00	2287.932
34.00	248.862	80.00	1197.657	126.00	2307.035
35.00	262.985	81.00	1223.769	127.00	2325.848
36.00	277.449	82.00	1250.055	128.00	2344.368
37.00	292.252	83.00	1276.512	129.00	2362.590
38.00	307.389	84.00	1303.136	130.00	2380.512
39.00	322.857	85.00	1329.922	131.00	2398.128
40.00	338.653	86.00	1356.868	132.00	2415.437
41.00	354.772	87.00	1383.968	133.00	2432.433
42.00	371.211	88.00	1411.220	134.00	2449.114
43.00	387.967	89.00	1438.374	135.00	2465.475
44.00	405.035	90.00	1465.449	136.00	2481.513
45.00	422.414	91.00	1492.368	137.00	2497.225
46.00	440.098	92.00	1519.126	138.00	2512.606

*NOTE: Height is the distance above the LOX tank reference station 156.416

HEIGHT VERSUS VOLUME LOX TANK-GROUND
LOADING CONDITION

HEIGHT* (in.)	VOLUME ft^3)		
139.00	2527.652		
140.00	2542.361		
141.00	2556.728		
142.00	2570.750		
143.00	2584.422		
144.00	2597.742		
145.00	2610.706		
146.00	2623.310		
147.00	2635.549		
148.00	2647.421		
149.00	2658.923		
150.00	2670.049		
151.00	2680.796		
152.00	2691.161		
153.00	2701.141		
154.00	2710.731		
155.00	2719.927		
156.00	2728.726		
157.00	2737.124		
158.00	2745.118		
159.00	2752.704		
160.00	2759.878		
161.00	2766.636		
162.00	2772.975		
163.00	2778.891		
164.00	2784.381		
165.00	2789.440		
166.00	2794.065		
167.00	2798.252		
168.00	2801.998		
169.00	2805.299		
170.00	2808.151		
171.00	2810.550		
172.00	2812.493		
173.00	2813.977		
174.00	2814.996		
175.00	2815.549		
176.00	2815.630		

*NOTE: Height is the distance above the LOX tank reference station 156.416
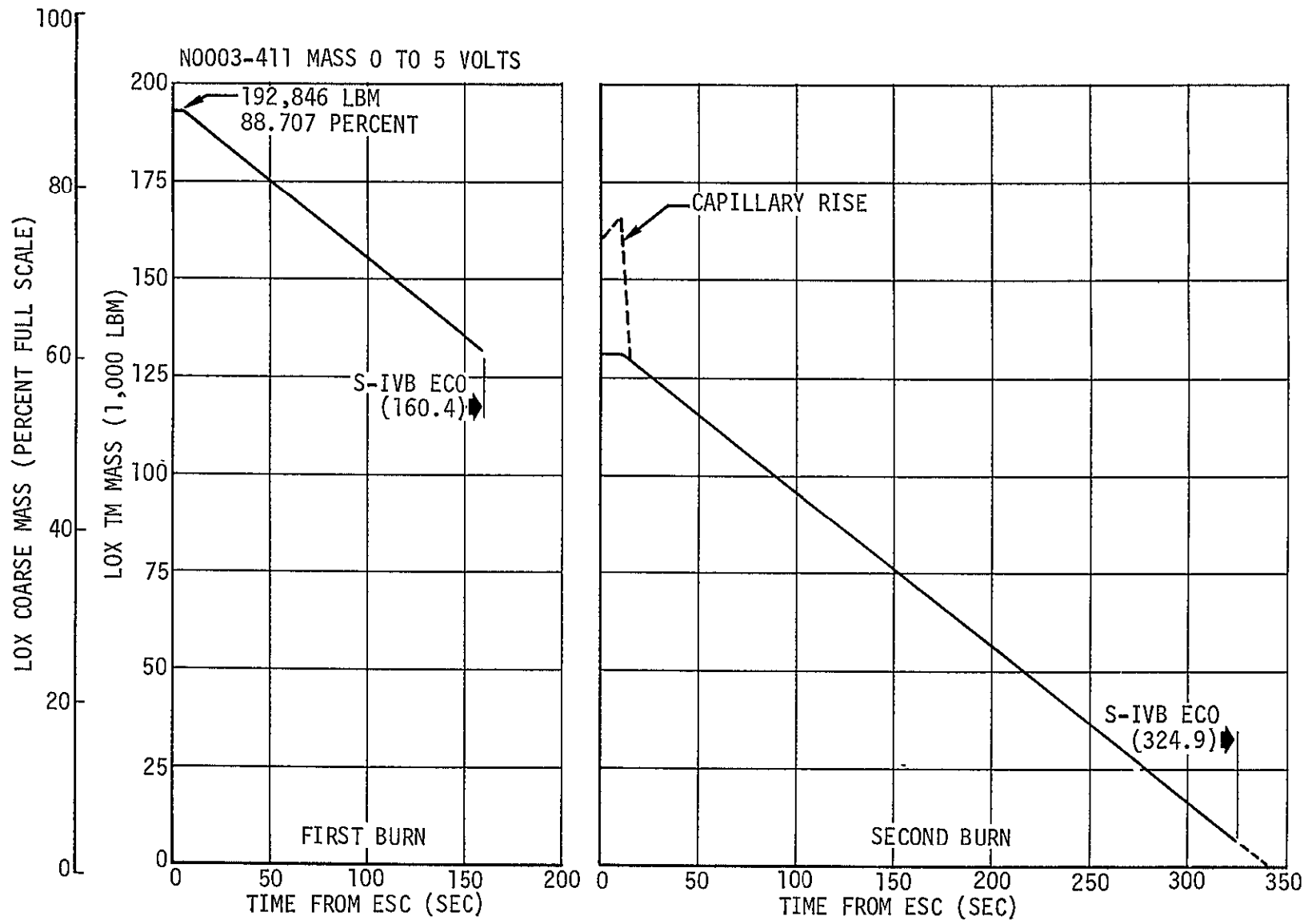
Figure AP 6-1. LOX Coarse Mass
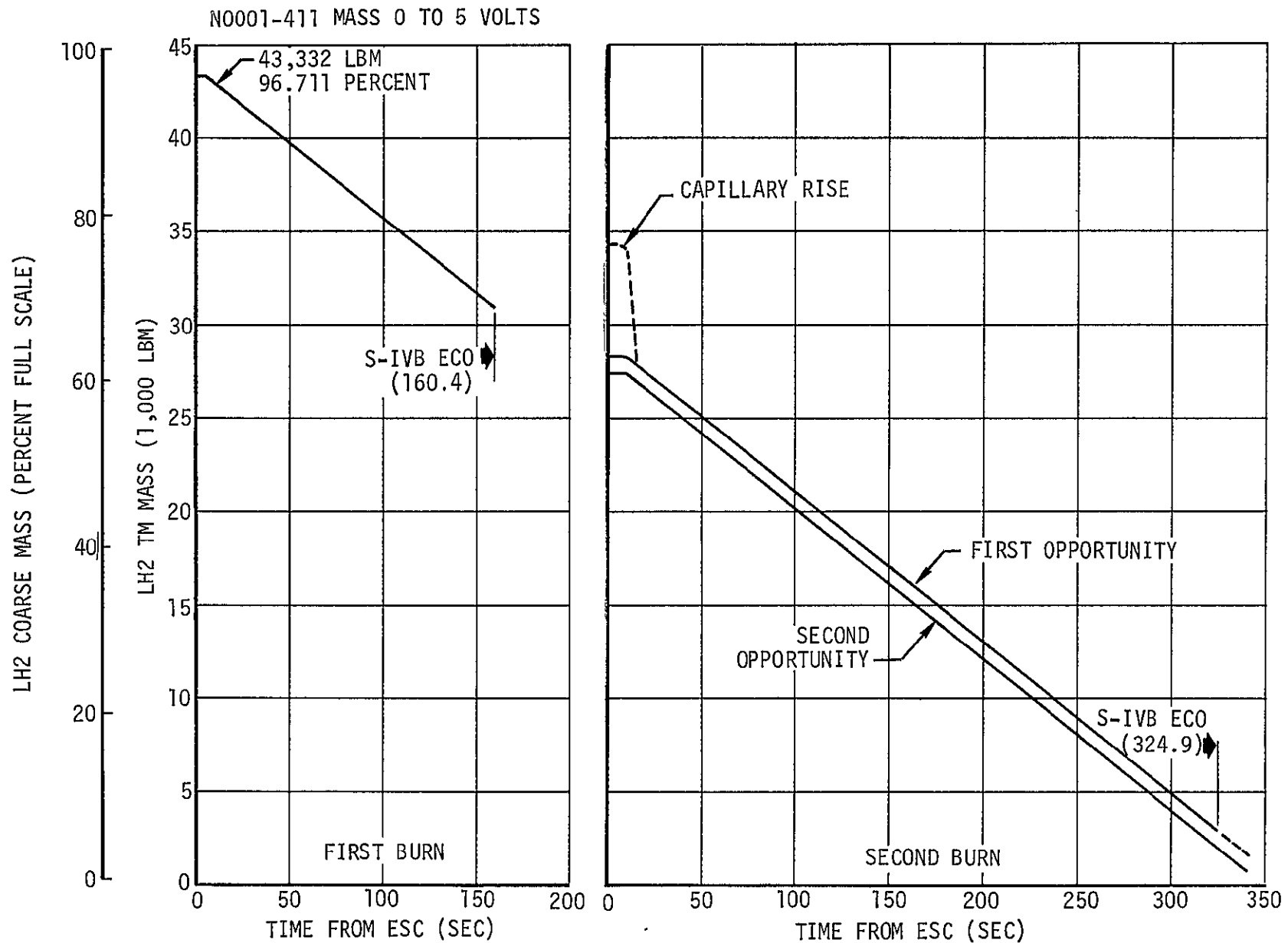
Figure AP 6-2. LH2 Coarse Mass
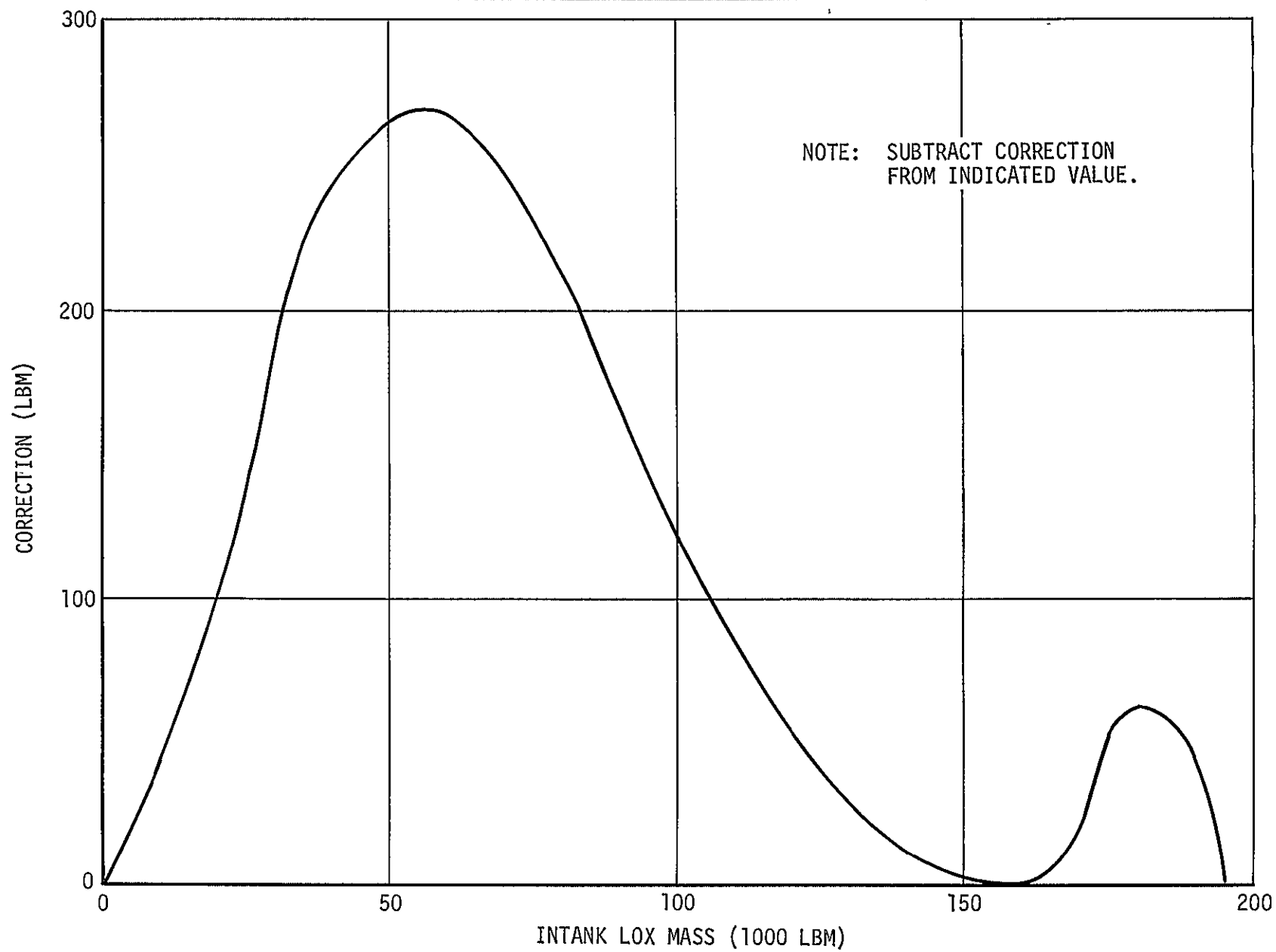
Figure AP 6-3. Total Predicted LOX Sensor Mass Correction (Volumetric Method)

NOTE: SUBTRACT CORRECTION FROM INDICATED VALUE.

CORRECTION (LBM)

INTANK LH2 MASS (1000 LBM)
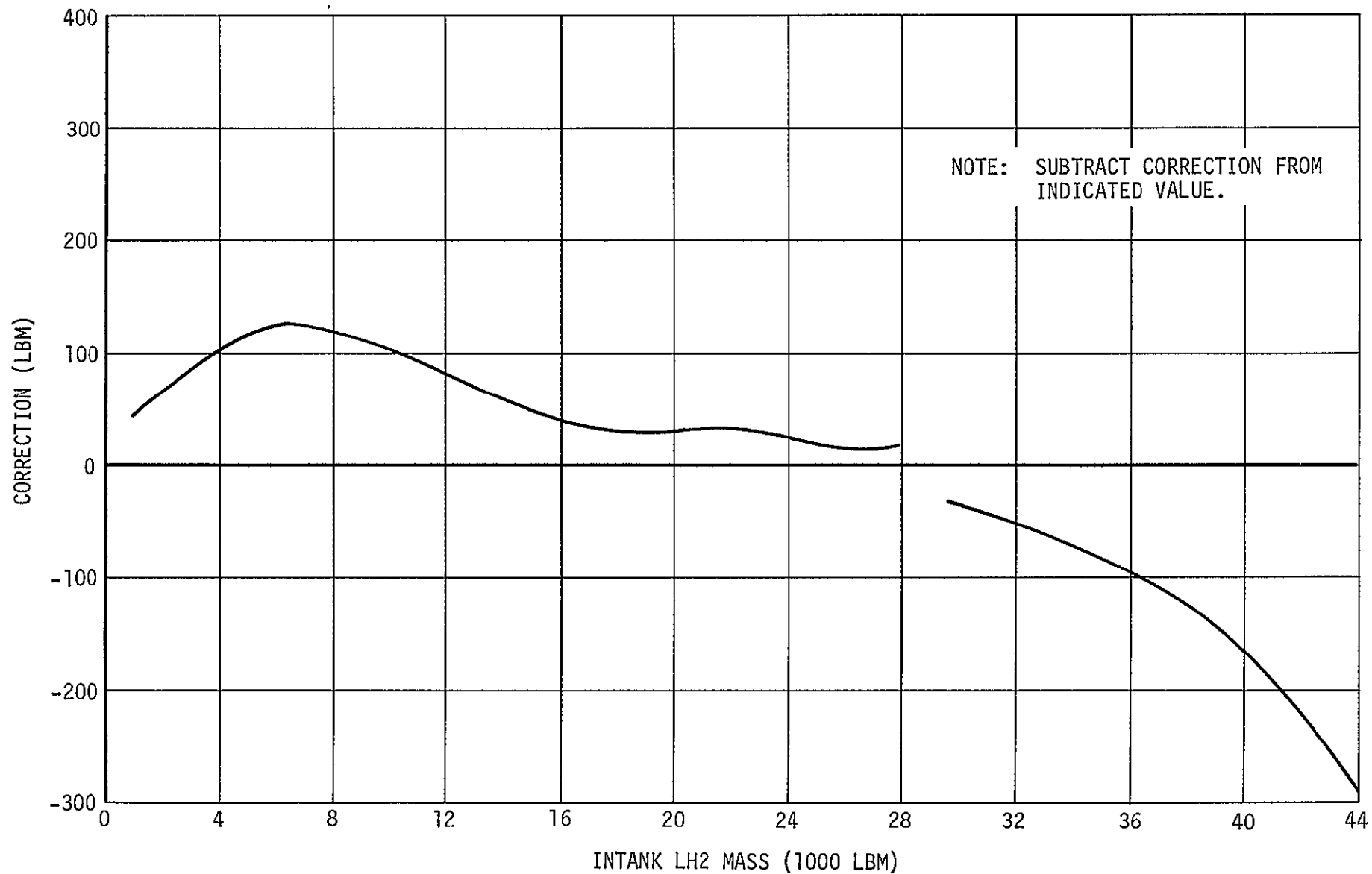
Figure AP 6-4. Total LH2 Sensor Mass Correction (Volumetric Method)
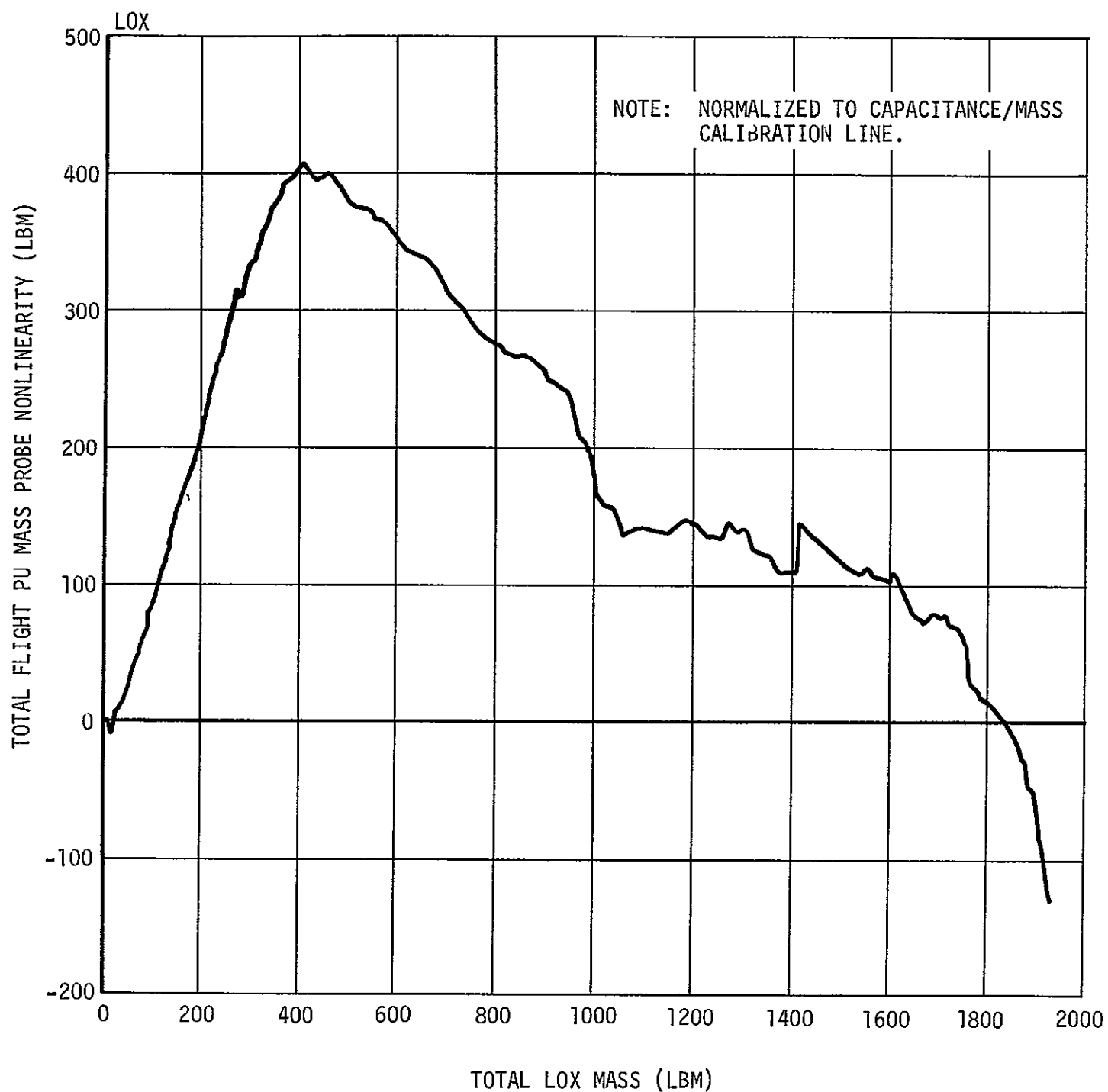
Figure AP 6-5. Predicted Total Flight LOX Sensor Mass (Flow Integral Method)
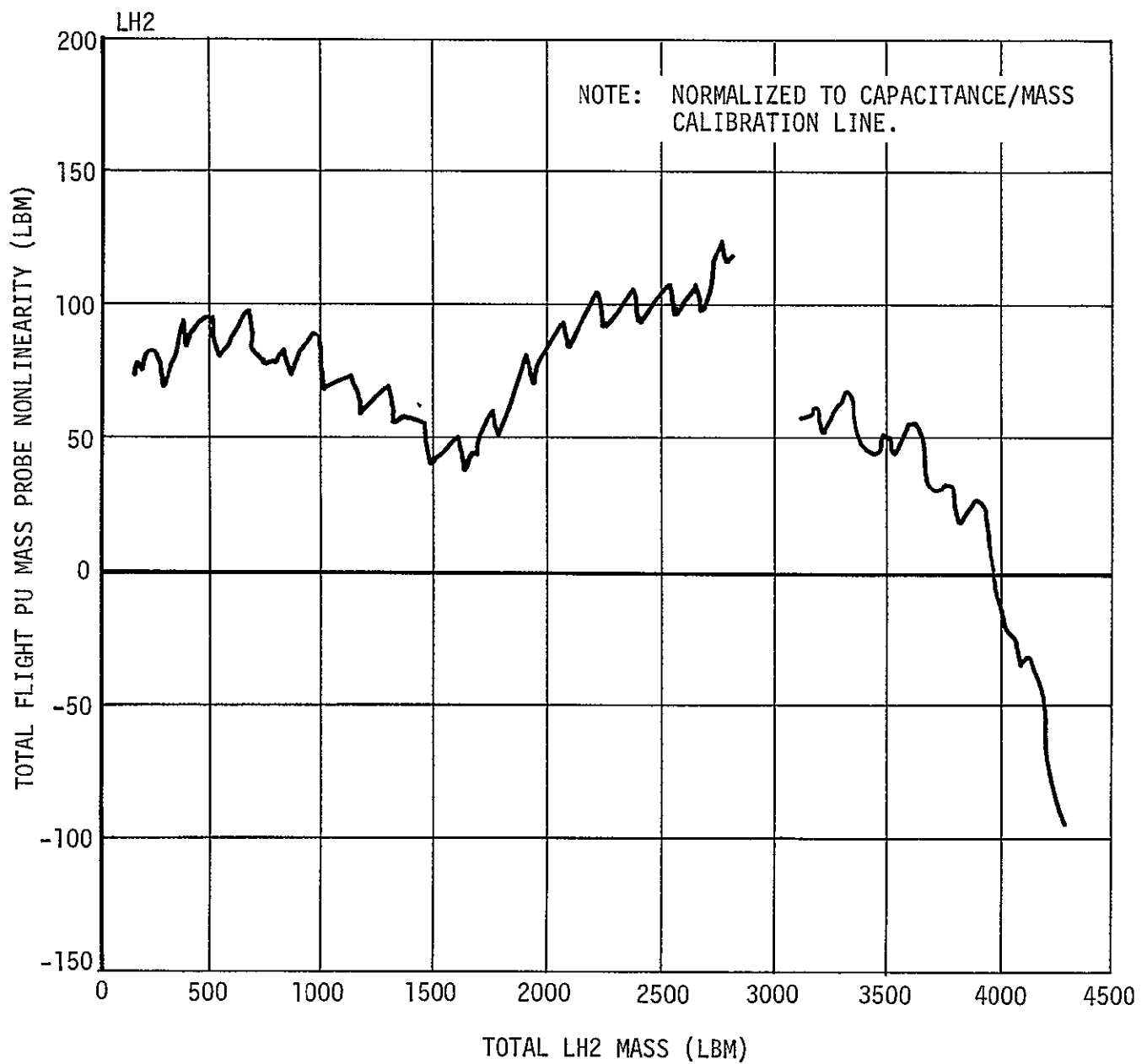
Figure AP 6-6. Predicted Total Flight LH2 Sensor Mass (Flow Integral Method)

APPENDIX 7

PREDICTED SEPARATION AND CONTROL PERFORMANCE

7. PREDICTED SEPARATION AND CONTROL PERFORMANCE

7.1 General

This appendix contains predicted S-II/S-IVB separation, preflight control transient simulations, and stage sloshing parameters (figures AP 7-1 through AP 7-6).

7.2 Predicted Control System Transients

Body attitude transients of varying magnitude are expected following S-II/S-IVB separation, and active guidance initiation. The nominal transients expected during these periods of flight were simulated and graphs of the resulting attitude errors, angular rates, and engine deflections for the pitch axis are shown in figure AP 7-1 for first burn; the pitch and yaw axis are shown in figures AP 7-2 and AP 7-3 for second burn. The transients resulting from commands in yaw and roll for first burn and roll for second burn are not significant in magnitude, therefore, they are not included. Closed loop control system sloshing frequencies are shown in figure AP 7-4. Predicted S-II/S-IVB separation parameters are shown in figures AP 7-5 and AP 7-6.
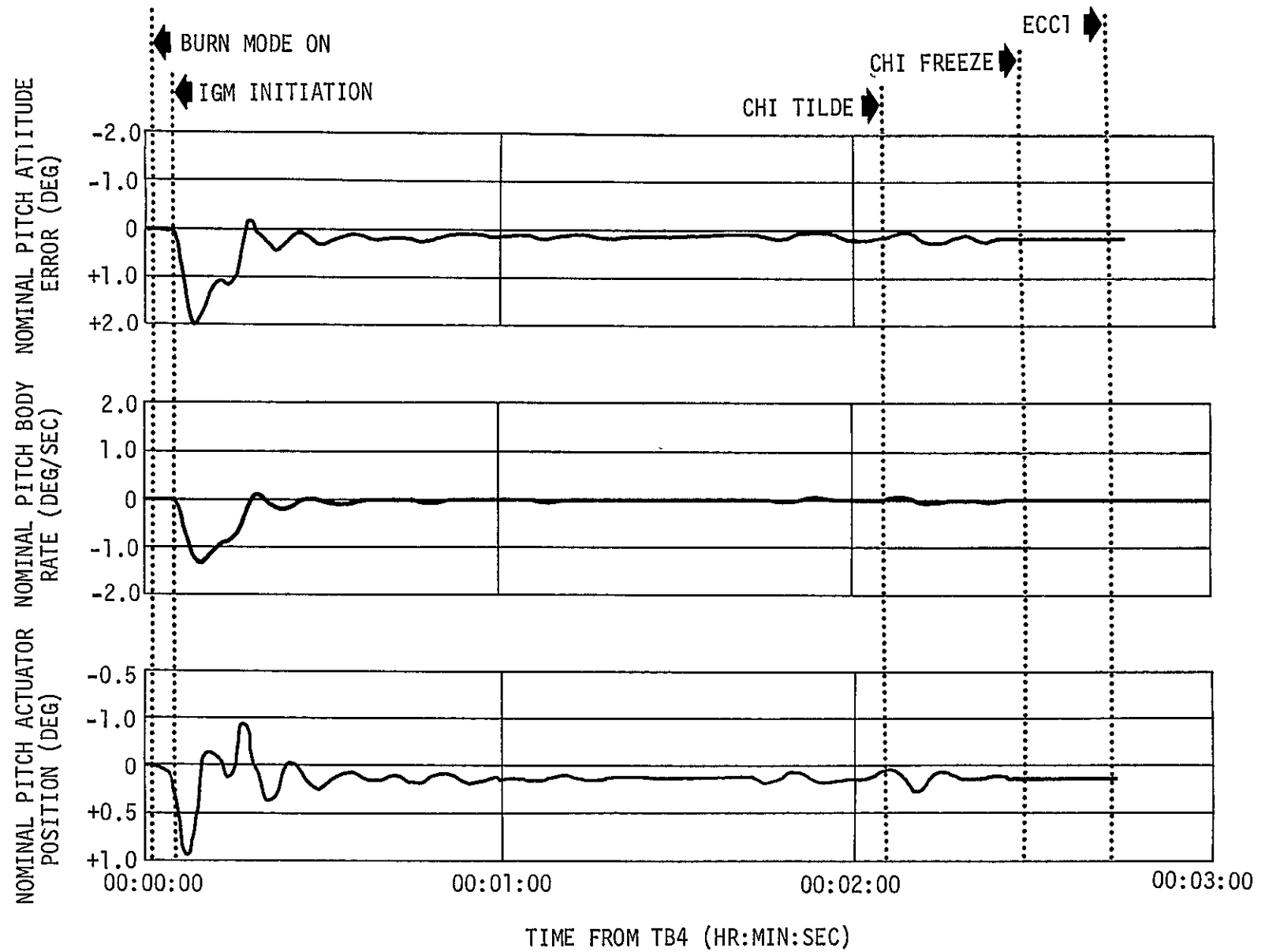
Figure AP 7-1.   Nominal Pitch Attitude Control During First S-IVB Burn
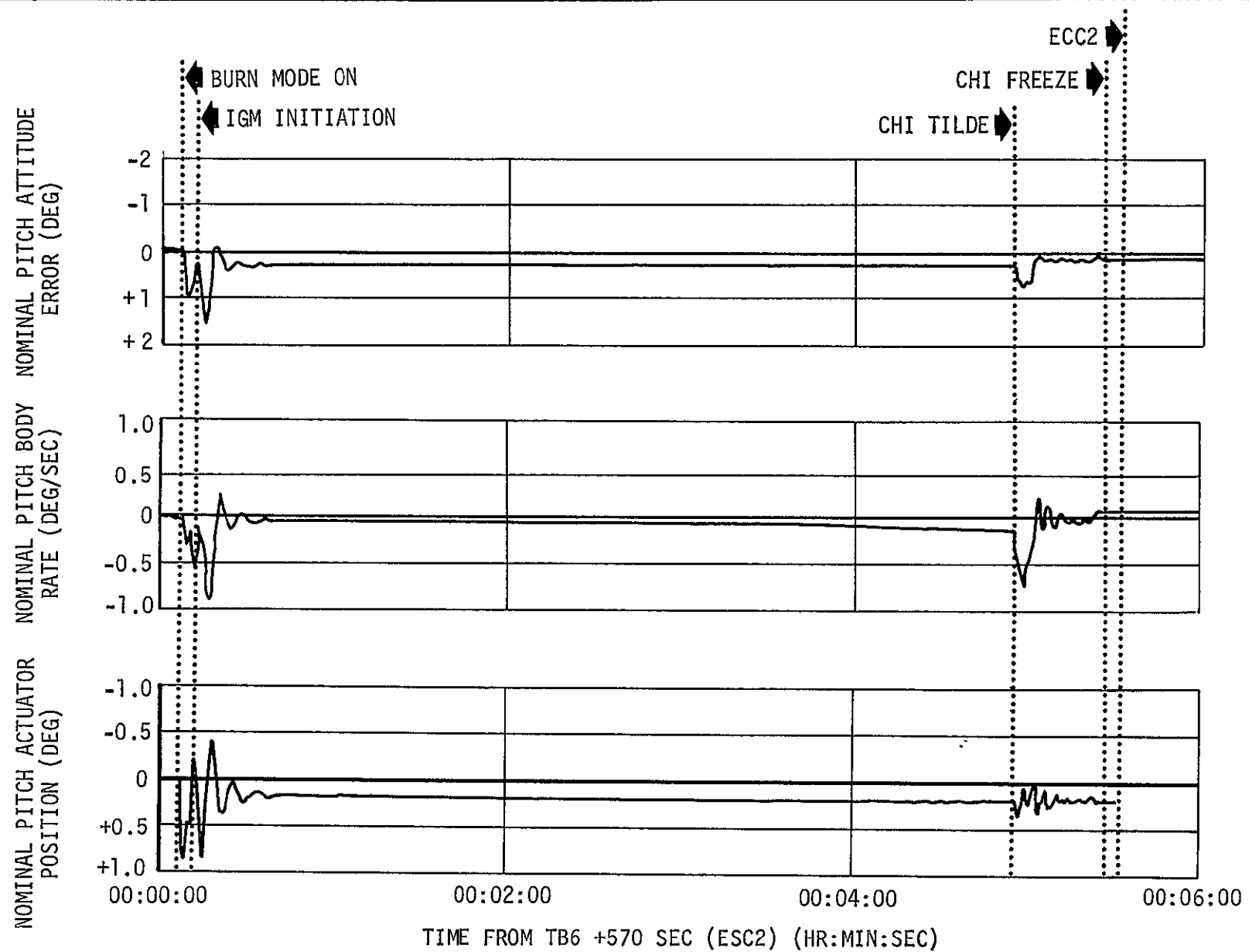
Figure AP 7-2. Nominal Pitch Attitude Control During Second S-IVB Burn
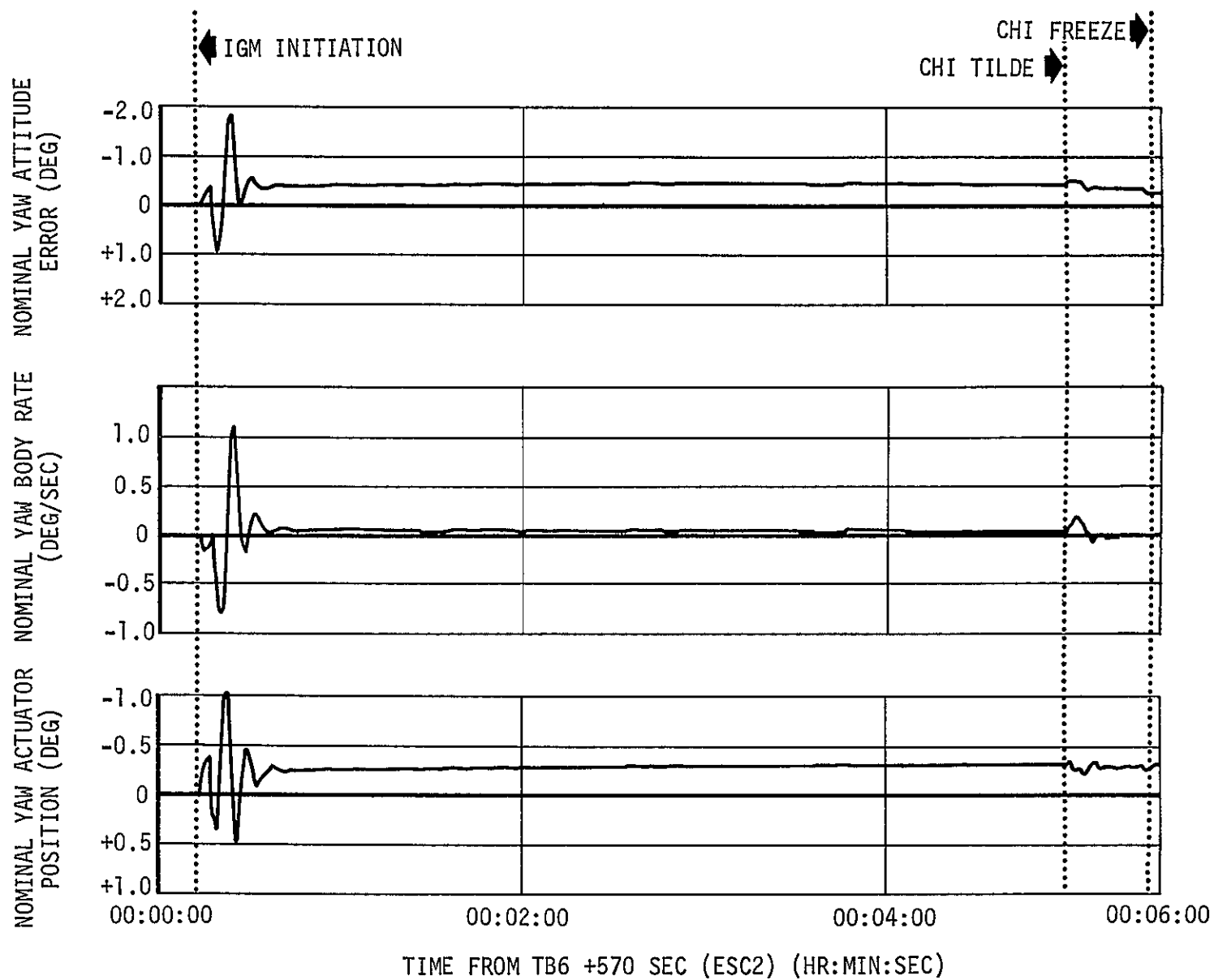
Figure AP 7-3. Nominal Yaw Attitude Control During Second S-IVB Burn
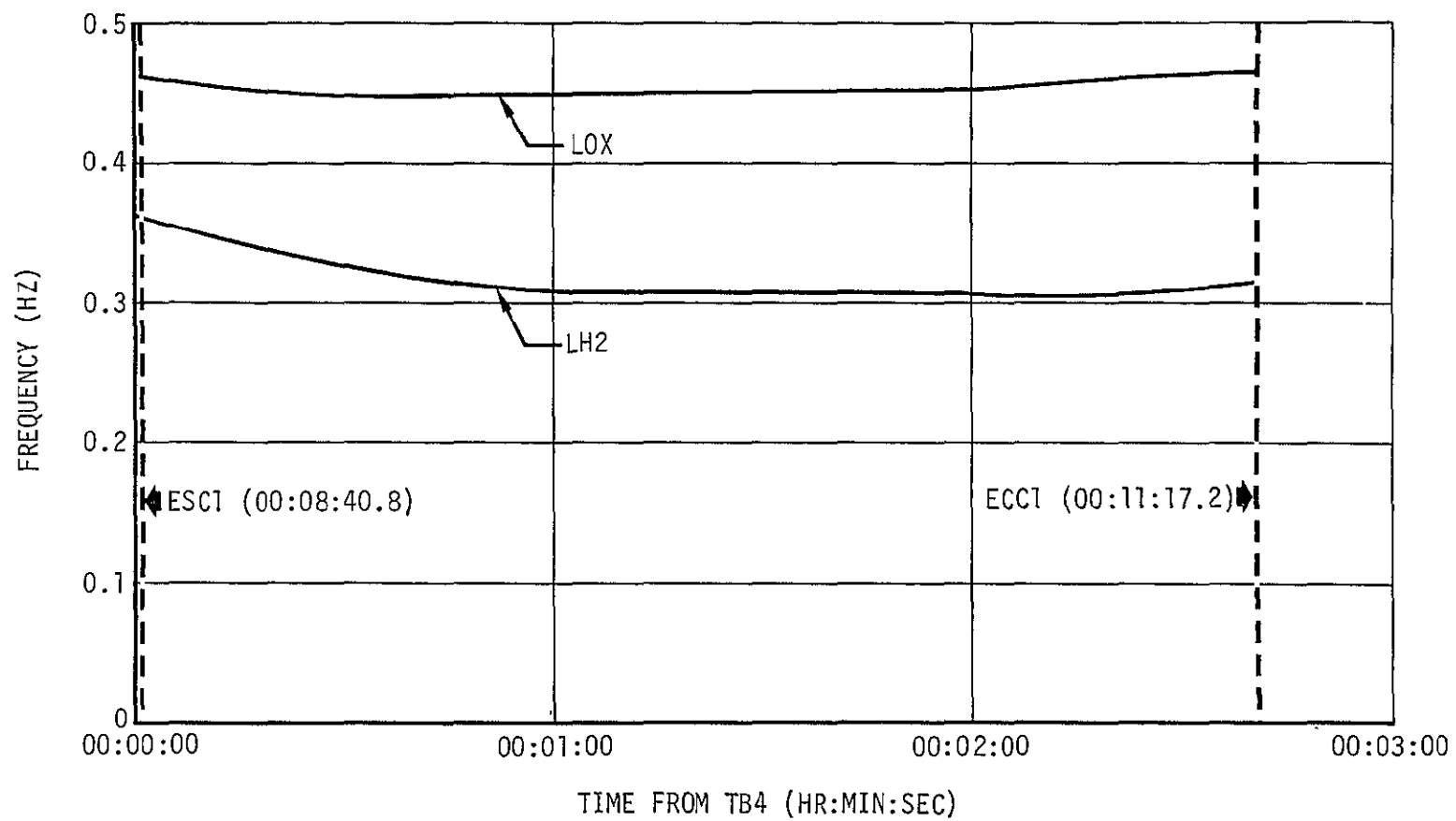
Figure AP 7-4.   Predicted LOX and LH2 Slosh Frequency (Sheet 1 of 2)
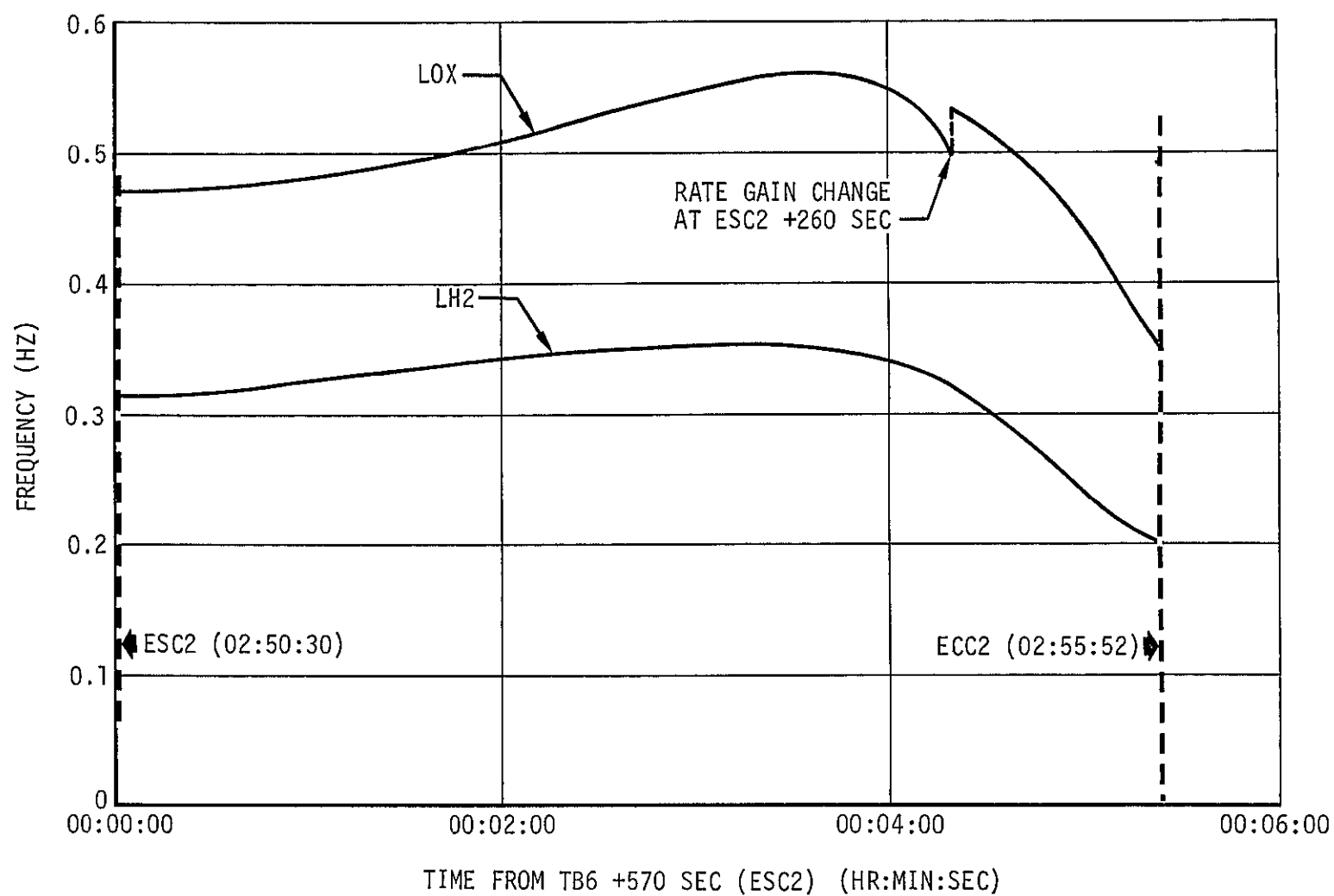
Figure AP 7-4. Predicted LOX and LH2 Slosh Frequency (Sheet 2 of 2)
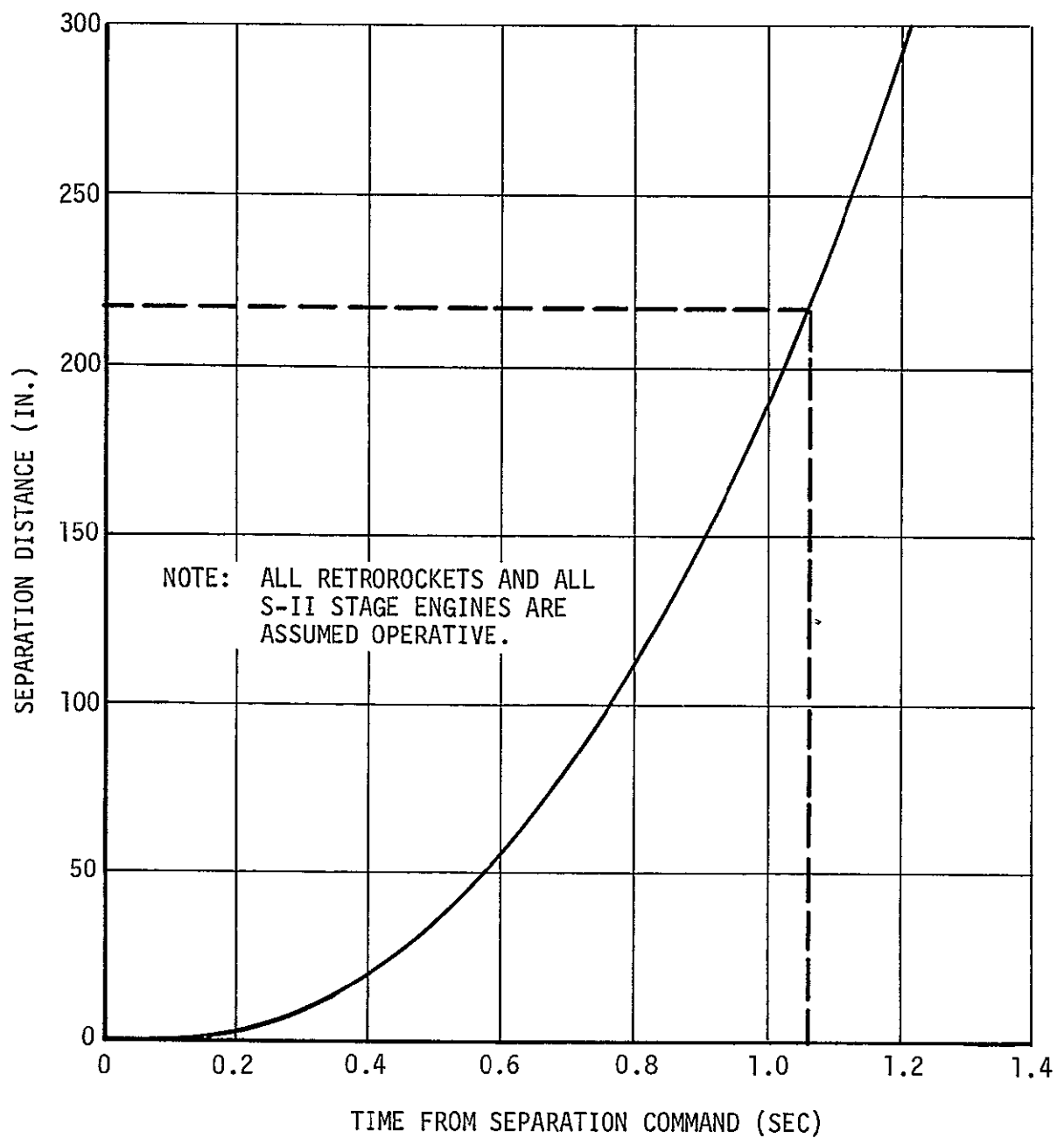
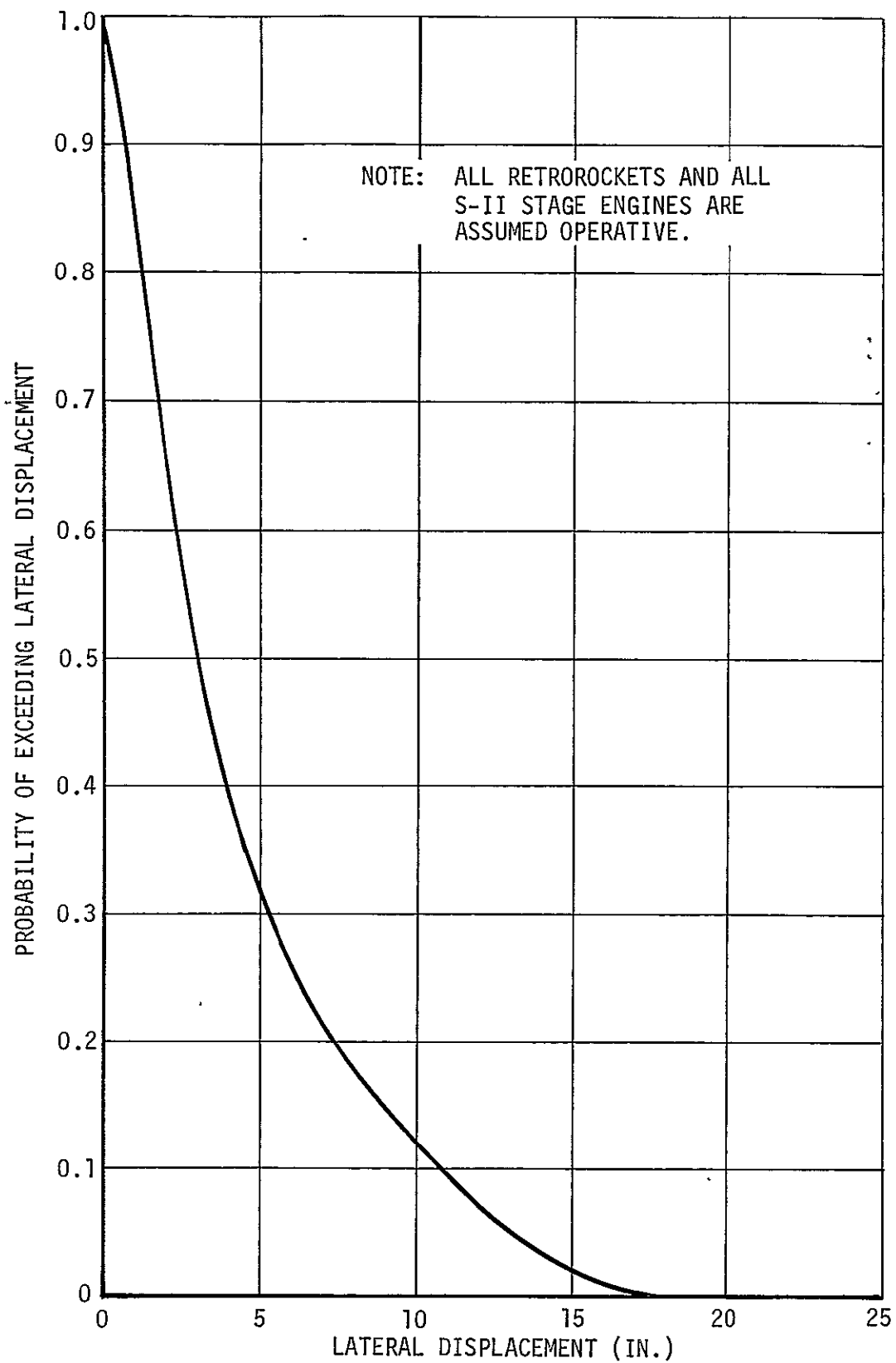Figure AP 7-5. Predicted S-II/S-IVB Separation History

NOTE: ALL RETROROCKETS AND ALL S-II STAGE ENGINES ARE ASSUMED OPERATIVE.

Figure AP 7-6.   Predicted S-II/S-IVB Separation Probability of Lateral Displacement Exceeding a Specified Value

ADDITIONAL PREDICTED PERFORMANCE DATA

8. ADDITIONAL PREDICTED PERFORMANCE DATA

This appendix presents additional predicted performance data and design performance levels not presented in other areas of the test plan. Figure AP 8-1 presents predicted S-IVB-503N hydraulic system operating levels, which are based on acceptance firing data. Figures AP 8-2 and AP 8-3 show the predicted acoustic and vibration levels to be measured. These levels were established from data obtained during previous flights and the MSFC J-2 engine ground tests.

The data acquisition system design tolerances are as follows:

a. Radio Frequency

    (1) The signal strengths received at the ground station shall be greater than threshold whenever the stage is at a positive elevation relative to the ground station horizon.

    (2) The output of the RF assemblies shall be 15 watts minimum under all operative and environmental conditions.

    (3) The VSWR, as computed from forward and reflected power of the RF system, shall not exceed 1.7:1.
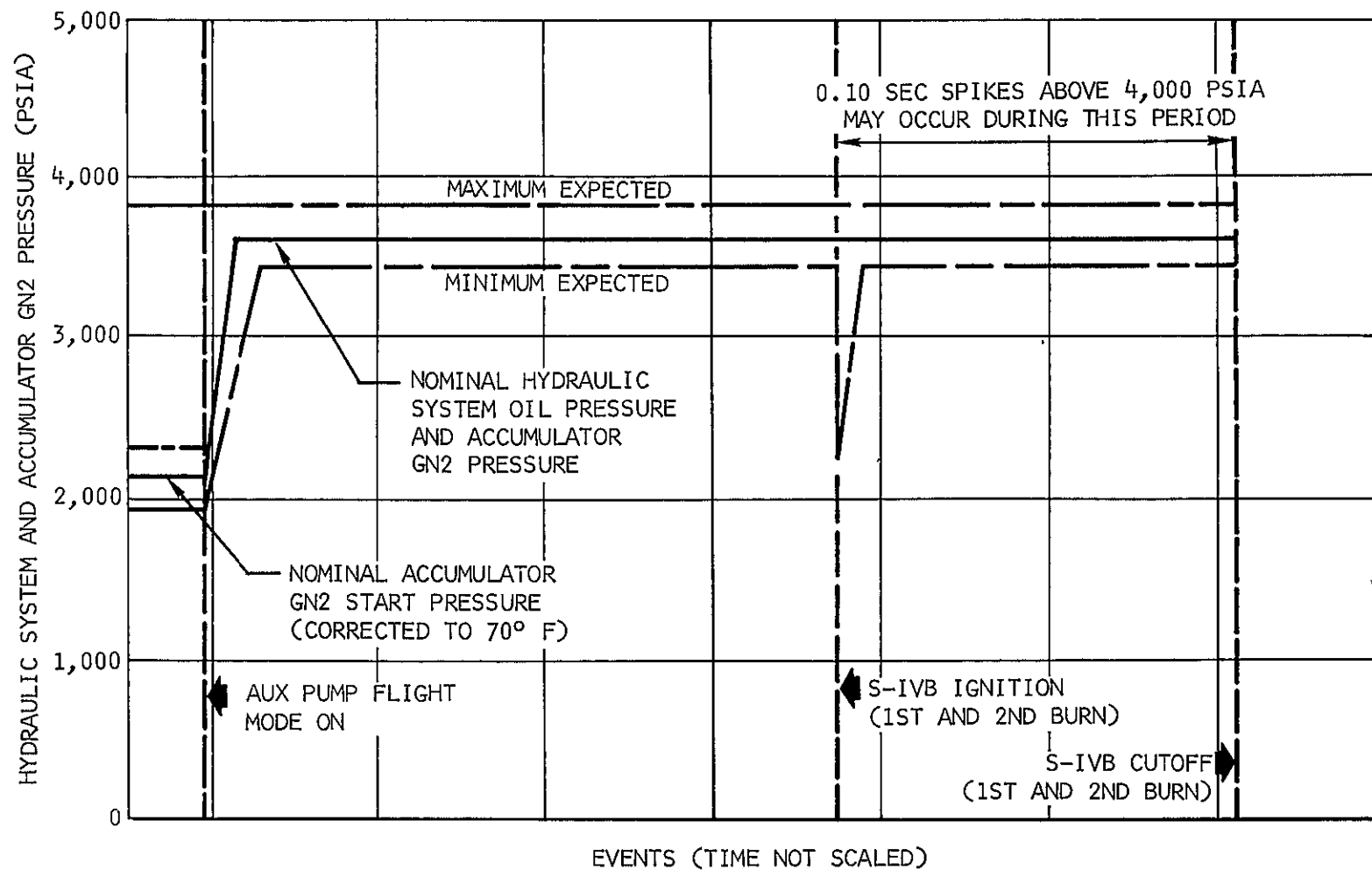
Figure AP 8-1.   Predicted S-IVB-503N Hydraulic System Operating Limits

Figure AP 8-2. Predicted Acoustic Levels

COMPONENT MEASUREMENTS

ACCELERATION (GRMS)

ENGINE MEASUREMENTS

S-IC BURN | S-II BURN | 1ST S-IVB BURN | COAST | 2ND S-IVB BURN
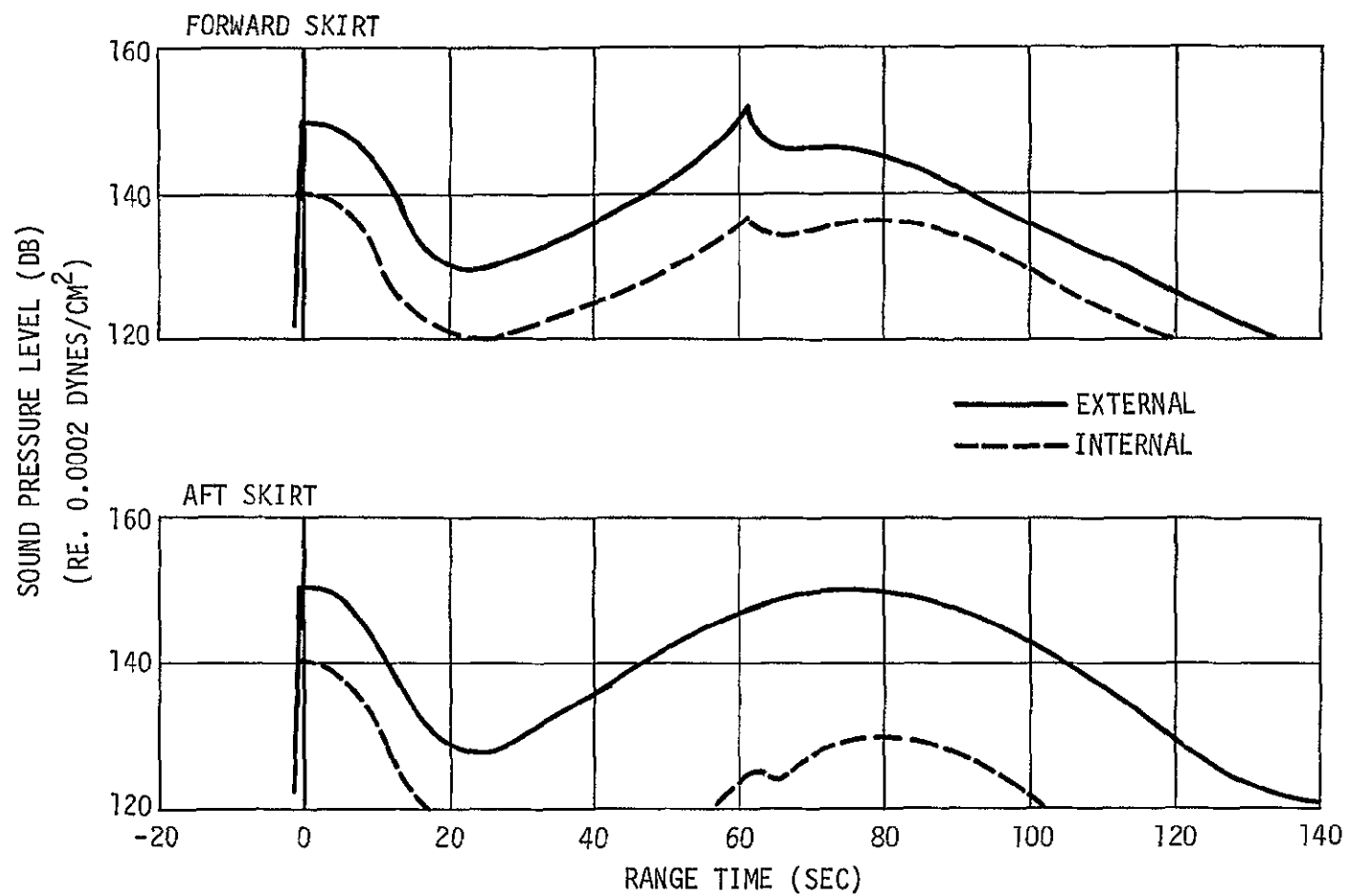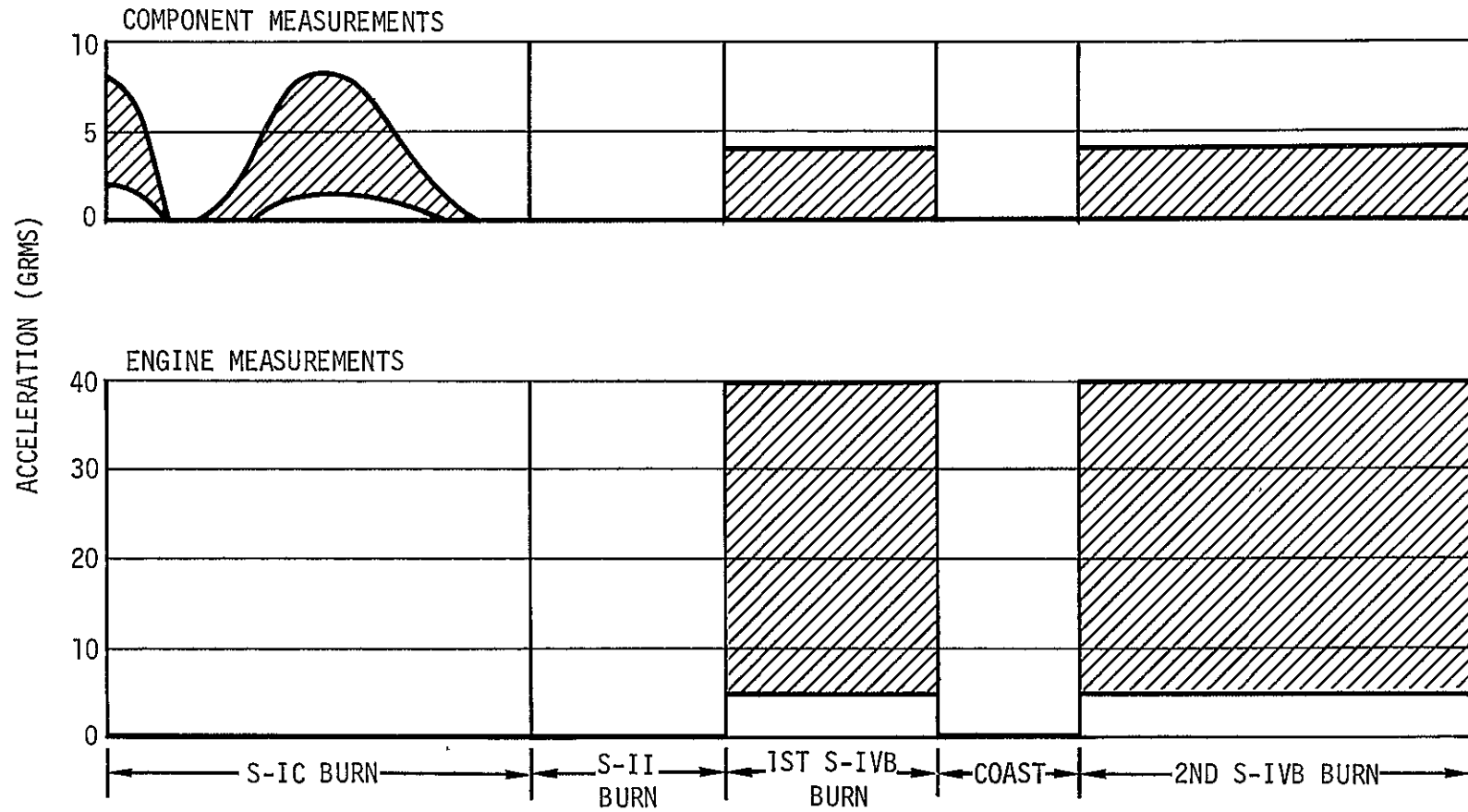
Figure AP 8-3. Predicted Envelopes of Composite Vibration

9. <u>RADIO FREQUENCY ALLOCATION</u>

The following radio frequencies will be used for S-IVB-503N telemetry and range safety transmitters:

<u>USAGE</u>	<u>FREQUENCY</u>
PCM/FM	258.5 MHz
FM/FM	253.8 MHz
SS/FM	246.3 MHz
Secure Range Safety	450 MHz

APPENDIX 10

ABBREVIATIONS

ITEM	TERM	ITEM	TERM
A.C.	Attitude Control	ECC	Engine Cutoff Command
amb	Ambient	ECO	Engine cutoff
amp	Ampere	EDS	Emergency detection system
amp-hr	Ampere-hour	E/D	Engine driven
APD	Aft Power Distributor	EMR	Engine propellant mixture ratio (The ratio of engine LOX mass flowrate to LH2 mass flowrate. Includes gas generator operations.)
APS	Auxiliary propulsion system		
A/P	Auxiliary pump		
AS	Apollo Saturn		
ASC	Air Force Eastern Test Range on Ascension Island	ES	Engine start
		ESC	Engine Start Command
ASI	Augmented Spark Igniter	ESE	Electrical Support Equipment
aux	Auxiliary	Ext	External
Bnr	Burner	°F	Degree Fahrenheit
BSE	Booster systems engineer	FCC	Flight control center
C/D	Chilldown	FD	Feed
ch	Channel	FD&C	Flight Dynamics and Control
cmd	Command	FDO	Flight dynamic officer
C/O	Cutoff	FIOR	Flight Information and Operations Report
Cryo	Cryogenic		
CSM	Command service module	FM	Frequency modulation
CVS	Continuous vent system	Freq	Frequency
CYI	Grand Canary Island	FU	Firing unit
dc	Direct current	Fwd	Forward
DCS	Digital command system	G	Gravitational acceleration (Acceleration of gravity due to the attractive potential of the reference body - ft/sec^2)
DDAS	Digital data acquisition system		
deg	Degree (temperature internal or difference)		
		GG	Gas generator
D/O	Dropout	GET	Ground elapsed time
DPF	Differential Pressure Feedback	GH2	Gaseous hydrogen
		GN2	Gaseous nitrogen
EBW	Exploding bridgewire	GOX	Gaseous oxygen

ITEM	TERM	ITEM	TERM
Gpm	Gallons per minute	MCR	Magnetic core register
Grd	Ground	MFV	Main fuel valve
GSE	Ground support equipment	min	Minute
He	Helium	Mod	Module
HPU	Hydraulic Pumping Unit	MOV	Main oxidizer valve
Hyd	Hydraulic	msec	Megacycle per second
Hz	Hertz (cycles per second)	MR	Mission Rule
IAS	Initiation of automatic sequence	M/S	Mainstage
		Mux	Multiplexer
IF	Intermediate frequency	MV	Megavolt
IGM	Iterative guidance mode	N/A	Not applicable
Inj	Injection	NC	Normally closed
Int	Internal	NO	Normally open
Isol	Isolated	No.	Number
IU	Instrument unit	N_2O_4	Nitrogen tetroxide
K	Kilohm	Nom	Nominal
L/L	Low level	NPSP	Net positive suction pressure
Lb	Pound	NPV	Nonpropulsive vent
lbf	Pound-force	OCT	Octa Code
LBM	Pound-mass	O_2-H_2	Oxygen hydrogen
LH2	Liquid hydrogen	OBECO	Outboard engine cutoff
LM	Lunar module	PCM	Pulse-count modulation
LOS	Loss of signal	PD	Propellant dispersion
LOX	Liquid oxygen	Pot	Potentiometer
L/O	Liftoff	pps	Pulses per second
L/R	Latching relief	psi	Pounds per square inch
LVDA	Launch vehicle digital adapter	psia	Pounds per square inch absolute
LVDC	Launch vehicle digital computer	psid	Pounds per square inch differential
M	Motor	psig	Pounds per square inch gauge
MDAC	McDonnell Douglas Astronautics Company	P/S	Pulse sensor

ITEM	TERM	ITEM	TERM
PU	Propellant utilization	Sys	System
PUEA	Propellant utilization electronics assembly	S-IC	First stage of the Saturn V (500) series of vehicles
Pwr	Power	S-II	Second stage of the Saturn V (500) series of vehicles
°R	Degree Rankine		
RASM	Remote analog sub-multiplexer	S-IVB	Second stage of the Saturn IB (200) series of vehicles and third stage of the Saturn V (500) series of vehicles
RCS	Reaction control system		
Rcvr	Receiver	T	Countdown time from prospective liftoff or as specifically defined in the text
RDSM	Remote digital sub-multiplexer		
Rec	Recommended	TA	Alternate time base
Reg	Regulator	TB	Time base
Ret	Return	TBD	To be determined
RF	Radio frequency	TC	Combustion chamber temperature
RMR	Reference mixture ratio		
RMS	Root-mean-square	Temp	Temperature
R/S	Range safety	TK	Tank
SA	System address (digital updata system)	TM or T/M	Telemetry
SC	Spacecraft - Includes Apollo command and service module and LM adapter	TV	Television
		TVC	Thrust vector control
		UDMH	Unsymmetrical di-methyl hydrazine
Sch	Schematic		
Sec	Second	Ull	Ullage
S/O	Shutoff	V	Volt
SOP	Standard operating procedure	vac	Voltage, alternating current
		vdc	Voltage, direct current
SOV	Shutoff valve	VHF	Very high frequency
SPS	Service propulsion system	Vlv	Valve
SS	Switch selector	VSWR	Voltage standing wave ratio
SSB	Single sideband	W	Watt
STDV	Start tank discharge valve		
SW	Switch		

11. REFERENCES

The following listed documents are referenced in the text:

(1) Saturn V Mission Implementation Plan, Mission C Prime, AS-503/Apollo-8, (prepared by Saturn V Systems Engineering Management Office [I-V-E]) dated September 18, 1968.

(2) AS-503 C' Operational Trajectory Analysis - Option 1, December Launch Opportunity

(3) Apollo 8 Mission C' Launch Vehicle Ground Support Plan, issue 1 October 1968.

(4) S-IVB-V Stage End Item Test Plan, 1B66684G, Huntington Beach, California, dated October 20, 1967.

(5) Apollo/Saturn Launch Mission Rules Apollo 8 (SA-503/CSM-103) Preliminary (prepared by KSC), K-V-05.10/3.

(6) Apollo/Saturn Launch Mission Rules Handbook, 630-23-0002 Revision 1, dated May 23, 1968.

(7) Saturn S-IVB-503N Instrumentation Program and Components List, 1B43569AB, Huntington Beach, California, dated December 22, 1967.

(8) Douglas S-IVB Stage Data Acquisition Requirements Document for Saturn V Flights, DAC-56334, (prepared by Saturn Data Engineering Section), Huntington Beach, California, dated June 15, 1966.

(9) S-IVB-503N Stage Flight Test Plan, report No. SM-47000, (Date of publication to be determined).

(10) S-IVB-503N Technical Performance Criteria Document, report No. DAC-56636, dated February 23, 1968.

(11) S-IVB-503N Stage Flight Evaluation Report, report No. SM-47006, (Date of publication to be determined).

(12) <u>Project Apollo Coordinate System Standards, Standard</u>
<u>Coordinate System 9, Mass Properties</u> (prepared by Office
of Manned Space Flight), Washington, D.C., dated June, 1965.

(13) <u>AS-503 C' Launch Vehicle Operational Trajectory For</u>
<u>December 1968 Launch Window</u>, MSFC Report FMT-1-68, dated
29 October 1968.

(14) <u>MSFC S-IVB Stage Test Information and Propulsion System</u>
<u>Performance Prediction Requirements for Flight Test Planning</u>,
contract letter I-V-S-IVB-TD-66-45, dated July 7, 1966.

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