Internal Note No. 69-FM-96

NI

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MSC INTERNAL NOTE NO. 69-FM-96

April 28, 1969

REVISION 1 OF THE SPACECRAFT OPERATIONAL TRAJECTORY FOR APOLLO 10 (MISSION F)

VOLUME I
OPERATIONAL MISSION PROFILE LAUNCHED MAY 18, 1969

Lunar Mission Analysis Branch,
Landing Analysis Branch
and
Orbital Mission Analysis Branch

MISSION PLANNING AND ANALYSIS DIVISION

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

MSC INTERNAL NOTE NO. 69-FM-96

PROJECT APOLLO

REVISION I OF THE SPACECRAFT OPERATIONAL TRAJECTORY FOR APOLLO 10 (MISSION F) VOLUME I - OPERATIONAL MISSION PROFILE LAUNCHED MAY 18, 1969

By Lunar Mission Analysis Branch, Landing Analysis Branch, and Orbital Mission Analysis Branch

April 28, 1969

MISSION PLANNING AND ANALYSIS DIVISION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

Approved: Edgar C. Lineberry
Edgar C. Lineberry, Chief
Orbital Mission Analysis Branch

Approved: Floyd V. Bennett for
Floyd V. Bennett, Chief
Landing Analysis Branch

Approved: Ronald L. Berry
Ronald L. Berry, Chief
Lunar Mission Analysis Branch

Approved: John P. Mayer for
John P. Mayer, Chief
Mission Planning and Analysis Division

Page Intentionally Left Blank

FOREWORD

This document is Volume I of the first revision to the spacecraft operational trajectory for Apollo 10 (Mission F).

The following discrepancies in the trajectory should be noted.

1. Since the generation of the trajectory it has been decided that the evasive maneuver should be performed at TLI plus 2 hours rather than at TLI plus 1 hour 50 minutes.

2. The pitch and yaw trim angles used in the generation of the trajectory were in error. The error will not affect the trajectory; however, the vehicle attitude data for the CSM thrust maneuver are slightly in error, and specifically, the ignition gimbal angles in the target load tables are incorrect.

CONTENTS

Section Page

TABLES

FIGURES

REVISION I OF THE SPACECRAFT OPERATIONAL TRAJECTORY FOR APOLLO 10 (MISSION F)

VOLUME I - OPERATIONAL MISSION PROFILE LAUNCHED MAY 18, 1969

By Lunar Mission Analysis Branch, Landing Analysis Branch, and Orbital Mission Analysis Branch

1.0 SUMMARY

This document is the first revision to the Apollo 10 (Mission F) Operational Trajectory. This volume and the revised volume II present a detailed operational mission profile for a typical lunar orbital mission launched within a three-month period: May, June, and July 1969. This revision of the mission profile reflects the changes that have evolved since the generation of the data for the publication of the original operational trajectory (Volumes I and II). The most significant changes are the following.

1. The launch date is May 18, 1969.

2. The TLI maneuver is still biased to compensate for a CSM evasive maneuver after LM extraction. In addition to the evasive maneuver, there is a planned midcourse maneuver at TLI plus 7 hours to change the approach conditions at the moon to provide a lunar orbital groundtrack identical to the G mission groundtrack for landing site 2 (Mission G launch date: July 16, 1969). The target site for the original operational trajectory was site 1.

3. For May 18, the lunar orbital time is approximately 61.5 hours. The additional time in lunar orbit allows for landing site 3 observation with acceptable lighting. The lunar orbital time for subsequent launch days is approximately 53.5 hours.

4. For a 72° launch azimuth, first injection opportunity, the transearth flight time is approximately 54 hours. The shorter transearth time permits the additional time in lunar orbit without an increase in mission duration.

5. The entry range for May 18 launch has been decreased to 1285 n. mi. (relative). This shorter range is required to avoid an up-control phase of the entry guidance for the nominal entry conditions taking into account 3σ variations in the entry parameters.

6. For the May 18 launch with the shorter entry range, earth landing is approximately 23 minutes prior to sunrise rather than 1 hour 20 minutes as for the May 17 launch.

The launch date for this profile is May 18, 1969; the launch azimuth is 72°; translunar injection occurs during the second orbit over the Pacific. A midcourse correction is planned to achieve the nominal G mission lunar groundtrack for landing site 2 located at a selenographic longitude 23.65° E and a selenographic latitude 0.73° N. The lunar orbital time is approximately 61.5 hours, which allows observation of site 3 with acceptable lighting conditions. The total mission time is 8 days, 0 hours, and 5 minutes.

2.0 INTRODUCTION

This volume and volume II (revision 1) present the mission profile for the first launch opportunity (72° launch azimuth) first injection opportunity on May 18, 1969. The sequence of major events is presented in table 2-I. The May launch window summary is presented in table 2-II. The targeted lunar site is site 2, which is located 23.65° E, .75° N. The lunar site selenographic coordinates and elevation above the mean lunar sphere are listed in table 2-III.

A complete trajectory description is provided in volume II revision 1, Operational Mission Profile Trajectory Parameters. The ground rules used in the design of the operational trajectory are defined in section 3 of this document. The spacecraft (SC) weight summary and engine performance data are contained in tables 2-IV and 2-V, respectively. The assumed mission-independent expendables are presented in table 2-VI. Radar acquisition and termination data for all phases of the mission are provided in table 2-VII. The AOS and LOS tracking information was computed for 0° and 5° minimum elevation angles for each mission phase. The tracking information is for the selected launch azimuth (72°) and for the first injection opportunity.

An earth orbital insertion ship and two translunar injection ships are used to provide the desired support (ref. 1). The ship locations for May 18 are as follows.

1. Insertion Ship - 25° N, 49° W
2. Injection Ship 1 - 32° S, 131° E
3. Injection Ship 2 - 14° S, 145.5° E

The insertion ship provides the required coverage for earth parking orbit insertion for the total 36° launch azimuth spread. The coverage requirement is 1 minute of postinsertion coverage above a 5° minimum elevation angle. The injection ships are placed to provide coverage for the last 2 minutes of the preignition sequence for as much of the daily window as possible. The mission shadow timeline is shown in table 2-VIII(a) and 2-VIII(b). The most significant points reflected by the data in table VIII are that launch occurs in daylight and that earth landing occurs approximately 23 minutes prior to sunrise.

3.0 SYMBOLS AND NOMENCLATURE

AGS	abort guidance system
AOS	acquisition of signal
APS	ascent propulsion system
C	cross-product steering gain constant
CDH	constant delta height
CDR	commander
CMC	command module computer
CMP	command module pilot
CSI	concentric sequencing initiation
CSM	command and service modules
c.g.	center of gravity
DOI	descent orbit insertion
DPS	descent propulsion system
DSKY	display keyboard
EI	entry interface
EMS	entry monitor system
EPO	earth parking orbit
FTP	fixed throttle point
h_a	apogee altitude
h_p	perigee altitude
IGA	inner gimbal angle
IMU	inertial measurement unit

IVT	intervehicular transfer
Jerk	time derivative of acceleration
L/D	lift-to-drag ratio
LLM	lunar landing mission
LM	lunar module
LMP	lunar module pilot
LOI	lunar orbit insertion
LOS	loss of signal
LPO	lunar parking orbit
LOX	liquid oxygen
LV	launch vehicle
MGA	middle gimbal angle
MNBY	mean nearest Besselian year
MSFC	Marshall Space Flight Center
OGA	outer gimbal angle
OPS	oxygen purge system
PC	plane change
PDI	powered descent initiation
PGNCS	primary guidance and navigation control subsystem
PTC	passive thermal control
RDG	position target for LM powered descent guidance
RCS	reaction control system
REFSMMAT	transformation matrix from the basic reference coordinate system to the stable member (IMU) coordinate system

RT	target vector for Lambert guidance scheme
SC	spacecraft
SPS	service propulsion system
T&D	transposition and docking
TEI	transearth injection
t_{IG}	time at ignition
TLI	translunar injection
Tf	Δt from ignition time (t_{IG}) to Lambert target vector (RT)
TPF	terminal phase finalization
TPI	terminal phase initiation
VHF	very high frequency
ΔV_X, ΔV_Y, ΔV_Z	components of velocity to be gained in the local vertical coordinate system
X_{SM}, Y_{SM}, Z_{SM}	components of unit vector in vehicle stable member system

4.0 PRIMARY GUIDELINES AND CONSTRAINTS

The design of the mission and the resultant launch windows were based on the following primary guidelines and constraints.

a. The monthly launch windows will consist of five possible launch days across as 8-day period with launches scheduled for the first, third, sixth, seventh and eighth days. The target site for the opening of the window is site 2.

b. All launch dates are selected to achieve favorable lunar lighting conditions for the primary G mission landing sites.

c. Two additional launch days are added to the normal G mission window, which consists of only the first three launch days. The additional launch days, which are targeted to site 5, accept the resultant high sun elevations at the site.

d. Daylight launch is highly desirable.

e. A launch azimuth range of 72° to 108° will be targeted.

f. The launch window is designed for Pacific injection.

g. Two TLI opportunities are targeted: the first on the second revolution and the second on the third revolution.

h. TLI will be targeted for a free-return circumlunar trajectory.

i. The LOI maneuver will be performed in two stages; the first burn, LOI-1, will result in a 60- by 170-n. mi. elliptical orbit, and the second burn, LOI-2, will circularize the orbit at 60 n. mi. two revolutions later.

j. The lunar orbit orientation will be selected so that the spacecraft will pass over a primary G mission site on the thirteenth revolution after LOI-1. This orientation results in a delta time of approximately 24 hours from LOI-1 to DOI. The groundtrack will be identical to the G mission track for at least the first two launch days of each monthly window.

k. Lunar operations will simulate the G mission timeline as closely as possible. The operation will include a G mission type of rendezvous and an APS burn to depletion.

l. The APS burn to depletion will be targeted to escape the earth-moon system.

m. The time from LOI-1 to TEI for a launch on May 18 is approximately 61.5 hours. This time will allow observation of site 3 with favorable lighting. The lunar orbital time for other days in the May window is approximately 53.5 hours.

n. The TEI maneuver will be targeted to return as soon as possible to 165° W longitude within the available ΔV capability and without exceeding a return inclination of 40°.

o. The earth relative entry range target will be 1285 n. mi.

5.0 MISSION SUMMARY

In this section, a mission profile is summarized for a May 18, 1969, launch date. The burn times, propellants used, and most mission phase times that are presented in this section are typical of the lunar orbital missions planned for the May and June launch window.

The profile is concisely presented in table 2-I. In this section, major events, spacecraft performance characteristics, and significant trajectory parameters are described in detail for each phase.

In the design of the spacecraft operational mission, the LV mission phases were simulated independently of the exact LV operational trajectory. The trajectory data presented here for the LV mission phases were simulated with LV data received from the MSFC for the Apollo 8 mission. This vehicle configuration is considerably lighter than the actual Mission F configuration. No attempt was made to duplicate exactly the LV operational mission, and the information for the LV phases will differ from that in the official trajectory document (ref. 2).

5.1 Earth Launch

The launch time for this mission was determined to provide an optimized injected payload to support two injection opportunities. The launch time is identical to the time in the MSFC LV operational trajectory.

To provide a daylight launch and acceptable lighting at the target lunar landing site, the mission was designed for a Pacific injection. The launch is summarized as follows.

Date, month, day, year	May 18, 1969
Time, hr:min:sec, e.s.t.	$11^h48^m35^s$
Azimuth, deg	72
Location (Cape Kennedy, Complex 39B)	
Geodetic latitude, deg:min:sec	28°:37':38.31"
Longitude, deg:min:sec	279°:22':44.86"

5.2 Earth Parking Orbit[a]

Insertion into EPO occurs at $00^h11^m24.0^s$ g.e.t. The insertion conditions are as follows.

Insertion location

Geodetic latitude, deg	32.8
Longitude, deg	-54.2
Altitude, n. mi.	103.4
Inclination, deg	32.7

The insertion ship positioned at 25° N latitude and 49° W longitude tracks the vehicle for approximately 3 minutes after insertion for a 0° minimum elevation angle.

The LV maintains local horizontal attitude throughout the EPO phase except for an inertial hold of approximately 10 seconds immediately after EPO insertion. The total time spent in EPO is $2^h22^m3.4^s$.

5.3 Translunar Injection

The TLI burn is initiated near central Australia during the second revolution in EPO. Note that the LV/SC weight model used to simulate the TLI phase was the Apollo 8 configuration and that the burn parameters below do not represent realistic values for the Apollo 10 (Mission F) configuration.

TLI burn initiation

Time, hr:min:sec, g.e.t.	2:33:27.4
Geodetic latitude, deg	-25.3
Longitude, deg	136.1

TLI cutoff

Geodetic latitude, deg	-13.9
Longitude, deg	159.7
Burn duration, sec	321.6
S-IVB propellant used, lb	155 932.8
Plane change, deg	1.3

[a]The parameters for this phase are approximate and are presented for information only. The official source for this phase is the MSFC launch vehicle operational trajectory (ref. 2).

The TLI maneuvers is initiated in darkness, and the vehicle enters sunlight approximately midway through the TLI burn. (Coverage for the major part of the preignition sequence is provided by Carnarvon, which terminates coverage approximately 2 minutes prior to ignition. Additional support of the burn and preignition sequence is supplied by the injection ships (section 2.0).

The TLI burn is biased for a 2 m/sec overburn to compensate for the SPS evasive maneuver that is performed after LM extraction (section 5.5).

5.4 Free-Return Circumlunar Trajectory

Free-return touchdown assumes perfect execution of TLI, evasive maneuver, and midcourse correction maneuvers. It is planned to occur in the Indian Ocean southeast of Madagascar. A more desirable landing position can be insured by a corrective maneuver at an acceptable time during either the translunar or transearth coast phases of the circumlunar trajectory. The trajectory is characterized by the following.

Pericynthion	
Time, hr:min:sec, g.e.t.	75:49:40.2
Altitude, n. mi.	58.4
Selenographic latitude, deg	0.5
Selenographic longitude, deg	177.8
Return vacuum perigee altitude, n. mi.	15.7
Transit time from TLI to entry interface, hr:min:sec	146:55:57.4
Earth entry	
Time, hr:min:sec, g.e.t.	149:34:46.4
Altitude, n. mi.	65.8
Geodetic latitude, deg	-13.7
Longitude, deg	65.0
Inclination, deg	35.6
Touchdown	
Geodetic latitude, deg	-25.0
Longitude, deg	84.3

5.5 Posttranslunar Injection Events

The summary of the major events from TLI cutoff ttrough S-IVB LOX blowdown is given in table 5.5-I. To determine the separation attitude maneuver (TB-7 plus 900 sec), the sun was constrained to between 32° and 90° of the LV +X-axis. This constraint provides over-the-shoulder lighting and avoids any CSM shadow on the S-IVB for the docking phase. The onboard SC event times will be referenced to TLI ignition (column 1 of table 5.5-I), and the LV event times will be referenced to TB-7. Therefore, the SC event times will vary with respect to TB-7 as the TLI burn time varies. The SC maneuver times referenced to TB-7 in the table assumed a 300-second TLI burn time. The purpose of the evasive maneuver at approximately TB-7 plus 6600 seconds is to decrease the probability of S-IVB recontact and to avoid the ice particles expected to be expelled by the S-IVB during the LOX dump.

The current profile combines an early SPS confidence burn with the evasive maneuver. This SPS burn will have a ΔV of 20 fps and will be approximately 3 seconds in duration. To achieve a burn of this magnitude without jeopardizing the RCS capability to return to a free-return circumlunar mission, the TLI burnout conditions will be biased for a 2— m/sec overspeed at burn termination. The SPS evasive maneuver then will be performed in a direction which will compensate for the TLI bias. The attitude will be pitched down 75° with respect to the local horizontal. This attitude will provide for SC high gain S-band coverage with the steerable antenna, and a roll of approximately ±60° (based on the CSM/S-IVB separation attitude) provides for visual monitoring of the S-IVB during the evasive maneuver burn. At approximately 2 hours after TLI, the S-IVB is ground commanded to assume a local horizontal attitude for the LOX blowdown. The local horizontal attitude components are the following: pitch, 194°; yaw, 0°; roll, 180°. The magnitude of the ΔV that results from the LOX dump is expected to be approximately 120 fps.

The LOX dump maneuver is designed to reduce the probability of SC recontact with the S-IVB and also to prevent S-IVB impact with the earth or moon. Nominally, the LOX dump maneuver results in a sling-shot trajectory; the S-IVB will pass behind the trailing edge of the moon and will be accelerated by the lunar gravitational field. The result is a heliocentric orbit which avoids either earth or lunar impact.

5.6 Translunar Coast

Passive thermal control attitude will be maintained throughout most of the translunar coast phase. Four midcourse correction maneuver points have been defined at the following times.

1. TLI plus 7 hours (MCC-1)
2. TLI plus 24 hours (MCC-2)
3. LOI minus 22 hours (MCC-3)
4. LOI minus 5 hours (MCC-4)

The following MCC philosophy for the translunar coast phase is unchanged, regardless of the nominal MCC-1 ΔV of $\approx$ 56 fps caused by the change in LPO orientation. However, the probability of having to perform MCC-1 or MCC-2 or both is greatly increased because it is highly unlikely that the dispersions at TLI would be such that the MCC-3 ΔV would be less than 25 fps.

The third midcourse correction (MCC-3) will be the prime maneuver to establish the desired lunar approach trajectory. The first two maneuvers will not be performed unless the magnitude of the MCC-3 maneuver exceeds 25 fps. The MCC-1 or MCC-2 maneuver or both will then be performed only if their values exceed the SPS minimum impulse ($\approx$3 fps). The MCC-1 and MCC-2 residuals will not be trimmed.

To avoid use of the SPS for the MCC-4 maneuver, the MCC-3 maneuver will be performed if the predicted magnitude of MCC-4 is greater than 3 fps using the SPS. Residuals will be trimmed to within 0.5 fps. If MCC-3 is less than 3 fps and if LOI-1 targeting cannot absorb the uncorrected approach dispersions without a shift greater than 45° in the line of apsides of the 60- by 170-n. mi. orbit, MCC-3 will be performed with the SM RCS; however, if LOI-1 targeting can absorb the dispersions with less than a 45° apsidal shift, MCC-3 will not be performed.

The MCC-4 maneuver will not be performed if the dispersions can be absorbed by the LOI-1 targeting with apsidal rotation less than 45°; otherwise the maneuver will be performed with the SPS if the ΔV is greater than 3 fps or the SM RCS if the ΔV is less than 3 fps. The residual will be trimmed to within 1 fps if the SPS is required for the MCC-4 maneuver.

The maneuvers are GNCS controlled and use external ΔV guidance. Unless gimbal lock problems occur, the pad IMU alinement (REFSMMAT) will be used for the MCC-1; the PTC REFSMMAT, for MCC-2 and MCC-3; and the descent REFSMMAT, for MCC-4. The CSM remains in sunlight during the entire translunar coast phase [table 2-IX(a)]. The duration of the phase is 73 hours 07 minutes.

5.7 Lunar Orbit Insertion

The LOI-1 is designed to insert the CSM into approximately a 60- by 170-n. mi. LPO. A time history of trajectory parameters during the burn is presented in figure 5.7-1. The burn was simulated with the external ΔV guidance. A description of the burn is as follows.

LOI initiation

Time, hr:min:sec, g.e.t.	75:45:43.2
Altitude, n. mi.	89.2
Selenographic latitude, deg	-1.9
Selenographic longitude, deg	-163.9
Burn duration, min:sec	6:01.5
Inertial burn arc, deg	23.5
Plane change, deg	-6.1
ΔV, fps	2 978
SPS propellant used, lb	23 561

LOI burnout (start LPO)

Time, hr:min:sec, g.e.t.	75:51:44.7
Altitude, n. mi.	58.2
Selenographic latitude, deg	0.2
Selenographic longitude, deg	172.6
Selenographic inclination, deg	178.8
Period of LPO, hr:min:sec	2:08:36
LPO pericynthion altitude above mean radius, n. mi.	57.9
LPO apocynthion altitude above mean radius, n. mi.	168.9

The LOI-1 burn parameters were computed without simulation of the SPS thrust buildup and tailoff. The effect of these, however, is reflected in the burn parameters presented in the simulation data package (ref. 3).

The REFSMMAT used for the LOI-1 burn as well as for all other burns in LPO is the landing site alinement at the nominal G mission landing time relative to DOI.

The target loads for the LOI-1 burn are given in table 5.7-I. More detailed information about the burn, including reset points, navigation updates, and ignition gimbal angles, is given in the F Mission Simulator Data Package (ref. 3).

5.8 Lunar Orbit Circularization

A coplanar circularization burn (LOI-2) is performed to place the CSM in approximately a 60-n. mi. circular LPO after two revolutions in the 60- by 170-n. mi. orbit. The target altitude of the orbit (60 n. mi.) is measured relative to the lunar target site (table 2-III) and not relative to the mean lunar radius.

The landing REFSMMAT (table 5.8-I) is used, and the CSM is oriented heads down. The burn is initiated near pericynthion of the second revolution. More detailed information is given in reference 4. The characteristics of the burn are the following.

Circularization burn initiation

Time, hr:min:sec, g.e.t.	80:10:45.5
Altitude above mean radius, n. mi.	57.9
Selenographic latitude, deg	0.3
Selenographic longitude, deg	164.0
Burn duration, sec	14.4
Inertial burn arc, deg	0.7
ΔV, fps	138.5
SPS propellant used, lb	935.3

5.9 CSM/LM Coast From LOI-2 to Undock

At a g.e.t. of 81^h45^m or at about 1 hour 13 minutes after LOI-2, the crew begins preparation for IVT to the LM. In the LM, general housekeeping and equipment storage is performed. Also, short checkout will be performed on the LM VHF and OPS systems. After about 2 hours in the LM, the CDR and LMP perform IVT to the CSM and close the hatch. Landmark tracking is performed on landmark F1 at a g.e.t. of approximately 82^h33^m and B1 at 82^h50^m. An inertial hold is initiated at a g.e.t. of 85^h00^m for an 8-hour crew rest period.

The rest period is ended at a g.e.t. of 93^h00^m. After a 1-hour eat period, the CDR and LMP perform IVT to enter the LM and begin LM checkout. At a g.e.t. of 96^h50^m (revolution 11), landmark tracking is performed on the target site. The LM checkout is completed, and undocking occurs at 98^h05^m during revolution 12 or approximately 4 hours 30 minutes after wakeup.

5.10 LM Undock and CSM Separation

Undocking will occur 30 minutes prior to the CSM RCS separation burn. Following CSM/LM undocking, LM inspection is performed at a distance of approximately 40 feet. After completion of the inspection, the LM will perform stationkeeping while the CMP prepares for the RCS separation. At approximately a 180° central angle prior to DOI, the CSM performs a 2.5 fps radially downward separation maneuver, which places the LM and CSM in equiperiod orbits. Rendezvous will be accomplished from the equiperiod orbits if the DOI maneuver is not performed.

5.11 Rendezvous Sequence

5.11.1 Sequence summary.- The basic objective of the rendezvous sequence on Apollo 10 (Mission F) is to simulate as nearly as possible the LLM rendezvous profile after LM insertion following ascent from the lunar surface. The rendezvous sequence is shown in table 5.11-I. After separation of the LM and CSM, the rendezvous activities are initiated by the CSM separation maneuver (minifootball, section 5.10) at 98:35:16 g.e.t. Then the LM must perform a DOI maneuver and a phasing maneuver to establish the proper relative conditions (LM 49.6 n. mi. below and 269.1 n. mi. behind the CSM) at the simulated insertion point over the target site (23.7° E). After the insertion maneuver has been completed, the LM will compute and execute the coelliptic sequence that is planned for the LLM rendezvous. The sequence of CSI, CDH, and TPI will result in LM approach, braking, and docking at approximately $106^h15^m00^s$ g.e.t., which completes the 7.7-hour exercise that began with separation. A detailed discussion of the rendezvous activities is given in sections 5.11.2 through 5.11.9.

5.11.2 DOI.- After the CSM separation maneuver, the LM will fine aline the platform and will aline the AGS to the PGNCS in preparation for the DOI maneuver. The DOI maneuver is a ground computed external ΔV to be executed 195° prior to the target site, which duplicates the same planned maneuver required in the LLM.

DOI is performed with the DPS in a horizontal retrograde direction so that the resultant LM pericynthion is 50 000 feet (referenced to the landing site radius) and is 15° up range (east) from the landing site. The 71.1-fps maneuver is performed at $99^h33^m57^s$ g.e.t. with 10-percent thrust for 15 seconds and 40-percent thrust for 14.9 seconds. The target loads for the DOI maneuver are shown in table 5.11-II.

5.11.3 Phasing.- After the DOI maneuver, the LM will prepare for a landing radar test to be conducted as the vehicle passes over the target site at 23.7° E longitude and at an altitude of approximately 50 000 feet. Because the LM will lead the CSM (fig. 5.11-4) during this first pass over the site, a phasing maneuver is performed approximately 10 minutes after the site is passed to place the LM in a dwell orbit so that eventually the LM will fall behind the CSM and will trail the CSM by approximately 270 n. mi. at the time of the second pass, at which time the lunar landing mission relative profile can be simulated. The phasing maneuver is a ground-computed maneuver with an external ΔV of 195.6 fps initiated with the DPS at $100^h46^m21^s$ g.e.t. By use of the two-impulse processor, the maneuver is targeted to establish the nominal LLM phase and height offset relative to the CSM at the time of insertion. The target loads for the phasing maneuver are shown in table 5.11-II. The posigrade burn at a 28.8° pitch above the local horizontal will place the LM in a 194- by 9.1-n. mi. orbit. The DPS burn will be started at 10-percent thrust for 26 seconds and will be increased to full throttle (92.5 percent) for 19.3 seconds.

5.11.4 Insertion.- During the LM phasing orbit, the LM and CSM will conduct onboard tracking to determine the orbits. The onboard tracking data may be used by the ground to update the required insertion maneuver. The insertion maneuver will initiate the sequence that is designed to simulate the in-orbit ascent rendezvous of the LM after the lunar liftoff on the LLM. Prior to insertion, the LM will stage the DPS so that the burn may be executed with the APS. Current plans call for the staging to occur at $102^h33^m18^s$ g.e.t., approximately 10 minutes prior to insertion. While in a retrograde attitude, the LM will thrust posigrade 2 fps with the -X RCS jets, will stage, and immediately will null this ΔV with 2 fps retrograde with the +X jets. The result of the separation maneuver is to send the descent stage ahead of and above the ascent stage so that no recontact can occur after the ascent stage performs insertion. At $102^h43^m18^s$ g.e.t., the APS thrusts at a 24.3° posigrade pitch, 180° yaw for 15.4 seconds to impart a retrograde ΔV of 206.9 fps and to place the LM into a 44.9- by 8.5-n. mi. orbit. Apocynthion occurs 51 minutes later. The 44.9- by 8.5-n. mi. orbit is very similar to the orbit planned after LM insertion in the LLM, and the insertion maneuver is scheduled 4.5 minutes prior to entry into darkness to duplicate the

LLM lighting conditions. The insertion maneuver is also targeted by the ground two-impulse processor which establishes the nominal CSI offset (LM 14.7 n. mi. below and 147 n. mi. behind the CSM) at the nominal time. Target loads for the insertion maneuver are shown in table 5.11-IV.

5.11.5 CSI.- After insertion, the LM will realine its platform and will resume radar tracking of the CSM to determine the orbits of the vehicles for onboard computation of the coelliptic sequence. The CSI maneuver will be scheduled for the apocynthion at $103^h33^m46^s$ g.e.t. and will be calculated to cause TPI to occur at the midpoint of darkness approximately 95 minutes later. The nominal relative condition will be such that the CSI will place the LM in a 44.9- by 44.3-n. mi. orbit, 15 n. mi. below the CSM orbit at the time of CDH, one-half an orbital period after the CSI. The CSI will be performed with the four +X RCS jets so that the interconnect can be opened and APS propellant can be used. The 32-second burn is horizontal and adds a posigrade ΔV of 50.5 fps. The target loads are shown in table 5.11-V.

5.11.6 Plane change technique.- An out-of-plane component, which nominally is not required, will be applied in conjunction with the CSI if an out-of-plane velocity is detected prior to the CSI. The out-of-plane component will be targeted to null to zero the out-of-plane velocity, which will force the existence of a common node approximately 90° later where the separate PC maneuver is scheduled. At PC, the out-of-plane velocity is again nulled to zero and a coplanar situation is established. If the out-of-plane situation is not determined soon enough to begin the PC at the CSI, the nodal shift would be initiated at the time of PC and completed in conjunction with the CDH. However, the CSI-PC sequence vectors are more economical than the PC-CDH sequence vectors because the in-plane component at the CSI is considerably larger than the in-plane component at CDH.

5.11.7 CDH.- After the CSI, the LM will continue to track the CSM and will compute the required CDH maneuver to be done at $104^h31^m43^s$ g.e.t. Normally, the CDH will be a small radial burn designed to coellipticize the LM orbit with the orbit of the CSM. If the CSM orbit were perfectly circular, the CDH would be zero; however, because of the simulated 60- by 58.9-n. mi. CSM orbit, a downward ΔV of 3.4 fps is required. The four-X jets are used so that radar lock-on at an elevation angle of approximately 9.3° above the local horizontal would not be disturbed. The 2.2-second burn places the LM in a 44.9- by 43.8-n. mi. orbit, 15 n. mi. below the CSM orbit and coelliptic with it. The target loads for the CDH maneuver are presented in table 5.11-VI.

5.11.8 TPI.- Radar tracking continues after CDH so that the LM may compute the required burn (TPI) when the elevation angle to the CSM reaches 26.6° above the LM local horizontal. Nominally, the maneuver should occur approximately 37 minutes after CDH, when the LM is 23 minutes into darkness. TPI will be calculated to start the LM on an intercepting orbit; theoretically, rendezvous would occur after 130° of CSM central angle travel. The 24.8-fps burn is planned to be executed with the four +X jets to use the APS propellant through the interconnect. However, this arrangement may cause a temporary loss of radar lock, which is not considered to be a problem. The TPI ignition is at $105^h08^m59^s$ g.e.t., and the burn duration is approximately 16 seconds. The target loads for the TPI maneuver are presented in table 5.11-VII.

5.11.9 Rendezvous midcourse corrections and braking.- The LM will track the CSM after TPI and will perform nominally zero midcourse correction maneuvers 15 minutes later and 30 minutes later. The braking schedule assumed for this trajectory simulation calls for a reduction in range rate to 35 fps at the 1-n. mi. gate, to 20 fps at 3000 feet, 10 fps at 1500 feet, and to 5 fps at 500 feet. Line-of-sight corrections will be made as required. Final approach and stationkeeping should occur at approximately $105^h55^m00^s$ g.e.t., approximately 23 minutes after the vehicles enter sunlight on the backside of the moon. Docking should begin at approximately $106^h15^m00^s$ g.e.t. to complete 7.7 hours of rendezvous activities.

5.12 APS Burn to Depletion

At approximately $107^h15^m00^s$ g.e.t., just prior to earth LOS, the CSM/LM establishes an inertial attitude which is suitable for LM steerable antenna communications during and after the APS burn to depletion. The antenna is in a locked position. Near 90° E longitude, the unmanned LM is jettisoned in attitude hold, and the CSM performs a radially upward separation maneuver of approximately 2 fps, which will place the CSM above and behind the LM at the time of the APS burn.

The ullage maneuver and the APS burn are initiated under PGNCS control, and after confirmation of burn initiation a command is sent to transfer control to the AGS. The ascent stage will have been in attitude hold since jettison. Whether either or both of the RCS interconnects will be open will depend on the RCS usage up to that time in the mission and will probably be a real-time decision. The need for attitude hold to be maintained during the burn and as long thereafter as possible could be satisfied either with one interconnect open or with both closed.

However, if the RCS margin is low enough at the time of jettison, both interconnects would be open to assure attitude control during the entire burn. In this case, ascent stage tracking after the burn would not be assured. The characteristics of the burn are as follows.

Burn initiation

Time, hr:min:sec, g.e.t.	108:38:56.8
Δt from LM jettison, min	30
Selenographic latitude, deg	0.35
Selenographic longitude, deg	0.0
Estimated propellant available, lb	2373
Vehicle attitude, local horizontal	
Pitch, deg	0
Yaw, deg	0
Roll, deg	0

Burn termination

Burn duration, min:sec	3:34:5
Burnout velocity, fps	9128
ΔV attained, fps	3837
Selenographic latitude, deg	+.05
Selenographic longitude, deg	-14.4
Burn arc, deg	14.4
Selenographic longitude of the lunar sphere exit, deg W	≈127

The resultant ascent stage trajectory is hyperbolic with respect to the earth-moon system, which assures a heliocentric orbit.

5.13 CSM Coast from APS Burn to Depletion to TEI

Shortly after the APS burn to depletion at a g.e.t. of $110^h00^m00^s$, an inertial attitude hold is initiated for an 8-hour crew rest period. The rest period ends at approximately 118^h00^m g.e.t. Prior to TEI, the following activities are performed:

1. One revolution of strip photography
2. Four revolutions of landmark tracking
3. Two revolutions of rest period

4. One revolution of target of opportunity photography

5. One revolution of landmark tracking

5.14 Transearth Injection

The TEI maneuver occurs $61^h34^m39^s$ after LOI-1. The burn was targeted for a 54-hour transearth flight time. The target loads are presented in table 5.14-I. The REFSMMAT for the burn is the same as for LOI. The characteristics of the burn are presented below.

Initiation time, hr:min:sec, g.e.t	137:20:22.417
Selenographic latitude, deg	-.1
Selenographic longitude, deg	155.6
Burn duration, sec	168.9
ΔV, fps	3622.5
SPS propellant used, lb	11 004
Plane change	-.2
Burnout	
Flight-path angle, deg	3.0
Altitude, n. mi.	59.5
Selenographic latitude, deg	0.1
Selenographic longitude, deg	144.3
Entry velocity (inertial), fps	36 309.7

5.15 Transearth Coast

A groundtrack of the transearth coast phase is provided in figure 5.15-1. Three midcourse decision points have been defined for the transearth phase.

1. MCC-5, TEI plus 15 hours

2. MCC-6, EI minus 15 hours

3. MCC-7, EI minus 3 hours

The maneuvers will be targeted for corridor control only. The midcourse strategy, which includes the threshold values for each maneuver, is contained in reference 5. The CSM remains in sunlight from TEI until darkness, which occurs approximately 21 minutes prior to EI. The last ground station coverage is by Honeysuckle [table 2-VIII(c)], which terminates at 0° elevation approximately 3 minutes prior to EI.

5.16 Entry

The entry phase of the operational trajectory was simulated with the Apollo Reentry Simulation program with six-degrees-of-freedom. Three-degree-of-freedom trajectories were used to determine the CM maneuver footprint. The entry corridor is presented in figure 5.16-1.

At the nominal EI, $191^h50^m32^s$ after lift-off, the CM is at an altitude of 399 817 feet, and the coordinates are 22.706° S geodetic latitude and 173.82° E longitude. Inertial velocity, flight-path angle, and azimuth at this point are 36 309 fps, 6.52° below the local horizontal, and 73.80°, respectively.

A plot of the CM maneuver footprint and the nominal ground trace on a map of the entry area are presented in figure 5.16-2. The footprint is extended to a 3500-n. mi. entry range. The nominal touchdown target location is 1285 n. mi. down range from the entry interface position, and the coordinates of the target are 165° W longitude and 15.11° S geodetic latitude. A sequence of pertinent events is given in table 5.16-I and includes the periods of communication blackout which occur along the trajectory. The guidance phases are shown in figure 5.16-3, which shows altitude as a function of range to the target. Time histories of (a) the bank angle commanded by the guidance system, (b) the load factor, and (c) altitude are presented in figure 5.16-4. The load factor at the c.g. reaches a first maximum of 6.69g and a second maximum of 5.06g. Time histories of the total heating rate and the total heat load are presented in figure 5.16-5. The maximum total heating rate is 293.6 $Btu/ft^2/sec$, and the total heat load is 24 142.7 Btu/ft^2. Time histories for inertial and relative velocity and flight-path angles are presented in figure 5.16-6.

The CM RCS uses 11.55 pounds of propellant for the separation and attitude hold maneuvers before the spacecraft reaches 400 000 feet. The RCS uses 23.7 pounds of propellant to perform the guidance commands during the remainder of the entry. A time history of the total RCS propellant consumed from separation is presented in figure 5.16-7. In figure 5.16-8, the altitude is plotted in relation to relative velocity, and the boundaries for S-band and C-band communication blackout are shown (ref. 6). Time histories for the primary DSKY displays, commanded bank angle, inertial velocity, and altitude rate are shown in figure 5.16-9. Time histories for the final phase DSKY displays, commanded bank angle, cross-range error, and down-range error are shown in figure 5.16-10.

The drogue parachute deployment sequence begins at an altitude of 23 300 feet, 8 minutes 12 seconds after EI. The two drogue parachutes are deployed 2 seconds later. At an altitude of 10 500 feet, the low altitude baroswitch closes, and the drogue parachutes are disconnected.

The three main parachutes are deployed 1 second after the baroswitch closes. The CM, suspended on the main parachutes, reaches splashdown 13 minutes 55 seconds after EI. The relative velocity and relative flight-path angle are plotted against time from drogue chute deployment in figure 5.16-11. Load factor and altitude are plotted against time from drogue chute deployment in figure 5.16-12.

An EMS scroll (NON-EXIT pattern) is presented in figure 5.16-13(a) with the reference trajectory from 0.05g superimposed upon it. This pattern has limit lines which allow the crew to monitor the entry trajectory to prevent an exit by the spacecraft from the atmosphere ($g < 0.2$). The commanded bank angle and EMS range-to-go are plotted against the inertial velocity in figure 5.16-13(b).

The following input was used in the generation of the operational entry trajectory.

CM RCS engine performance data . . .	reference 7
CM mass properties for entry .	table 5.16-II, reference 13
Conditions at entry interface and target point	table 5.16-III
Aerodynamic coefficients	table 5.16-IV
Parachute aerodynamics	reference 7
Aerodynamic heating data	references 8 and 9
Entry guidance	references 10 and 11
Atmospheric model	reference 12
Entry REFSMMAT and gimbal angles at EI	table 5.16-V

TABLE 2.0-I.- SEQUENCE OF MAJOR EVENTS

[Launch occurs at 12:48:35 e.d.t. with a 72° launch azimuth]

Event	Time,[a] hr:min:sec g.e.t.	Data Summary	
Earth orbit insertion	11:24.0	Latitude, deg N	32.8
		Longitude, deg W	-54.2
		Inclination, deg	32.7
Translunar injection	2:33:27.4	Burn time, sec	321.6
		Plane change, deg	1.34
SPS evasive maneuver	4:28:47.6	Altitude, n. mi.	16 657
		ΔV, fps	19.7
		Burn time, sec	2.8
		Propellant used, lb	183.7
Midcourse correction[b]	9:38:46.4	Altitude, n. mi.	47 706
		ΔV, fps	57.0
		Burn time, sec	8.1
		Propellant used, lb	529.8
Free return, circumlunar pericynthion	75:49:40.2	Altitude, n. mi.	58.4
		Selenographic latitude, deg	0.5
		Longitude, deg	177.8
Free-return entry	149:34:46.4	Altitude, n. mi.	65.8
		Longitude, deg	65.0
		Latitude, deg	-13.7
		Flight-path angle, deg	-6.8
		Velocity, fps	36 140.5
		Equatorial inclination, deg	35.6
		Vacuum perigee altitude, n. mi.	15.7
Lunar orbit insertion	75:45:43.2	Mass at ignition, lb	92 427.9
		Burn time, sec	361.5
		SPS propellant used, lb	23 560.7
		Inclination of LPO, deg	1.2
		ΔV, fps	2978
LOI-2	80:10:45.5	Mass at ignition, lb	68 821.2
		Burn duration, sec	14.4
		SPS propellant used, lb	935.3
		ΔV, fps	138.5
Undocking	98:05:15.6		
LM separation (minifootball)	98:35:15.6	Mass at ignition, lb	36 484.4
		RCS burn time, sec	6.9
		Propellant used, lb	10.2
DOI	99:33:57	Ignition longitude, deg	-139.7
		ΔV, fps	71.1
		Burn duration, sec	29.9
CSM pass over target site (REV 13)	100:38:30.9	Sun elevation at site, deg	10.4
Phasing	100:46:21	Ignition longitude, deg	-11.3
		ΔV, fps	195.6
		Burn duration, sec	45.3
Insertion	102:43:18	Ignition longitude, deg	19.0
		ΔV, fps	206.9
		Burn duration, sec	15.4

[a] Time refers to g.e.t. of ignition for burns.

[b] Nominal maneuver designed to change lunar parking orbit orientation to be compatible with G mission lunar orbit.

TABLE 2.0-I.- SEQUENCE OF MAJOR EVENTS - Concluded

[Launch occurs at 12:48:35 e.d.t. with a 72° launch azimuth]

Event	Time,[a] hr:min:sec g.e.t.	Data summary	
CSI	103:33:46	Ignition longitude, deg	-142.0
		ΔV, fps	50.5
		Burn duration, sec	32.2
CDH	104:31:42	Ignition longitude, deg	37.5
		ΔV, fps	3.4
		Burn duration, sec	2.2
TPI	105:08:57	Ignition longitude, deg	-78.7
		ΔV, fps	25.4
		Burn duration, sec	16.1
Fourth braking	105:54:24	Ignition longitude, deg	141.2
		ΔV, fps	4.6
		Burn duration, sec	5.9
CSM separation maneuver following LM jettison	108:09:24	Mass at ignition, lb	36 674.0
		RCS burn time, sec	5.5
		Propellant used, lb	8.2
		ΔV, fps	2.0
APS burn to depletion	108:38:57	Ignition longitude, deg	0.0
		Burn duration, sec	214.5
		Mass at ignition, lb	7 600.0
		Propellant used, lb	2 451.0
		ΔV, fps	3 836.0
Transearth injection	137:20:22.4	Mass at ignition	36 574.9
		Burn time, sec	168.9
		Plane change, sec	-0.2
		Propellant used, lb	11 003.5
Entry interface	191:50:32.2	Velocity, fps	36 309.7
		Flight-path angle, deg	-6.52
		Latitude, deg	-22.71
		Longitude, deg	173.8
		Time from TEI, hr:min	54:27
Splashdown	192:04:27	Latitude, deg	-15.11
		Longitude, deg	-165.0
		Local time, a.m.	5:53
		Time of sunrise, a.m.	6:17

[a] Time refers to g.e.t. of ignition for burns.

TABLE 2.0-II.- LAUNCH WINDOW SUMMARY

Launch date, day, month, 1969	Target site number	Time at opening of window, hr:min:sec, e.d.t.	Launch window duration, hr:min:sec	Selenographic approach azimuth to target site, deg	Sun elevation at site, deg		Transearth flight time, hr:min:sec		Total mission duration, day:hr:min	
					[a]72° - 1	[b]108° - 2	[a]72° - 1	[b]108° - 2	[a]72° - 1	[b]108 - 2
May 18	2	12:48:35	04:20:24	-91.00	10.5	13.4[c]	54:27:21	48:51:42[c]	07:23:51	06:43:37[c]
May 20	3	13:02:21	04:21:27	-89.00	10.3	13.1[c]	65:05:44	59:33:40[c]	08:00:55	07:20:39[c]
May 23	4	13:11:41	04:23:29	-92.0	10.0	12.5	68:25:15[c]	63:32:13[c]	08:03:16[c]	07:24:00[c]
May 24	5	13:14:27	04:24:34	-95.0	16.8	19.5	69:53:38[c]	64:41:50[c]	08:03:07[c]	07:23:52[c]
May 25	5	13:18:46	04:25:48	-95.0	28.3	31.0	72:15:40[c]	67:07:02[c]	08:04:59[c]	08:00:44[c]
June 17	2	11:15:45	04:21:52	-91.00	16.7	19.5[c]	65:01:10	59:37:41[c]	08:01:19	07:21:03[c]
June 19	3	11:21:23	04:23:16	-89.00	15.6	18.3[c]	67:44:51	62:37:55[c]	08:02:41	07:22:25[c]
June 22	5	11:34:49	04:26:42	-95.0	9.8	12.4	72:22:28[c]	67:16:33[c]	08:05:28[c]	08:01:12[c]
June 23	5	11:41:26	04:28:50	-95.0	21.2	23.8	75:02:55[c]	69:57:27[c]	08:06:22[c]	08:02:04[c]
June 24	5	11:56:57	04:32:16	-95.0	32.6	35.3	77:36:25[c]	72:26:40[c]	08:07:09[c]	08:02:48[c]

[a]Launch azimuth = 72°, first injection opportunity.

[b]Launch azimuth = 108°, second injection opportunity.

[c]Approximations (data not available).

TABLE 2.0-III.- LUNAR TARGET SITE POSITIONS

Lunar target site no	Latitude, deg	Longitude, deg	Altitude,[a] n. mi.
1	2.632	34.025	-0.818
2	0.732	23.647	-1.66
3	0.374	-1.345	-0.502
4	-3.643	-36.698	-1.539
5	1.772	-41.939	-1.323

[a]Assumed mean lunar radius of 938.5 n. mi.

TABLE 2.0-IV.- SPACECRAFT WEIGHT SUMMARY

Total CSM dry, lb	23 098
CSM inert, lb	12 300
SM inert, lb	10 700
SLA ring, lb	98
Total SPS propellant tanked, lb	40 634
SPS propellant usable, lb	40 264
SPS propellant unusable, lb	370
Total LM loaded, lb	30 849
LM descent stage inert, lb	4 703
LM DPS propellant tanked, lb	18 134
LM ascent stage inert, lb	5 393
LM APS propellant tanked, lb	2 619
SLA, lb	4 000
Total injected Saturn payload, lb	98 581

TABLE 2.0-V.- ENGINE PERFORMANCE SUMMARY

Propulsion system	I_{sp}, sec	Thrust per engine, lb	Flow rate per engine, lb/sec
(a) Service module			
SPS	314.6	20 500	65.16
SM RCS	277.3	102.8	0.371
(b) Lunar module			
DPS (full throttle)	302.1 (average)	9712.5	32.15
APS	306.3	3500.0	11.43
LM RCS	273.0	100.0	0.37

TABLE 2.0-VI.- ASSUMED MISSION-INDEPENDENT EXPENDABLES[a]

Mission-independent SPS budget	
Translunar MCC, fps	120
Transearth MCC, fps	00
Total	120
SPS propellant allowances	
Unbalance meter, lb	100
Mean outage, lb	52
Dispersions, lb	548
Total	700
Other expendables	
Translunar coast, lb	332
Lunar orbital coast, lb	298
Transearth coast, lb	290
Total	920

[a]These figures were used only as estimates to compute the end of mission propellant reserves. A detailed dispersion and consumables analysis will be performed and will be published later.

TABLE 2.0-VII.- MISSION RADAR TIMELINE

(a) Radar station characteristics

Geodetic latitude, LATR, deg
Longitude, LONR, deg
Altitude, ALTR, ft
Range capability, SRANGE, n. mi.
Keyhole, FTINDC: 0 = none
1 = north-south
2 = east-west

```
RADAR = MERRITT ISLAND CB, LATR=  28.424862, LONR =  -80.664404
      ALTR =     39.372, SRANGE =   23400.0, FTINDC = 0.0
RADAR = PATRICK AFB CB   , LATR=  28.226553, LONR =  -80.599292
      ALTR =     49.215, SRANGE =   23400.0, FTINDC = 0.0
RADAR = CAPE KENNEDY CB  , LATR=  28.481767, LONR =  -80.576514
      ALTR =     45.934, SRANGE =    1000.0, FTINDC = 0.0
RADAR = GRAND BAHAMA CB  , LATR=  26.636350, LONR =  -78.267708
      ALTR =     39.372, SRANGE =   23400.0, FTINDC = 0.0
RADAR = GRAND TURK CB    , LATR=  21.462889, LONR =  -71.132114
      ALTR =     91.868, SRANGE =   23400.0, FTINDC = 0.0
RADAR = BERMUDA CB       , LATR=  32.348103, LONR =  -64.653800
      ALTR =     59.058, SRANGE =   23400.0, FTINDC = 0.0
RADAR = ANTIGUA ISLAND CB, LATR=  17.144031, LONR =  -61.792858
      ALTR =    190.298, SRANGE =   23400.0, FTINDC = 0.0
RADAR = GRAND CANARY CB  , LATR=  27.763206, LONR =  -15.634814
      ALTR =    682.208, SRANGE =    2532.0, FTINDC = 0.0
RADAR = ASCENSION CB     , LATR=  -7.972761, LONR =  -14.401694
      ALTR =    469.183, SRANGE =   23400.0, FTINDC = 0.0
RADAR = PRETORIA CB      , LATR= -25.943733, LONR =   28.358489
      ALTR =   5334.906, SRANGE =   23400.0, FTINDC = 0.0
RADAR = CARNARVON CB     , LATR= -24.897403, LONR =  113.716078
      ALTR =    203.422, SRANGE =   23400.0, FTINDC = 0.0
RADAR = HAWAII CB        , LATR=  22.122092, LONR = -159.665383
      ALTR =   3740.340, SRANGE =   23400.0, FTINDC = 0.0
RADAR = PT ARGUELLO CB   , LATR=  34.582903, LONR = -120.561150
      ALTR =   2119.526, SRANGE =   23400.0, FTINDC = 0.0
RADAR = WHITE SANDS CB   , LATR=  32.358222, LONR = -106.369564
      ALTR =   4042.192, SRANGE =   23400.0, FTINDC = 0.0
RADAR = EGLIN AFB CB     , LATR=  30.421767, LONR =  -86.798114
      ALTR =     91.868, SRANGE =    1000.0, FTINDC = 0.0
RADAR = TANANARIVE TLM   , LATR= -19.003019, LONR =   47.314650
      ALTR =   4329.608, SRANGE =   23400.0, FTINDC = 0.0
RADAR = KANO NIGERIA TLM , LATR=  11.969722, LONR =    8.464444
      ALTR =   1601.128, SRANGE =    1500.0, FTINDC = 0.0
RADAR = MERRITT ISLAND SB, LATR=  28.508272, LONR =  -80.693417
      ALTR =     32.810, SRANGE =  225000.0, FTINDC = 1.0
RADAR = GRAND BAHAMA SB  , LATR=  26.632857, LONR =  -78.237664
      ALTR =     16.405, SRANGE =  225000.0, FTINDC = 1.0
RADAR = BERMUDA SB       , LATR=  32.351286, LONR =  -64.658181
      ALTR =     68.901, SRANGE =  225000.0, FTINDC = 1.0
RADAR = ANTIGUA ISLAND SB, LATR=  17.016917, LONR =  -61.752849
      ALTR =    141.083, SRANGE =  225000.0, FTINDC = 1.0
RADAR = GRAND CANARY SB  , LATR=  27.764536, LONR =  -15.634814
      ALTR =    567.613, SRANGE =  225000.0, FTINDC = 1.0
RADAR = ASCENSION SB     , LATR=  -7.955056, LONR =  -14.327578
      ALTR =   1843.922, SRANGE =  225000.0, FTINDC = 1.0
RADAR = CARNARVON SB     , LATR= -24.906647, LONR =  113.726036
      ALTR =     82.025, SRANGE =  225000.0, FTINDC = 1.0
RADAR = GUAM SB          , LATR=  13.309244, LONR =  144.734414
      ALTR =    416.687, SRANGE =  225000.0, FTINDC = 1.0
RADAR = HAWAII SB        , LATR=  22.124897, LONR = -159.664989
      ALTR =   3773.150, SRANGE =  225000.0, FTINDC = 1.0
RADAR = GUAYMAS SB       , LATR=  27.963206, LONR = -110.720850
      ALTR =     62.339, SRANGE =  225000.0, FTINDC = 1.0
RADAR = CORPUS TEX SB    , LATR=  27.653750, LONR =  -97.378469
      ALTR =     32.810, SRANGE =  225000.0, FTINDC = 1.0
RADAR = MADRID DS        , LATR=  40.454992, LONR =   -4.167994
      ALTR =   2553.930, SRANGE =  300000.0, FTINDC = 2.0
RADAR = CANBERRA DS      , LATR= -35.583494, LONR =  148.978286
      ALTR =   3755.433, SRANGE =  300000.0, FTINDC = 2.0
RADAR = GOLDSTONE DS     , LATR=  35.341594, LONR = -116.873200
      ALTR =   2976.175, SRANGE =  300000.0, FTINDC = 2.0
 RADAR = INSERTION SHIP, LATR=25.0, LONR=-49.0
 ALTR=0.0, SRANGE=23400.0, FTINDC=0.0
```

TABLE 2.0-VII.- MISSION RADAR TIMELINE[a] - Continued

(b) Definitions of radar table headings[b]

MLA CB	Merritt Island C-band	MLA SB	Merritt Island S-band
PAT CB	Patrick C-band	GBI SB	Grand Bahama Island S-band
KEN CB	Cape Kennedy C-band	BDA SB	Bermuda S-band
GBI CB	Grand Bahama Island C-band	ANT SB	Antigua S-band
GTI CB	Grand Turk Island C-band	CYI SB	Grand Canary S-band
BDA CB	Bermuda C-band	ASC SB	Ascension S-band
ANT CB	Antigua C-band	CRO SB	Carnarvon S-band
CYI CB	Grand Canary C-band	GUM SB	Guam S-band
ASC CB	Ascension Island C-band	HAW SB	Hawaii S-band
PRE CB	Pretoria C-band	GYM SB	Guaymas S-band
CRO CB	Carnarvon C-band	TEX SB	Corpus S-band
HAW CB	Hawaii C-band	MAD DS	Madrid deep space
CAL CB	Pt. Arguello C-band	HSK DS	Canberra deep space
WHS CB	White Sands C-band	GLD DS	Goldstone deep space
EGL CB	Eglin C-band	SHIP 1	Insertion ship
TAN TM	Tananarive telemetry	SHIP 2	Injection ship (1)
KNO TM	Kano telemetry	SHIP 3	Injection ship (2)

[a]The enclosed radar table gives data for the coast phases only. If a station does not acquire or terminate at the nominal minimum elevation of 0° or 5°, the user must then investigate to see if the event took place because of exceeding maximum range, occulation, or end of a phase. All numbers are rounded off to the nearest unit of time, degrees, or nautical miles.

[b]Time is g.e.t. and range is slant range from the station to the spacecraft (n. mi.). See figure A-3b in the appendix for definitions of RA and DEC, figure A-3a for AZ and ELV, and figures A-3c and A-3d for X and Y. RA is equivalent to -HA in figure A-3b.

TABLE 2.0-VIII. - MISSION RADAR TIMELINE - Continued

(c) CSM acquisition and termination - 0° minimum elevation

VEHICLE	RADAR TABLE TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
BDA SB	0	1	18	0	0	11	24	154	8	84	6	84	6	548	0	0	12	42	160	6	83	0	90	7	850
BDA CB	0	1	18	0	0	11	24	154	8	84	6	84	6	548	0	0	12	42	160	6	83	0	90	7	850
SHIP 1	0	4	8	0	0	11	24	-37	56	-29	6	-78	60	560	0	0	15	32	-172	29	57	0	90	33	847
CYI SB	0	7	7	0	0	16	29	18	16	-72	0	-90	18	848	0	0	23	36	-162	-19	112	0	90	-22	841
CYI CB	0	7	7	0	0	16	29	18	16	-72	0	-90	18	848	0	0	23	36	-162	-19	112	0	90	-22	841
KNO TM	0	6	45	0	0	23	42	40	45	-43	0	-90	47	839	0	0	30	26	-129	-14	104	0	90	-14	830
TAN TM	0	5	34	0	0	37	1	137	63	-20	0	-90	70	824	0	0	42	35	-85	2	87	0	90	3	827
CAR CB	0	5	46	0	0	52	15	151	-29	-122	0	-90	-32	833	0	0	58	1	4	-33	127	0	90	-37	834
CAR SB	0	5	47	0	0	52	15	151	-28	-122	0	-90	-32	833	0	0	58	1	4	-33	127	0	90	-37	834
CNB DS	0	6	5	0	0	59	30	-151	9	-79	0	-90	-79	832	0	1	5	35	-8	37	43	0	-90	43	829
GYM SB	0	7	5	0	1	28	15	-36	-24	-118	0	-90	-28	840	0	1	35	19	139	13	75	0	90	15	848
CAL CB	0	4	21	0	1	28	19	10	-54	-169	0	-90	-79	838	0	1	32	40	106	-21	115	0	90	-25	845
GLD DS	0	4	44	0	1	28	55	5	-51	-163	0	90	-17	839	0	1	33	39	111	-19	113	0	90	67	845
WHS CB	0	6	45	0	1	29	42	-23	-31	-127	0	-90	-37	839	0	1	36	27	137	1	89	0	90	1	845
TEX SB	0	7	2	0	1	31	8	-34	-4	-95	0	-90	-5	844	0	1	38	11	157	21	66	0	90	24	850
EGL CB	0	7	7	0	1	33	35	-24	-2	-92	0	-90	-2	847	0	1	40	42	164	12	76	0	90	14	848
MIL SB	0	6	52	0	1	35	2	-24	10	-78	0	-90	12	847	0	1	41	53	174	18	69	0	90	21	850
MLA CB	0	6	51	0	1	35	3	-24	11	-78	0	-90	12	847	0	1	41	53	174	19	69	0	90	21	850
KEN CB	0	6	51	0	1	35	4	-24	11	-78	0	-90	12	847	0	1	41	55	174	18	69	0	90	21	850
PAT CB	0	6	49	0	1	35	4	-25	12	-77	0	-90	13	847	0	1	41	53	174	19	68	0	90	22	850

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI CB	0	6	28	0	1	35	45	-26	20	-68	0	-90	22	849	0	1	42	13	179	25	62	0	90	28	849
GBI SB	0	6	28	0	1	35	46	-26	20	-68	0	-90	22	849	0	1	42	13	179	25	62	0	90	28	849
BDA SB	0	7	10	0	1	38	27	-5	5	-84	0	-90	6	850	0	1	45	37	178	-4	95	0	90	-5	848
BDA CB	0	7	10	0	1	38	27	-5	5	-84	0	-90	6	850	0	1	45	37	178	-4	95	0	90	-5	848
GTI CB	0	4	9	0	1	38	37	-36	50	-34	0	-90	56	849	0	1	42	45	-161	48	37	0	90	53	848
SHIP 1	0	6	39	0	1	42	32	-2	31	-55	0	-90	35	849	0	1	49	11	-161	6	83	0	90	7	843
CYI SB	0	5	22	0	1	50	1	55	-9	-100	0	-90	-10	843	0	1	55	23	179	-57	161	0	90	-71	835
CYI CB	0	5	22	0	1	50	1	55	-9	-100	0	-90	-10	843	0	1	55	23	179	-57	161	0	90	-71	835
KNO TM	0	5	35	0	1	57	3	76	-1	-91	0	-90	-1	833	0	2	2	38	-135	-68	162	0	90	-72	826
PRE CB	0	3	11	0	2	7	55	-158	63	6	0	90	84	825	0	2	11	7	-94	26	61	0	90	29	828
TAN TM	0	6	50	0	2	9	7	123	15	-75	0	-90	15	827	0	2	15	58	-46	-35	128	0	90	-38	829
CAR CB	0	6	14	0	2	25	22	170	-34	-128	0	-90	-38	835	0	2	31	36	17	-15	106	0	90	-16	833
CAR SB	0	6	14	0	2	25	22	170	-34	-128	0	-90	-38	835	0	2	31	36	17	-15	106	0	90	-16	833
18 MAY 69 UPDATE 72.1 TLI BO TO EVASIVE MANEUVER IG																									
HAW CB	1	45	5	0	2	43	43	-58	-43	-137	0	-90	-47	2029	0	4	28	48	90	32	67	41	46	17	17668
HAW SB	1	45	5	0	2	43	43	-58	-43	-137	0	-90	-47	2029	0	4	28	48	90	32	67	41	46	17	17667
CAL CB	1	39	2	0	2	49	45	-27	-18	-112	0	-90	-22	3374	0	4	28	48	83	31	117	83	7	-3	16680
GLD DS	1	38	22	0	2	50	25	-24	-16	-110	0	90	-70	3522	0	4	28	48	82	31	147	85	4	3	16668
GYM SB	1	37	39	0	2	51	9	-25	-8	-99	0	-90	-9	3682	0	4	28	48	81	32	-37	84	-3	4	16670
WHS CB	1	36	35	0	2	52	13	-20	-8	-100	0	-90	-10	3915	0	4	28	48	80	31	-94	82	-8	-1	16683
TEX SB	1	34	38	0	2	54	9	-15	0	-90	0	-90	0	4337	0	4	28	48	78	32	-71	72	-17	6	16798

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	1	29	46	0	2	59	1	-1	7	-82	0	-90	8	5367	0	4	28	48	75	31	-75	55	-34	8	17168
MLA CB	1	29	45	0	2	59	2	-1	7	-82	0	-90	8	5370	0	4	28	48	75	31	-75	55	-34	8	17169
PAT CB	1	29	43	0	2	59	4	-1	7	-82	0	-90	8	5377	0	4	28	48	75	31	-75	55	-34	9	17173
GBI CB	1	28	48	0	2	59	60	1	9	-80	0	-90	10	5567	0	4	28	48	75	31	-72	52	-36	11	17259
GBI SB	1	28	47	0	3	0	0	1	9	-80	0	-90	10	5569	0	4	28	48	75	31	-72	52	-36	11	17260
GTI CB	1	25	19	0	3	3	28	7	15	-74	0	-90	16	6271	0	4	28	48	73	32	-66	43	-44	17	17578
BDA SB	1	23	46	0	3	5	2	13	11	-77	0	-90	13	6581	0	4	28	48	73	30	-77	41	-48	10	17671
BDA CB	1	23	46	0	3	5	2	13	11	-77	0	-90	13	6582	0	4	28	48	73	30	-77	41	-48	10	17671
ANT CB	1	19	26	0	3	9	22	17	20	-69	0	-90	21	7424	0	4	28	48	72	32	-63	32	-54	23	18043
ANT SB	1	19	22	0	3	9	26	18	20	-69	0	-90	21	7435	0	4	28	48	72	32	-63	32	-55	23	18048
SHIP 1	1	12	35	0	3	16	13	29	20	-68	0	-90	22	8703	0	4	28	48	71	30	-67	24	-64	21	18444

35

18 MAY 69 UPDATE 72.1 EVASIVE MANEUVER BO TO MIDCOURSE IG

SHIP 1	0	38	60	0	4	28	50	72	30	-67	24	-64	21	18451	0	5	7	50	80	30	-67	23	-65	21	23400
ANT CB	0	42	18	0	4	28	50	72	32	-63	32	-54	23	18049	0	5	11	9	81	31	-63	31	-56	23	23400
BDA CB	0	45	26	0	4	28	50	73	30	-77	41	-48	10	17677	0	5	14	17	82	30	-76	39	-50	11	23400
GTI CB	0	46	13	0	4	28	50	73	32	-66	43	-44	17	17585	0	5	15	3	82	31	-66	41	-46	17	23400
HAW CB	0	48	7	0	4	28	50	90	32	67	41	46	17	17674	0	5	16	58	95	32	67	47	41	16	23400
GBI CB	0	48	58	0	4	28	50	75	31	-72	52	-36	11	17265	0	5	17	49	84	31	-73	50	-39	11	23400
PAT CB	0	49	39	0	4	28	50	75	31	-75	55	-34	9	17179	0	5	18	30	84	31	-75	52	-37	9	23390
MLA CB	0	49	41	0	4	28	50	75	31	-75	55	-34	8	17176	0	5	18	31	84	31	-75	53	-37	9	23390
WHS CB	0	54	33	0	4	28	50	80	31	-94	82	-8	-1	16689	0	5	23	23	88	31	-92	77	-13	0	23397

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
CAL CB	0	55	7	0	4	28	50	83	31	117	83	7	-3	16686	0	5	23	57	90	31	161	86	1	-4	23397
ANT SB	4	16	15	0	4	28	50	72	32	-63	32	-55	23	18054	0	8	45	6	99	28	-60	0	-90	30	46497
MIL SB	5	9	56	0	4	28	50	75	31	-75	55	-34	8	17174	0	9	38	46	101	28	-65	12	-77	25	50344
GBI SB	5	9	56	0	4	28	50	75	31	-72	52	-36	11	17266	0	9	38	46	101	28	-63	9	-80	26	50508
BDA SB	5	9	56	0	4	28	50	73	30	-77	41	-48	10	17677	0	9	38	46	102	27	-58	1	-89	32	50961
HAW SB	5	9	56	0	4	28	50	90	32	67	41	46	17	17673	0	9	38	46	104	30	-45	79	-8	8	47768
GYM SB	5	9	56	0	4	28	50	81	32	-37	84	-3	4	16677	0	9	38	46	102	29	-74	37	-52	13	49008
TEX SB	5	9	56	0	4	28	50	78	32	-71	72	-17	6	16804	0	9	38	46	101	28	-70	25	-63	18	49590
GLD DS	5	9	56	0	4	28	50	82	31	147	85	4	3	16674	0	9	38	46	102	28	-83	44	-7	-46	48704
GUM SB	3	38	4	0	6	0	42	101	30	60	0	90	30	30713	0	9	38	46	108	30	62	41	46	21	48830
CNB DS	1	14	13	0	8	24	33	106	33	48	0	-90	48	44685	0	9	38	46	108	33	37	10	-78	37	50441

18 MAY 69 UPDATE 72.1 MIDCOURSE 80 TO LOI1 IG

BDA SB	0	7	55	0	9	38	55	102	27	-58	1	-89	32	50974	0	9	46	49	102	27	-57	0	-90	33	51700
GBI SB	0	51	14	0	9	38	55	101	28	-63	9	-80	26	50521	0	10	30	9	103	27	-59	0	-90	31	55191
MIL SB	1	8	3	0	9	38	55	101	28	-65	12	-77	25	50357	0	10	46	57	104	27	-59	0	-90	31	56512
TEX SB	2	19	18	0	9	38	55	101	28	-70	25	-63	18	49602	0	11	58	13	105	27	-59	0	-90	31	61925
GYM SB	3	18	14	0	9	38	55	102	29	-74	37	-52	13	49021	0	12	57	8	107	27	-59	0	-90	31	66196
GLD DS	4	7	52	0	9	38	55	102	28	-83	44	-7	-46	48716	0	13	46	47	108	26	-57	0	-90	-57	69670
HAW SB	6	30	57	0	9	38	55	104	30	-45	79	-8	8	47780	0	16	9	52	110	27	-61	0	-90	29	79127
CNB DS	7	40	34	0	9	38	55	108	33	37	10	-78	37	50451	0	17	19	28	111	29	-53	0	-90	-53	83465
GUM SB	10	2	33	0	9	38	55	108	30	62	41	46	21	48840	0	19	41	28	112	27	-63	0	-90	27	91905

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
CAR SB	10	9	19	0	10	14	6	110	31	55	0	90	35	53904	0	20	23	26	113	28	-59	0	-90	31	94292
MAD DS	15	23	36	0	15	38	58	114	26	55	0	-90	55	77150	1	7	2	34	118	25	-57	0	-90	-57	126509
CYI SB	14	3	52	0	17	7	59	116	26	60	0	90	30	82768	1	7	11	50	118	25	-61	0	-90	29	126927
ASC SB	11	27	22	0	18	23	56	117	28	62	0	90	28	87365	1	5	51	18	117	26	-63	0	-90	27	123236
BDA SB	14	24	2	0	20	18	29	117	26	59	0	90	31	94020	1	10	42	31	119	25	-60	0	-90	30	136176
ANT SB	13	8	58	0	20	45	25	118	26	62	0	90	28	95535	1	9	54	23	118	25	-64	0	-90	26	134107
GBI SB	13	52	31	0	21	30	13	118	26	61	0	90	29	98023	1	11	22	44	119	25	-62	0	-90	28	137879
MIL SB	14	2	1	0	21	35	21	118	26	60	0	90	30	98306	1	11	37	22	119	25	-61	0	-90	29	138497
TEX SB	13	56	28	0	22	46	16	118	26	61	0	90	29	102144	1	12	42	45	119	25	-62	0	-90	28	141221
GYM SB	13	57	15	0	23	40	12	118	26	61	0	90	29	104996	1	13	37	27	119	25	-62	0	-90	28	143465
GLD DS	14	37	24	0	23	44	29	118	25	58	0	-90	58	105221	1	14	21	53	120	24	-59	0	-90	-59	145265
HAW SB	13	26	55	1	3	14	44	120	26	62	0	90	28	115813	1	16	41	39	120	25	-63	0	-90	27	150801
GUM SB	12	47	44	1	7	20	7	121	25	64	0	90	26	127298	1	20	7	50	121	25	-65	0	-90	25	158640
CNB DS	9	11	13	1	8	53	7	121	27	56	0	-90	56	131432	1	18	4	20	120	26	-57	0	-90	-57	153980
CAR SB	10	11	43	1	10	44	57	121	26	61	0	90	29	136270	1	20	56	40	121	26	-62	0	-90	28	160438
MAD DS	14	57	34	1	16	15	13	122	24	57	0	-90	57	149770	2	7	12	47	123	24	-58	0	-90	-58	181693
CYI SB	13	46	15	1	17	37	43	123	24	62	0	90	28	152971	2	7	23	58	123	24	-63	0	-90	27	182053
ASC SB	11	24	48	1	18	44	22	123	25	64	0	90	26	155507	2	6	9	9	122	25	-65	0	-90	25	179609
BDA SB	14	7	51	1	20	44	13	123	24	61	0	90	29	159988	2	10	52	4	123	24	-62	0	-90	28	188672
ANT SB	12	58	51	1	21	7	37	123	25	64	0	90	26	160846	2	10	6	28	123	24	-65	0	-90	25	187241

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	13	39	31	1	21	53	23	123	24	63	0	90	27	162515	2	11	32	53	123	24	-63	0	-90	27	189944
MIL SB	13	48	18	1	21	58	45	123	24	62	0	90	28	162711	2	11	47	4	123	24	-63	0	-90	27	190383
TEX SB	13	43	54	1	23	8	5	124	24	62	0	90	28	165205	2	12	51	59	123	24	-63	0	-90	27	192383
GYM SB	13	45	6	2	0	1	11	124	24	62	0	90	28	167091	2	13	46	17	123	24	-63	0	-90	27	194042
GLD DS	14	22	43	2	0	6	47	124	24	60	0	-90	60	167290	2	14	29	30	123	24	-61	0	-90	-61	195354
HAW SB	13	18	13	2	3	31	37	124	24	64	0	90	26	174363	2	16	49	50	124	24	-64	0	-90	26	199566
GUM SB	12	42	37	2	7	33	6	125	24	65	0	90	25	182347	2	20	15	42	124	24	-66	0	-90	24	205633
CNB DS	9	20	31	2	8	57	56	125	25	59	0	-90	59	185063	2	18	18	28	124	25	-59	0	-90	-59	202180
CAR SB	10	16	4	2	10	51	20	125	25	62	0	90	28	188642	2	21	7	25	124	24	-63	0	-90	27	207126
MAD DS	11	10	22	2	16	27	46	125	23	59	0	-90	59	198932	3	3	38	8	124	24	-91	39	1	-51	216958
CYI SB	9	50	28	2	17	47	42	126	24	63	0	90	27	201287	3	3	38	10	124	24	-85	48	-42	4	216564
ASC SB	8	47	57	2	18	50	16	126	24	66	0	90	24	203120	3	3	38	13	124	24	-54	33	-51	30	217233
BDA SB	6	45	3	2	20	52	60	126	23	62	0	90	28	206714	3	3	38	2	125	24	160	81	3	-8	215741
ANT SB	6	22	55	2	21	15	9	126	24	65	0	90	25	207370	3	3	38	4	125	24	3	83	0	7	215725
GBI SB	5	36	45	2	22	1	16	126	23	64	0	90	26	208718	3	3	38	0	125	24	96	74	16	-2	215825
MIL SB	5	31	30	2	22	6	31	126	23	63	0	90	27	208867	3	3	38	0	125	24	100	72	18	-3	215868
TEX SB	4	22	22	2	23	15	35	126	23	63	0	90	27	210900	3	3	37	58	125	24	88	57	33	1	216246
GYM SB	3	30	5	3	0	7	51	126	23	63	0	90	27	212444	3	3	37	56	125	24	83	45	45	5	216689
GLD DS	3	23	22	3	0	14	34	126	23	61	0	-90	61	212651	3	3	37	56	125	24	88	40	-3	50	216895
HAW SB	0	3	44	3	3	34	9	126	24	64	0	90	26	219007	3	3	37	53	126	24	65	1	89	25	219064

18 MAY 69 UPDATE 72.1 LOI1 BO TO LOI2 IG

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
HAW SB	1	24	44	3	4	12	11	125	24	68	8	81	22	218196	3	5	36	54	127	24	74	26	63	15	217169
GLD DS	1	24	45	3	4	12	17	125	24	93	48	2	42	216158	3	5	37	1	126	23	109	64	9	25	215600
GYM SB	1	24	42	3	4	12	18	125	24	87	53	37	2	215956	3	5	37	1	126	24	98	71	19	-3	215439
TEX SB	1	24	45	3	4	12	20	125	24	92	65	25	-1	215589	3	5	37	5	126	24	119	82	7	-4	215283
GBI SB	1	24	44	3	4	12	25	125	24	108	82	7	-2	215296	3	5	37	9	125	24	-103	79	-11	-2	215321
MIL SB	1	24	42	3	4	12	25	125	24	113	79	10	-4	215322	3	5	37	8	126	24	-117	80	-9	-5	215304
BDA SB	1	24	41	3	4	12	29	124	24	-148	80	-5	-8	215311	3	5	37	9	125	24	-105	66	-24	-6	215558
ANT SB	1	24	42	3	4	12	30	124	24	-47	79	-8	7	215320	3	5	37	12	125	24	-71	62	-27	9	215649
MAD DS	1	24	38	3	4	12	36	124	24	-85	32	-7	-57	216839	3	5	37	14	125	23	-74	17	-42	-67	217664
CYI SB	1	24	40	3	4	12	37	124	24	-81	40	-49	7	216449	3	5	37	17	125	23	-75	23	-66	14	217341
ASC SB	1	24	41	3	4	12	40	124	24	-58	26	-60	29	217162	3	5	37	21	125	24	-64	9	-80	25	218160
HAW SB	1	24	39	3	6	20	24	126	24	76	36	53	11	216600	3	7	45	3	127	23	80	54	36	6	215802
GLD DS	1	24	40	3	6	20	33	126	24	126	72	11	15	215346	3	7	45	13	127	23	-162	77	12	-4	215243
GYM SB	1	24	40	3	6	20	34	126	24	114	80	9	-4	215226	3	7	45	14	127	23	-113	79	-10	-4	215220
TEX SB	1	24	39	3	6	20	37	125	24	-138	85	-4	-4	215189	3	7	45	16	126	23	-96	68	-22	-2	215415
MIL SB	1	24	41	3	6	20	40	125	24	-100	71	-19	-3	215363	3	7	45	21	126	23	-88	53	-37	1	215857
GBI SB	1	24	41	3	6	20	40	125	24	-93	69	-21	-1	215404	3	7	45	21	126	23	-85	51	-39	3	215942
BDA SB	1	24	39	3	6	20	43	125	24	-96	56	-34	-3	215742	3	7	45	22	126	23	-85	39	-51	4	216425
ANT SB	1	24	39	3	6	20	44	125	24	-73	52	-37	10	215891	3	7	45	23	126	23	-73	33	-55	14	216695
MAD DS	0	56	58	3	6	20	44	125	23	-67	9	-67	-66	218038	3	7	17	42	126	23	-59	0	-90	-59	217336

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
CYI SB	1	10	13	3	6	20	48	125	23	-70	14	-76	19	217779	3	7	31	0	126	23	-64	0	-90	26	217885
GUM SB	0	2	51	3	7	42	6	128	23	66	0	90	24	218434	3	7	44	57	128	23	66	1	89	24	218530
18 MAY 69 UPDATE 72.1 LOI2 BO TO LM SEPARATION																									
HAW SB	1	13	42	3	8	27	52	127	23	82	64	26	4	215467	3	9	41	35	128	23	82	80	10	1	215012
GUM SB	1	11	47	3	8	29	37	128	23	68	11	78	21	217813	3	9	41	23	129	23	71	26	62	17	216855
GLD DS	1	11	44	3	8	29	58	126	23	-127	72	11	-15	215193	3	9	41	42	127	23	-105	59	9	-30	215459
GYM SB	1	11	45	3	8	29	60	126	23	-98	70	-20	-3	215234	3	9	41	45	127	23	-89	54	-36	1	215606
TEX SB	1	11	42	3	8	30	4	126	23	-90	58	-32	0	215544	3	9	41	46	127	23	-83	42	-47	5	216077
GBI SB	1	11	39	3	8	30	9	126	23	-81	40	-49	7	216211	3	9	41	48	127	23	-76	25	-64	13	216920
BDA SB	1	11	38	3	8	30	10	126	23	-80	30	-60	9	216740	3	9	41	48	127	23	-73	15	-74	17	217475
MIL SB	1	11	36	3	8	30	11	126	23	-84	43	-47	5	216102	3	9	41	47	127	23	-78	28	-61	11	216782
ANT SB	1	11	37	3	8	30	14	126	23	-71	23	-66	17	217082	3	9	41	52	127	23	-68	8	-82	21	217928
CNB DS	0	38	33	3	9	2	57	128	24	60	0	-90	60	217101	3	9	41	29	128	24	55	6	-79	54	217990
GUM SB	1	11	28	3	10	28	6	128	23	71	37	51	15	216282	3	11	39	33	129	23	69	53	35	12	215553
CNB DS	1	11	30	3	10	28	13	128	24	47	14	-70	45	217521	3	11	39	42	129	24	33	23	-63	30	216943
HAW SB	1	11	31	3	10	28	20	128	23	-53	88	-1	1	214927	3	11	39	51	128	23	-84	73	-17	2	215027
GLD DS	1	11	31	3	10	28	27	127	23	-95	49	5	-41	215745	3	11	39	58	128	23	-86	35	-6	-55	216322
BDA SB	0	33	27	3	10	28	29	127	23	-67	6	-83	23	217972	3	11	1	56	127	23	-63	0	-90	27	217013
GYM SB	1	11	30	3	10	28	29	127	23	-84	44	-46	4	215962	3	11	39	59	128	23	-78	29	-61	10	216640
TEX SB	1	11	28	3	10	28	31	127	23	-79	32	-58	9	216516	3	11	39	60	128	23	-73	17	-72	16	217275
GBI SB	1	11	26	3	10	28	33	127	23	-72	15	-74	18	217434	3	11	39	59	128	22	-65	1	-89	25	218238

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	1	11	25	3	10	28	33	127	23	-73	18	-71	16	217281	3	11	39	58	128	22	-67	4	-86	23	218072
CAR SB	0	38	54	3	11	0	37	129	23	64	0	90	26	217015	3	11	39	32	130	23	60	7	81	30	217828
CAR SB	1	11	45	3	12	26	8	129	23	54	16	70	35	217291	3	13	37	53	130	23	42	28	52	41	216567
GUM SB	1	11	48	3	12	26	12	129	23	65	64	24	11	215203	3	13	37	59	130	23	41	77	8	10	214857
CNB DS	1	11	43	3	12	26	20	129	24	22	27	-61	20	216670	3	13	38	3	130	23	5	31	-59	4	216423
HAW SB	1	11	40	3	12	26	29	128	23	-83	62	-28	3	215235	3	13	38	9	129	22	-80	46	-43	7	215732
GLD DS	1	11	32	3	12	26	37	128	22	-80	26	-20	-62	216760	3	13	38	8	129	22	-71	12	-56	-68	217479
GYM SB	1	11	35	3	12	26	38	128	23	-74	19	-70	15	217137	3	13	38	13	129	22	-67	5	-85	23	217929
TEX SB	0	38	48	3	12	26	40	128	22	-69	7	-82	21	217795	3	13	5	28	128	22	-65	0	-90	25	216921
CAR SB	1	11	31	3	14	24	39	130	23	32	35	37	44	216201	3	15	36	10	131	23	14	41	15	47	215840
GUM SB	1	11	34	3	14	24	44	130	23	-17	80	-3	9	214784	3	15	36	19	130	22	-62	69	-19	10	214914
CNB DS	1	11	32	3	14	24	49	130	23	-8	31	-59	-7	216389	3	15	36	21	130	23	-25	27	-61	-22	216536
GLD DS	0	17	47	3	14	24	53	129	22	-65	3	-83	-65	217958	3	14	42	39	129	22	-63	0	-90	-63	217238
HAW SB	1	11	32	3	14	24	53	129	22	-77	35	-54	10	216165	3	15	36	25	130	22	-74	20	-69	15	216931
CAR SB	1	11	38	3	16	22	53	131	23	-1	42	-1	48	215743	3	17	34	31	132	23	-22	39	-24	46	215810
GUM SB	1	11	33	3	16	23	2	130	22	-69	58	-30	11	215140	3	17	34	35	131	22	-72	42	-46	13	215687
CNB DS	1	11	33	3	16	23	3	130	23	-36	22	-63	-33	216746	3	17	34	36	131	23	-50	13	-71	-48	217223
HAW SB	0	47	4	3	16	23	7	130	22	-70	10	-80	20	217468	3	17	10	11	131	22	-66	0	-90	24	216878
MAD DS	0	36	20	3	16	57	48	132	22	61	0	-90	61	216711	3	17	34	8	133	21	67	6	-76	66	217637
CYI SB	1	11	25	3	18	20	49	133	22	66	1	89	24	217909	3	19	32	14	134	21	73	15	75	16	216993

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MAD DS	1	11	27	3	18	20	51	132	21	74	14	-48	69	217117	3	19	32	18	133	21	84	27	-12	63	216330
CAR SB	1	11	37	3	18	21	14	131	23	-34	34	-39	43	215996	3	19	32	50	132	22	-48	25	-58	38	216463
GUM SB	1	11	34	3	18	21	17	131	22	-72	31	-57	15	216153	3	19	32	50	132	21	-71	16	-74	18	216966
CNB DS	0	31	15	3	18	21	19	131	23	-57	5	-81	-57	217619	3	18	52	34	131	22	-62	0	-90	-62	216616
ASC SB	0	16	9	3	19	16	7	134	22	68	0	90	22	217056	3	19	32	16	134	22	67	4	86	23	217647
CYI SB	1	11	37	3	20	18	56	133	21	78	25	65	11	216408	3	21	30	33	134	21	85	40	50	4	215571
MAD DS	1	11	39	3	20	18	57	133	21	92	36	2	54	215852	3	21	30	36	134	21	105	48	13	40	215202
ASC SB	1	11	37	3	20	18	57	134	22	65	14	74	24	216997	3	21	30	35	135	22	60	29	57	26	216074
GUM SB	0	22	4	3	20	19	32	132	21	-69	5	-85	21	217533	3	20	41	36	132	21	-68	0	-90	22	216738
CAR SB	1	11	30	3	20	19	34	132	22	-56	16	-71	33	216865	3	21	31	4	133	22	-64	3	-87	26	217597
ANT SB	1	11	27	3	22	17	14	135	21	70	6	83	20	217362	3	23	28	41	136	21	74	21	68	15	216379
BDA SB	1	11	26	3	22	17	15	134	21	71	9	81	19	217203	3	23	28	41	136	21	79	22	67	10	216324
CYI SB	1	11	32	3	22	17	19	134	21	90	50	40	0	215100	3	23	28	50	135	21	100	65	25	-4	214541
ASC SB	1	11	34	3	22	17	22	134	22	53	39	45	27	215557	3	23	28	55	135	21	39	52	27	29	214956
MAD DS	1	11	30	3	22	17	23	134	21	116	57	16	29	214861	3	23	28	53	135	21	143	67	19	14	214506
GBI SB	0	49	35	3	22	39	6	135	21	67	0	90	23	216654	3	23	28	41	136	21	72	10	80	18	217066
MIL SB	0	42	49	3	22	45	51	135	21	66	0	90	24	216454	3	23	28	41	136	21	71	8	81	19	217153
TEX SB	1	11	34	4	0	15	18	136	21	69	4	86	21	217397	4	1	26	52	137	20	76	18	72	13	216460
MIL SB	1	11	35	4	0	15	20	135	21	76	18	71	13	216554	4	1	26	55	137	20	83	33	57	6	215669
GBI SB	1	11	36	4	0	15	20	136	21	76	20	70	13	216459	4	1	26	56	137	20	83	35	55	6	215573

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
ANT SB	1	11	35	4	0	15	22	135	21	76	32	57	12	215777	4	1	26	57	136	21	78	48	41	8	214961
BDA SB	1	11	35	4	0	15	23	135	21	85	32	57	4	215777	4	1	26	58	136	20	94	47	43	-3	215027
CYI SB	1	11	34	4	0	15	35	135	21	115	75	13	-6	214299	4	1	27	9	136	21	-160	82	-3	-7	214138
MAD DS	1	11	33	4	0	15	37	135	21	173	70	20	2	214388	4	1	27	10	136	20	-144	66	20	-13	214391
ASC SB	1	11	32	4	0	15	40	135	21	23	58	14	29	214697	4	1	27	12	136	21	-8	61	-4	29	214542
GYM SB	0	34	31	4	0	52	22	136	20	67	0	90	23	216251	4	1	26	53	137	20	71	7	83	19	217119
GLD DS	0	24	22	4	1	2	30	136	20	65	0	-90	65	216409	4	1	26	52	137	20	68	4	-79	68	217259
GLD DS	0	21	39	4	2	13	36	136	20	75	13	-48	70	216695	4	2	35	16	137	20	77	18	-35	69	215385
GYM SB	0	21	39	4	2	13	36	136	20	75	17	73	14	216511	4	2	35	16	137	20	78	21	68	12	215184
TEX SB	0	21	37	4	2	13	39	136	20	81	28	61	8	215871	4	2	35	16	137	20	83	33	57	6	214565
MIL SB	0	21	34	4	2	13	41	136	20	88	43	47	2	215151	4	2	35	16	136	20	90	48	42	0	213890
GBI SB	0	21	33	4	2	13	42	136	20	87	45	45	2	215059	4	2	35	16	136	20	89	50	40	0	213803
BDA SB	0	21	31	4	2	13	44	136	20	102	57	33	-7	214627	4	2	35	16	136	20	107	61	28	-8	213429
ANT SB	0	21	31	4	2	13	44	136	21	78	59	30	6	214539	4	2	35	16	136	21	78	64	25	5	213335
CYI SB	0	21	20	4	2	13	56	135	21	-115	75	-14	-6	214180	4	2	35	16	136	20	-107	70	-19	-6	213198
MAD DS	0	21	20	4	2	13	56	135	20	-124	60	18	-25	214519	4	2	35	16	135	20	-117	56	17	-29	213568
ASC SB	0	21	17	4	2	13	58	135	21	-28	57	-17	29	214605	4	2	35	16	136	21	-36	54	-23	28	213638

18 MAY 69 UPDATE 72.1 LM SEPARATION BO TO LM JETTISON IG

GYM SB	0	49	42	4	2	35	23	137	20	78	21	68	12	215179	4	3	25	4	138	20	82	31	59	6	215614
GLD DS	0	49	43	4	2	35	23	137	20	77	18	-35	69	215379	4	3	25	5	137	20	84	27	-12	63	215843
TEX SB	0	49	44	4	2	35	23	137	20	83	33	57	6	214559	4	3	25	7	137	20	88	43	47	2	215054

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	0	49	47	4	2	35	23	136	20	90	48	42	0	213884	4	3	25	10	137	20	97	58	32	-4	214496
GBI SB	0	49	49	4	2	35	23	136	20	89	50	40	0	213798	4	3	25	11	137	20	96	60	30	-3	214423
BDA SB	0	49	52	4	2	35	23	136	20	107	61	28	-8	213424	4	3	25	15	137	20	123	70	17	-11	214187
ANT SB	0	49	53	4	2	35	23	136	21	78	64	25	5	213330	4	3	25	15	137	20	75	75	14	4	214089
MAD DS	0	50	2	4	2	35	23	135	20	-117	56	17	-29	213564	4	3	25	25	136	20	-106	48	14	-40	214867
CYI SB	0	50	3	4	2	35	23	136	20	-107	70	-19	-6	213194	4	3	25	26	136	20	-98	60	-30	-4	214443
ASC SB	0	50	6	4	2	35	23	136	21	-36	54	-23	28	213635	4	3	25	28	136	21	-48	47	-35	27	214918
GLD DS	1	11	34	4	4	11	49	137	20	90	37	0	53	215326	4	5	23	22	138	20	102	50	10	39	214637
GYM SB	1	11	33	4	4	11	50	137	20	87	42	48	2	215087	4	5	23	23	138	20	96	57	33	-3	214410
TEX SB	1	11	37	4	4	11	51	137	20	93	54	36	-2	214608	4	5	23	28	138	20	107	68	21	-6	214091
GBI SB	1	11	37	4	4	11	56	137	20	105	71	19	-5	214130	4	5	23	33	138	20	160	83	2	-7	213883
MIL SB	1	11	37	4	4	11	57	137	20	108	68	21	-6	214185	4	5	23	34	138	20	151	80	5	-9	213907
BDA SB	1	11	36	4	4	11	60	137	20	155	77	6	-12	214030	4	5	23	36	138	20	-139	74	-11	-12	213991
ANT SB	1	11	39	4	4	12	0	137	20	40	86	3	3	213948	4	5	23	39	137	20	-75	76	-13	3	213959
MAD DS	1	11	39	4	4	12	9	136	20	-97	39	8	-51	215197	4	5	23	48	137	19	-86	26	-9	-64	215795
CYI SB	1	11	43	4	4	12	9	136	20	-91	49	-41	-1	214748	4	5	23	52	137	20	-84	34	-56	5	215362
ASC SB	1	11	46	4	4	12	13	136	21	-56	37	-48	26	215273	4	5	23	59	137	20	-64	23	-65	24	215974
HAW SB	0	57	53	4	4	25	22	138	20	68	0	90	22	216651	4	5	23	15	139	20	73	12	78	16	216560
HAW SB	1	11	31	4	6	9	56	138	20	77	22	67	12	215929	4	7	21	27	139	19	82	38	52	6	215026
GLD DS	1	11	33	4	6	10	4	138	20	113	59	13	28	214282	4	7	21	37	139	19	142	70	16	12	213909

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GYM SB	1	11	29	4	6	10	8	138	20	106	67	22	-6	214078	4	7	21	38	139	19	144	80	6	-8	213770
TEX SB	1	11	29	4	6	10	12	138	20	128	78	10	-7	213880	4	7	21	41	139	19	-140	80	-7	-8	213773
MIL SB	1	11	29	4	6	10	17	137	20	-143	79	-7	-9	213860	4	7	21	46	138	19	-107	66	-23	-7	214006
GBI SB	1	11	29	4	6	10	18	137	20	-126	79	-9	-6	213862	4	7	21	47	138	19	-101	65	-25	-5	214049
BDA SB	1	11	26	4	6	10	21	137	20	-116	66	-22	-10	214097	4	7	21	47	138	19	-100	52	-38	-6	214449
ANT SB	1	11	29	4	6	10	23	137	20	-79	65	-25	5	214113	4	7	21	52	138	20	-80	49	-41	7	214561
MAD DS	1	11	24	4	6	10	26	137	19	-79	17	-33	-70	216218	4	7	21	49	138	19	-69	4	-78	-68	216885
CYI SB	1	11	22	4	6	10	30	137	20	-79	24	-66	10	215821	4	7	21	53	138	19	-73	9	-80	17	216597
ASC SB	0	55	14	4	6	10	33	137	20	-67	12	-77	22	216493	4	7	5	47	138	20	-70	0	-90	20	216336
HAW SB	1	11	37	4	8	8	15	139	19	85	49	41	3	214521	4	9	19	52	140	19	92	65	25	-1	213911
GLD DS	1	11	46	4	8	8	23	139	19	177	74	16	1	213803	4	9	20	9	139	19	-134	68	16	-15	213838
GYM SB	1	11	44	4	8	8	25	138	19	-148	80	-5	-8	213721	4	9	20	9	139	19	-108	67	-22	-7	213854
TEX SB	1	11	43	4	8	8	30	138	19	-111	71	-18	-7	213857	4	9	20	12	139	19	-97	56	-34	-4	214184
GBI SB	1	11	48	4	8	8	31	138	19	-93	54	-36	-2	214314	4	9	20	19	139	19	-86	39	-51	3	214882
MIL SB	1	11	46	4	8	8	32	138	19	-97	56	-34	-4	214245	4	9	20	17	139	19	-89	41	-49	1	214776
BDA SB	1	11	45	4	8	8	33	138	19	-92	42	-48	-2	214801	4	9	20	17	139	19	-84	27	-63	5	215451
ANT SB	1	11	49	4	8	8	34	138	20	-78	38	-52	9	214982	4	9	20	24	139	19	-76	22	-68	13	215743
GUM SB	0	49	5	4	8	30	34	140	19	70	0	90	20	215994	4	9	19	40	141	19	73	11	79	17	216358
GUM SB	1	11	30	4	10	6	23	140	19	74	22	68	14	215692	4	11	17	52	141	19	76	38	52	11	214754
CNB DS	1	11	27	4	10	6	31	140	20	60	6	-78	60	216594	4	11	17	58	141	20	49	17	-64	46	215817

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
HAW SB	1	11	30	4	10	6	36	140	19	99	76	14	-2	213636	4	11	18	6	141	19	-150	86	-2	-3	213445
GLD DS	1	11	28	4	10	6	45	139	19	-116	60	14	-27	213973	4	11	18	13	140	19	-101	47	10	-42	214369
GYM SB	1	11	28	4	10	6	48	139	19	-98	57	-33	-4	214062	4	11	18	16	140	19	-90	42	-48	0	214570
TEX SB	1	11	26	4	10	6	51	139	19	-90	45	-45	0	214501	4	11	18	17	140	19	-84	30	-60	6	215143
MIL SB	1	11	23	4	10	6	53	139	19	-84	30	-59	5	215194	4	11	18	16	140	19	-77	16	-74	12	215936
BDA SB	1	11	22	4	10	6	53	139	19	-78	17	-72	11	215911	4	11	18	15	140	18	-70	3	-86	20	216659
GBI SB	1	11	23	4	10	6	54	139	19	-82	28	-62	7	215319	4	11	18	17	140	19	-76	13	-76	14	216086
ANT SB	0	50	51	4	10	6	58	139	19	-73	11	-79	16	216278	4	10	57	50	139	19	-70	0	-90	20	215885
CAR SB	0	4	48	4	12	4	36	141	19	66	6	84	24	216463	4	12	9	24	141	19	65	7	83	25	216153
GUM SB	0	4	48	4	12	4	36	141	19	76	49	40	9	214235	4	12	9	24	141	19	76	50	39	9	213940
CNB DS	0	4	41	4	12	4	43	141	20	40	24	-60	36	215400	4	12	9	24	141	20	39	25	-60	34	215122
HAW SB	0	4	34	4	12	4	50	140	19	-102	76	-13	-3	213480	4	12	9	24	140	19	-100	75	-14	-3	213255
GLD DS	0	4	30	4	12	4	54	140	19	-93	37	4	-53	214738	4	12	9	24	140	19	-92	36	3	-54	214545
GYM SB	0	4	29	4	12	4	55	140	19	-84	32	-58	5	215008	4	12	9	24	140	19	-84	31	-59	5	214822
MIL SB	0	4	27	4	12	4	56	140	18	-72	6	-84	18	216462	4	12	9	24	140	18	-72	5	-85	18	216283
TEX SB	0	4	27	4	12	4	57	140	19	-79	20	-70	11	215641	4	12	9	24	140	19	-78	19	-71	11	215461
GBI SB	0	4	27	4	12	4	57	140	18	-71	3	-87	19	216622	4	12	9	24	140	18	-70	2	-88	20	216443
18 MAY 69 UPDATE 72.1 LM JETTISON BO TO TEI IG																									
GBI SB	0	9	57	4	12	9	29	140	18	-70	2	-88	20	216439	4	12	19	26	140	18	-69	0	-90	21	216035
MIL SB	0	23	47	4	12	9	29	140	18	-72	5	-85	18	216279	4	12	33	17	140	18	-69	0	-90	21	215523
CAR SB	1	6	42	4	12	9	29	141	19	65	7	83	25	216147	4	13	16	11	142	19	57	19	67	31	215554

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GUM SB	1	6	48	4	12	9	29	141	19	76	50	39	9	213934	4	13	16	17	142	19	74	65	24	6	213607
CNB DS	1	6	57	4	12	9	29	141	20	38	25	-60	34	215116	4	13	16	26	142	19	23	32	-56	20	214906
HAW SB	1	7	3	4	12	9	29	140	19	-100	75	-14	-3	213251	4	13	16	32	141	18	-92	61	-29	-1	213741
GLD DS	1	7	8	4	12	9	29	140	19	-92	36	3	-54	214541	4	13	16	38	141	18	-84	23	-15	-66	215389
GYM SB	1	7	10	4	12	9	29	140	19	-84	31	-59	5	214818	4	13	16	39	141	18	-78	17	-73	12	215751
TEX SB	1	7	11	4	12	9	29	140	19	-78	19	-71	11	215457	4	13	16	41	141	18	-72	5	-85	18	216429
CAR SB	1	11	33	4	14	2	54	142	19	49	28	55	35	215038	4	15	14	28	143	19	34	39	35	40	214407
GUM SB	1	11	34	4	14	2	59	142	19	66	76	13	6	213337	4	15	14	33	143	18	-36	84	-4	5	213161
CNB DS	1	11	30	4	14	3	7	142	19	10	35	-55	8	214697	4	15	14	37	142	19	-9	35	-55	-8	214587
HAW SB	1	11	29	4	14	3	14	141	18	-87	50	-40	2	214039	4	15	14	43	142	18	-83	34	-56	6	214664
GLD DS	1	11	25	4	14	3	15	141	18	-77	13	-43	-72	215845	4	15	14	40	142	18	-68	0	-90	-68	216563
GYM SB	0	32	3	4	14	3	19	141	18	-73	6	-83	17	216255	4	14	35	22	141	18	-70	0	-90	20	215314
CAR SB	1	11	43	4	16	1	12	143	19	21	44	20	42	214131	4	17	12	55	143	18	-2	47	-2	43	213917
GUM SB	1	11	47	4	16	1	16	142	18	-70	74	-15	5	213215	4	17	13	3	143	18	-78	58	-31	7	213521
CNB DS	1	11	46	4	16	1	20	142	19	-23	32	-56	-19	214656	4	17	13	6	143	18	-39	25	-58	-35	214939
HAW SB	1	11	43	4	16	1	24	142	18	-79	23	-67	10	215163	4	17	13	8	143	17	-74	7	-82	16	215984
CAR SB	1	11	28	4	17	59	35	143	18	-18	45	-17	42	213918	4	19	11	3	144	18	-38	38	-38	39	214142
GUM SB	1	11	25	4	17	59	41	143	18	-78	47	-43	8	213843	4	19	11	6	144	17	-78	30	-59	11	214518
CNB DS	1	11	25	4	17	59	43	143	18	-49	19	-63	-46	215218	4	19	11	8	144	18	-61	8	-74	-60	215786
MAD DS	1	10	36	4	17	59	60	144	17	67	0	-90	67	216319	4	19	10	36	145	17	78	12	-45	73	215528

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
CYI SB	1	11	34	4	19	57	19	145	17	76	9	81	14	215655	4	21	8	53	146	17	83	24	66	6	214692
ASC SB	1	11	36	4	19	57	21	145	18	72	0	90	18	216182	4	21	8	57	146	17	69	16	73	20	215117
MAD DS	1	11	33	4	19	57	23	145	17	85	21	-13	69	214982	4	21	8	56	146	17	97	33	10	56	214187
CAR SB	1	11	48	4	19	57	49	144	18	-48	30	-52	35	214434	4	21	9	37	145	17	-60	18	-69	28	215028
GUM SB	1	11	44	4	19	57	49	143	17	-76	19	-70	13	215052	4	21	9	33	145	17	-74	3	-87	16	215914
CYI SB	1	11	30	4	21	55	35	146	17	88	34	56	2	214104	4	23	7	5	147	16	97	49	41	-5	213316
ASC SB	1	11	29	4	21	55	38	146	17	66	27	61	21	214465	4	23	7	7	147	17	59	42	43	23	213604
MAD DS	1	11	28	4	21	55	39	146	17	106	42	17	45	213720	4	23	7	7	147	16	123	54	22	30	213141
CAR SB	0	43	50	4	21	56	12	145	17	-66	9	-81	24	215483	4	22	40	2	145	17	-71	0	-90	19	214730
BDA SB	0	37	28	4	22	29	31	147	16	71	0	90	19	214663	4	23	6	59	147	16	75	7	83	15	215482
ANT SB	0	25	37	4	22	41	21	147	16	73	0	90	17	214770	4	23	6	58	147	16	75	6	84	15	215566
MIL SB	1	11	39	4	23	53	41	147	16	73	2	87	17	215725	5	1	5	20	148	16	81	17	73	9	214749
BDA SB	1	11	41	4	23	53	42	147	16	81	17	73	8	214878	5	1	5	23	148	16	90	31	59	0	213978
GBI SB	1	11	38	4	23	53	42	147	16	74	4	86	16	215630	5	1	5	20	148	16	81	19	71	8	214643
ANT SB	1	11	39	4	23	53	42	147	16	77	17	73	12	214889	5	1	5	22	148	16	81	32	57	7	213898
CYI SB	1	11	46	4	23	53	48	147	16	105	60	30	-8	212916	5	1	5	35	148	16	131	73	13	-11	212484
ASC SB	1	11	52	4	23	53	51	147	17	49	52	31	24	213172	5	1	5	43	148	17	26	63	13	24	212716
MAD DS	1	11	44	4	23	53	52	147	16	140	61	23	18	212877	5	1	5	36	147	16	176	65	25	2	212644
TEX SB	0	10	40	5	0	54	36	148	16	72	0	90	18	215194	5	1	5	16	148	16	73	2	88	17	215606
GYM SB	1	11	21	5	1	51	60	148	16	73	1	89	17	215633	5	3	3	21	149	15	80	15	75	9	214649

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	1	11	27	5	1	52	1	148	16	86	29	61	4	214018	5	3	3	27	149	16	94	44	46	-3	213170
TEX SB	1	11	24	5	1	52	1	148	16	78	12	77	11	214955	5	3	3	24	149	15	86	27	63	4	213997
MIL SB	1	11	24	5	1	52	1	148	16	86	27	63	4	214125	5	3	3	25	149	15	94	42	48	-3	213270
BDA SB	1	11	26	5	1	52	2	148	16	97	41	49	-5	213441	5	3	3	29	149	15	110	55	34	-12	212765
ANT SB	1	11	28	5	1	52	3	148	16	84	44	46	4	213316	5	3	3	31	149	16	88	60	30	1	212599
CYI SB	1	11	27	5	1	52	14	147	16	173	78	1	-12	212332	5	3	3	41	148	16	-127	71	-15	-11	212335
MAD DS	1	11	26	5	1	52	16	147	16	-157	64	24	-10	212605	5	3	3	43	148	15	-129	56	23	-26	212747
ASC SB	1	11	26	5	1	52	21	147	17	0	65	0	25	212559	5	3	3	46	148	16	-35	61	-18	24	212591
GLD DS	1	2	53	5	2	0	30	148	16	71	0	-90	71	215240	5	3	3	22	149	15	79	11	-43	74	214876
GLD DS	1	11	41	5	3	50	5	149	15	86	21	-11	69	214291	5	5	1	46	150	15	96	35	9	55	213438
GYM SB	1	11	44	5	3	50	6	149	15	85	26	64	4	214033	5	5	1	49	150	15	94	41	49	-3	213161
TEX SB	1	11	46	5	3	50	7	149	16	91	38	52	-1	213430	5	5	1	53	150	15	101	52	37	-7	212679
MIL SB	1	13	42	5	3	50	9	149	16	102	52	37	-7	212811	5	5	3	52	150	15	120	67	20	-12	212347
GBI SB	1	11	47	5	3	50	11	149	16	101	55	35	-6	212720	5	5	1	58	150	15	119	69	18	-10	212204
BDA SB	1	11	51	5	3	50	12	148	16	125	64	22	-15	212448	5	5	2	3	149	15	164	72	5	-17	212143
ANT SB	1	11	50	5	3	50	13	148	16	91	71	19	0	212274	5	5	2	3	149	15	130	87	2	-2	211983
MAD DS	1	11	46	5	3	50	24	148	15	-115	48	21	-37	212968	5	5	2	10	149	15	-101	35	15	-53	213428
CYI SB	1	11	47	5	3	50	25	148	16	-110	62	-27	-9	212494	5	5	2	11	149	15	-97	47	-43	-5	212909
ASC SB	1	11	51	5	3	50	26	148	16	-50	53	-30	23	212786	5	5	2	16	149	16	-63	39	-48	21	213268
HAW SB	1	11	24	5	5	48	23	150	15	76	6	83	14	214949	5	6	59	47	151	15	82	22	68	7	213925

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GLD DS	1	11	25	5	5	48	27	150	15	104	44	14	44	212941	5	6	59	52	151	15	121	57	19	28	212334
GYM SB	1	11	23	5	5	48	30	150	15	101	51	38	-7	212665	5	6	59	53	151	15	117	65	22	-11	212097
TEX SB	1	11	25	5	5	48	32	150	15	112	63	26	-10	212288	5	6	59	58	150	15	145	75	9	-13	211908
MIL SB	1	11	24	5	5	48	37	149	15	145	74	9	-13	212034	5	7	0	1	150	15	-151	74	-8	-14	211912
GBI SB	1	11	24	5	5	48	38	149	15	150	77	7	-11	211992	5	7	0	3	150	15	-139	75	-10	-11	211909
BDA SB	1	11	25	5	5	48	41	149	15	-158	72	-7	-17	212074	5	7	0	6	150	15	-123	62	-24	-15	212193
ANT SB	1	11	24	5	5	48	44	149	15	-99	80	-10	-1	211948	5	7	0	8	150	15	-91	64	-26	0	212139
MAD DS	1	11	23	5	5	48	48	148	15	-92	26	5	-64	213799	5	7	0	12	149	14	-82	13	-31	-75	214438
CYI SB	1	11	25	5	5	48	51	148	15	-91	36	-54	-1	213285	5	7	0	15	149	15	-84	21	-69	5	213984
ASC SB	1	11	25	5	5	48	56	148	16	-68	28	-60	20	213701	5	7	0	21	149	15	-73	-12	-77	17	214495
HAW SB	1	11	47	5	7	46	29	151	15	86	33	57	3	213306	5	8	58	16	152	14	93	48	42	-2	212460
GYM SB	1	11	50	5	7	46	37	150	15	141	73	11	-13	211874	5	8	58	27	151	14	-155	75	-6	-13	211725
GLD DS	1	11	46	5	7	46	38	150	15	139	64	20	16	212068	5	8	58	23	151	14	-179	69	21	0	211835
TEX SB	1	11	47	5	7	46	42	150	15	-168	77	-3	-13	211819	5	8	58	28	151	14	-122	67	-20	-12	211880
MIL SB	1	11	47	5	7	46	44	150	15	-123	67	-20	-12	211996	5	8	58	31	151	14	-105	53	-36	-9	212299
GBI SB	1	11	45	5	7	46	47	150	15	-115	66	-22	-10	212018	5	8	58	31	151	14	-101	51	-38	-7	212363
BDA SB	1	11	46	5	7	46	48	150	15	-110	53	-36	-12	212416	5	8	58	33	151	14	-98	39	-51	-6	212900
ANT SB	1	11	45	5	7	46	49	149	15	-88	52	-38	1	212427	5	8	58	34	150	14	-84	36	-54	5	213015
MAD DS	0	24	5	5	7	46	49	149	14	-75	4	-74	-74	214888	5	8	10	54	150	14	-71	0	-90	-71	213969
CYI SB	0	52	11	5	7	46	53	149	15	-79	11	-79	11	214502	5	8	39	4	150	14	-74	0	-90	16	214100

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
ASC SB	0	3	58	5	7	46	57	149	15	-75	1	-89	15	215077	5	7	50	54	149	15	-75	0	-90	15	214915
GUM SB	1	11	22	5	9	44	46	152	14	77	6	84	13	214616	5	10	56	8	153	14	80	22	68	9	213540
HAW SB	1	11	28	5	9	44	55	151	14	99	59	30	-5	212010	5	10	56	23	152	14	119	74	14	-8	211538
GLD DS	1	11	24	5	9	45	5	151	14	-150	66	21	-12	211817	5	10	56	28	152	14	-122	56	20	-28	211996
GYM SB	1	11	26	5	9	45	6	151	14	-125	68	-18	-12	211774	5	10	56	32	152	14	-106	54	-35	-9	212063
TEX SB	1	11	23	5	9	45	12	151	14	-108	57	-31	-9	212058	5	10	56	35	151	14	-97	42	-47	-5	212527
MIL SB	1	11	23	5	9	45	13	150	14	-97	43	-47	-5	212619	5	10	56	36	151	14	-89	28	-62	1	213252
BDA SB	1	11	20	5	9	45	16	150	14	-91	28	-62	-1	213303	5	10	56	36	151	14	-83	14	-76	7	214009
GBI SB	1	11	22	5	9	45	16	150	14	-94	41	-49	-3	212707	5	10	56	38	151	14	-87	25	-65	3	213375
ANT SB	1	11	21	5	9	45	19	150	14	-82	25	-65	8	213498	5	10	56	41	151	14	-78	9	-81	12	214321
CNB DS	0	54	48	5	10	1	27	152	15	71	0	-90	71	214085	5	10	56	15	153	15	64	10	-68	62	214229
GUM SB	1	11	49	5	11	42	51	153	14	82	33	56	7	212898	5	12	54	40	154	14	85	50	40	4	212024
CNB DS	1	11	47	5	11	42	58	153	15	56	18	-60	52	213693	5	12	54	45	153	14	42	29	-53	36	212971
HAW SB	1	11	52	5	11	43	1	152	14	166	82	2	-8	211390	5	12	54	53	153	14	-118	73	-15	-8	211372
GLD DS	1	11	47	5	11	43	9	151	14	-110	47	17	-40	212253	5	12	54	56	152	13	-97	33	11	-56	212763
BDA SB	0	21	3	5	11	43	11	151	14	-76	4	-86	13	214515	5	12	4	14	151	14	-74	0	-90	16	213699
GYM SB	1	11	47	5	11	43	12	151	14	-98	44	-46	-6	212393	5	12	54	58	152	13	-89	29	-61	0	213013
MIL SB	1	11	47	5	11	43	12	151	14	-83	17	-73	6	213750	5	12	54	59	152	13	-76	2	-88	14	214515
GBI SB	1	10	22	5	11	43	13	151	14	-82	15	-75	8	213888	5	12	53	35	152	13	-75	0	-90	15	214588
TEX SB	1	11	46	5	11	43	13	151	14	-90	32	-58	0	212950	5	12	54	59	152	13	-83	17	-73	6	213667

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
CAR SB	0	44	36	5	12	10	3	153	14	74	0	90	16	213502	5	12	54	38	154	14	70	9	80	20	214083
CAR SB	1	11	24	5	13	41	17	154	14	64	19	69	25	213445	5	14	52	40	155	14	53	32	51	31	212590
GUM SB	1	11	24	5	13	41	20	153	14	86	61	29	2	211565	5	14	52	44	154	13	89	78	12	0	211093
CNB DS	1	11	25	5	13	41	25	153	14	30	35	-51	24	212604	5	14	52	50	154	14	10	40	-50	8	212236
HAW SB	1	11	21	5	13	41	35	152	14	-104	63	-26	-6	211509	5	14	52	57	153	13	-95	47	-43	-3	211936
GLD DS	1	11	21	5	13	41	38	152	13	-90	24	1	-66	213173	5	14	52	59	153	13	-81	10	-42	-77	213870
GYM SB	1	11	21	5	13	41	39	152	13	-84	18	-72	6	213487	5	14	53	1	153	13	-77	3	-87	13	214262
TEX SB	0	30	22	5	13	41	41	152	13	-78	6	-84	12	214174	5	14	12	3	152	13	-75	0	-90	15	213232
CNB DS	1	13	41	5	15	37	37	154	14	-4	40	-50	-3	212239	5	16	51	18	155	13	-26	37	-50	-21	212181
CAR SB	1	11	50	5	15	39	21	154	14	42	40	38	34	212155	5	16	51	11	155	13	22	49	18	37	211650
GUM SB	1	11	49	5	15	39	25	154	13	98	90	0	0	210960	5	16	51	14	155	13	-90	74	-16	0	210968
GLD DS	0	1	26	5	15	39	33	153	13	-75	0	-89	-75	214348	5	15	40	58	153	13	-74	0	-90	-74	214293
HAW SB	1	11	46	5	15	39	34	153	13	-90	36	-54	0	212341	5	16	51	21	154	13	-84	20	-70	5	213067
				18 MAY 69 UPDATE 72.1 TEI BD TO ENTRY																						
CAR SB	5	49	43	5	17	29	19	155	13	7	51	6	38	211764	5	23	19	2	154	13	-75	0	-90	15	197382
GUM SB	4	22	14	5	17	29	21	154	13	-88	64	-26	1	211370	5	21	51	35	154	13	-77	0	-90	13	201463
CNB DS	3	13	57	5	17	29	22	154	14	-37	33	-51	-30	212576	5	20	43	20	154	13	-73	0	-90	-73	204674
HAW SB	0	48	34	5	17	29	23	154	13	-81	11	-79	9	213771	5	18	17	58	154	13	-76	0	-90	14	211771
MAD DS	13	19	34	5	18	58	35	155	12	74	0	-90	74	209712	6	8	18	9	155	12	-75	0	-90	-75	171953
CYI SB	12	46	41	5	20	1	43	156	12	76	0	90	14	206619	6	8	48	24	155	12	-77	0	-90	13	170478
ASC SB	11	39	35	5	20	30	30	156	13	77	0	90	13	205289	6	8	10	5	155	13	-77	0	-90	13	172341

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
BDA SB	12	57	29	5	23	12	35	156	12	75	0	90	15	197719	6	12	10	3	155	11	-76	0	-90	14	160498
ANT SB	12	24	46	5	23	18	4	156	12	77	0	90	13	197427	6	11	42	50	155	12	-78	0	-90	12	161861
GBI SB	12	44	25	6	0	13	53	156	12	76	0	90	14	194875	6	12	58	18	155	12	-77	0	-90	13	158064
MIL SB	12	48	5	6	0	22	3	156	12	76	0	90	14	194467	6	13	10	8	155	11	-77	0	-90	13	157465
TEX SB	12	46	26	6	1	29	47	156	12	76	0	90	14	191345	6	14	16	13	155	11	-77	0	-90	13	154095
GYM SB	12	46	36	6	2	23	30	156	12	76	0	90	14	188807	6	15	10	6	156	11	-77	0	-90	13	151320
GLD DS	13	3	37	6	2	39	21	156	12	75	0	-90	75	188069	6	15	42	58	156	11	-76	0	-90	-76	149615
HAW SB	12	34	29	6	5	46	35	156	12	77	0	90	13	179248	6	18	21	4	156	11	-78	0	-90	12	141265
GUM SB	12	18	4	6	9	39	16	157	12	78	0	90	12	167986	6	21	57	20	157	11	-79	0	-90	11	129413
CNB DS	10	43	14	6	10	11	13	157	13	74	0	-90	74	166410	6	20	54	27	157	12	-75	0	-90	-75	132912
CAR SB	11	10	22	6	12	19	46	157	13	76	0	90	14	160005	6	23	30	8	157	12	-77	0	-90	13	124152
MAD DS	13	8	15	6	19	14	7	159	11	76	0	-90	76	138408	7	8	22	22	160	8	-79	0	-90	-79	91324
CYI SB	12	42	8	6	20	15	23	159	11	78	0	90	12	135068	7	8	57	31	160	9	-80	0	-90	10	88950
ASC SB	11	46	9	6	20	40	47	159	12	78	0	90	12	133669	7	8	26	56	159	10	-80	0	-90	10	91014
BDA SB	12	49	13	6	23	30	55	160	10	78	0	90	12	124109	7	12	20	8	162	7	-81	0	-90	9	74577
ANT SB	12	24	52	6	23	33	12	160	11	79	0	90	11	123978	7	11	58	4	161	8	-82	0	-90	8	76206
GBI SB	12	39	33	7	0	32	8	160	10	79	0	90	11	120575	7	13	11	41	162	7	-82	0	-90	8	70698
MIL SB	12	42	32	7	0	40	24	160	10	78	0	90	12	120095	7	13	22	55	162	7	-82	0	-90	8	69838
TEX SB	12	41	6	7	1	49	38	161	10	79	0	90	11	116024	7	14	30	43	163	6	-83	0	-90	7	64534
GYM SB	12	41	39	7	2	44	10	161	10	79	0	90	11	112765	7	15	25	49	164	6	-83	0	-90	7	60062

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GLD DS	12	52	45	7	3	2	17	161	10	78	0	-90	78	111671	7	15	55	2	164	5	-84	0	-90	-84	57622
HAW SB	12	37	3	7	6	11	7	162	9	80	0	90	10	99922	7	18	48	10	167	3	-87	0	-90	3	41936
GUM SB	13	27	3	7	10	9	11	165	9	81	0	90	9	84009	7	23	36	13	-160	-48	-140	0	-90	-50	4037
CNB DS	13	18	28	7	10	30	26	165	11	77	0	-90	77	82513	7	23	48	54	-9	27	56	0	-90	56	1046
CAR SB	10	58	58	7	12	46	27	167	10	79	0	90	11	72607	7	23	45	25	-19	-11	102	0	90	-12	1883
CAR CB	2	28	51	7	21	16	34	176	4	-52	47	-36	25	23400	7	23	45	25	-19	-11	102	0	90	-12	1883
TAN TM	2	15	17	7	21	17	51	-175	3	66	43	44	17	23400	7	23	33	8	-88	-14	105	0	90	-15	4730
PRE CB	2	1	1	7	21	25	5	-173	4	73	24	65	15	23400	7	23	26	6	-110	-8	99	0	90	-9	6221

APS BURN TO DEPLETION

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
TEX SB	1	1	35	4	12	42	31	140	18	-75	12	-78	14	214726	4	13	44	7	142	18	-70	0	-90	20	214999
GYM SB	1	59	12	4	12	42	31	140	18	-81	29	-66	8	214062	4	14	41	43	143	17	-70	0	-90	20	218599
GLD DS	2	38	51	4	12	42	31	140	18	-88	30	-9	-60	213742	4	15	21	22	144	17	-69	0	-89	-69	219750
HAW SB	5	10	26	4	12	42	31	141	19	-95	68	22	-2	212264	4	18	0	57	147	16	-73	0	-90	17	224637
CNB DS	7	41	57	4	12	42	31	141	19	31	28	58	27	213795	4	20	24	28	150	16	-71	0	-90	-71	229400
MAD DS	4	35	17	4	18	26	19	149	15	70	0	90	70	225961	5	23	1	35	171	5	110	29	32	94	300000
GLD DS	13	27	42	5	2	49	4	157	12	75	0	90	75	243832	5	16	16	46	166	7	-82	0	-90	-82	280686
CNB DS	11	39	6	5	10	31	36	164	10	78	0	90	78	264005	5	22	10	42	170	6	-83	0	-90	-83	296936

TABLE 2.0-VIII. - MISSION RADAR TIMELINE - Continued

(d) CSM acquisition and termination - 5° minimum elevation

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
BDA SB	0	0	14	0	0	11	24	154	8	84	6	84	6	548	0	0	11	38	156	8	84	5	85	6	602
BDA CB	0	0	14	0	0	11	24	154	8	84	6	84	6	548	0	0	11	38	156	8	84	5	85	6	602
SHIP 1	0	2	39	0	0	11	24	-37	56	-29	6	-78	60	560	0	0	14	3	-164	49	38	5	82	52	601
CYI SB	0	4	59	0	0	17	34	23	18	-73	5	-85	17	599	0	0	22	32	-167	-17	113	5	85	-23	593
CYI CB	0	4	59	0	0	17	34	23	18	-73	5	-85	17	599	0	0	22	32	-167	-17	113	5	85	-23	593
KNO TM	0	4	29	0	0	24	50	45	54	-36	5	-81	54	590	0	0	29	19	-132	-5	97	5	85	-7	585
TAN TM	0	2	28	0	0	38	34	-167	66	3	5	33	84	578	0	0	41	2	-98	22	65	5	85	25	581
CAR SB	0	2	47	0	0	53	45	143	-49	-143	5	-82	-52	587	0	0	56	31	14	-53	148	5	81	-58	587
CAR CB	0	2	46	0	0	53	45	143	-49	-143	5	-82	-52	587	0	0	56	31	14	-54	148	5	81	-58	587
CNB DS	0	3	28	0	1	0	48	-137	18	-63	5	-79	-63	584	0	1	4	16	-28	42	27	5	-84	27	582
GYM SB	0	4	55	0	1	29	19	-30	-24	-120	5	-84	-30	593	0	1	34	14	133	14	77	5	85	13	599
WHS CB	0	4	28	0	1	30	51	-12	-34	-135	5	-83	-45	593	0	1	35	18	128	-3	97	5	85	-7	597
TEX SB	0	4	51	0	1	32	14	-32	2	-90	5	-85	0	597	0	1	37	4	155	28	61	5	84	29	601
EGL CB	0	4	57	0	1	34	40	-21	3	-89	5	-85	1	598	0	1	39	37	161	17	73	5	85	17	601
MIL SB	0	4	34	0	1	36	10	-23	20	-70	5	-85	20	600	0	1	40	45	173	28	61	5	84	29	601
MLA CB	0	4	33	0	1	36	11	-24	20	-70	5	-85	20	600	0	1	40	44	173	28	60	5	84	29	601
KEN CB	0	4	34	0	1	36	12	-23	20	-70	5	-85	20	600	0	1	40	46	173	28	61	5	84	29	601
PAT CB	0	4	30	0	1	36	13	-24	22	-68	5	-85	22	600	0	1	40	43	174	29	59	5	84	31	601
GBI CB	0	3	55	0	1	37	2	-28	34	-55	5	-84	35	599	0	1	40	57	-178	39	48	5	83	41	601
GBI SB	0	3	55	0	1	37	2	-28	34	-54	5	-84	35	599	0	1	40	57	-178	39	48	5	83	41	601

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
BDA SB	0	5	1	0	1	39	31	0	8	-84	5	-85	6	602	0	1	44	33	173	-1	94	5	85	-4	600
BDA CB	0	5	1	0	1	39	32	0	8	-84	5	-85	6	602	0	1	44	33	173	-1	94	5	85	-4	600
SHIP 1	0	4	16	0	1	43	44	-2	43	-44	5	-83	45	600	0	1	48	0	-161	18	73	5	85	17	597
CYI SB	0	1	46	0	1	51	49	76	-30	-128	5	-84	-38	593	0	1	53	35	124	-56	-171	5	-62	-79	590
CYI CB	0	1	46	0	1	51	49	76	-30	-128	5	-84	-38	593	0	1	53	35	124	-56	-171	5	-62	-79	590
KNO TM	0	2	27	0	1	58	37	87	-22	-114	5	-85	-24	586	0	2	1	4	150	-72	-175	5	-45	-83	582
TAN TM	0	4	39	0	2	10	13	126	8	-80	5	-85	10	580	0	2	14	52	-50	-42	133	5	83	-43	582
CAR SB	0	3	38	0	2	26	40	166	-49	-143	5	-82	-52	586	0	2	30	18	19	-30	121	5	84	-31	586
CAR CB	0	3	38	0	2	26	40	166	-49	-143	5	-82	-53	586	0	2	30	18	19	-30	121	5	84	-31	586
18 MAY 69 UPDATE 72.1 TLI BO TO EVASIVE MANEUVER IG																									
HAW CB	1	44	23	0	2	44	24	-51	-41	-139	5	-82	-49	1903	0	4	28	48	90	32	67	41	46	17	17668
HAW SB	1	44	23	0	2	44	24	-51	-41	-139	5	-82	-49	1903	0	4	28	48	90	32	67	41	46	17	17667
CAL CB	1	37	59	0	2	50	48	-22	-16	-113	5	-85	-23	3318	0	4	28	48	83	31	117	83	7	-3	16680
GLD DS	1	37	16	0	2	51	31	-19	-14	-111	5	76	-69	3475	0	4	28	48	82	31	147	85	4	3	16668
GYM SB	1	36	29	0	2	52	18	-21	-5	-98	5	-85	-8	3647	0	4	28	48	81	32	-37	84	-3	4	16670
WHS CB	1	35	20	0	2	53	27	-15	-6	-100	5	-85	-10	3897	0	4	28	48	80	31	-94	82	-8	-1	16683
TEX SB	1	33	11	0	2	55	36	-11	2	-90	5	-85	0	4357	0	4	28	48	78	32	-71	72	-17	6	16798
MIL SB	1	27	45	0	3	1	3	4	9	-82	5	-85	8	5490	0	4	28	48	75	31	-75	55	-34	8	17168
MLA CB	1	27	44	0	3	1	4	4	9	-82	5	-85	8	5494	0	4	28	48	75	31	-75	55	-34	8	17169
PAT CB	1	27	41	0	3	1	6	4	10	-82	5	-85	8	5501	0	4	28	48	75	31	-75	55	-34	9	17173
GBI CB	1	26	38	0	3	2	10	6	12	-80	5	-85	10	5715	0	4	28	48	75	31	-72	52	-36	11	17259

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	1	26	37	0	3	2	10	6	12	-80	5	-85	10	5718	0	4	28	48	75	31	-72	52	-36	11	17260
GTI CB	1	22	36	0	3	6	11	12	17	-73	5	-85	17	6516	0	4	28	48	73	32	-66	43	-44	17	17578
BDA SB	1	20	50	0	3	7	58	18	13	-77	5	-85	13	6861	0	4	28	48	73	30	-77	41	-48	10	17671
BDA CB	1	20	50	0	3	7	58	18	13	-77	5	-85	13	6861	0	4	28	48	73	30	-77	41	-48	10	17671
ANT CB	1	15	34	0	3	13	14	23	23	-68	5	-85	22	7857	0	4	28	48	72	32	-63	32	-54	23	18043
ANT SB	1	15	29	0	3	13	18	23	23	-68	5	-85	22	7871	0	4	28	48	72	32	-63	32	-55	23	18048
SHIP 1	1	7	9	0	3	21	38	35	22	-68	5	-85	22	9378	0	4	28	48	71	30	-67	24	-64	21	18444
18 MAY 69 UPDATE 72.1 EVASIVE MANEUVER BO TO MIDCOURSE IG																									
SHIP 1	0	38	60	0	4	28	50	72	30	-67	24	-64	21	18451	0	5	7	50	80	30	-67	23	-65	21	23400
ANT CB	0	42	18	0	4	28	50	72	32	-63	32	-54	23	18049	0	5	11	9	81	31	-63	31	-56	23	23400
BDA CB	0	45	26	0	4	28	50	73	30	-77	41	-48	10	17677	0	5	14	17	82	30	-76	39	-50	11	23400
GTI CB	0	46	13	0	4	28	50	73	32	-66	43	-44	17	17585	0	5	15	3	82	31	-66	41	-46	17	23400
HAW CB	0	48	7	0	4	28	50	90	32	67	41	46	17	17674	0	5	16	58	95	32	67	47	41	16	23400
GBI CB	0	48	58	0	4	28	50	75	31	-72	52	-36	11	17265	0	5	17	49	84	31	-73	50	-39	11	23400
PAT CB	0	49	39	0	4	28	50	75	31	-75	55	-34	9	17179	0	5	18	30	84	31	-75	52	-37	9	23390
MLA CB	0	49	41	0	4	28	50	75	31	-75	55	-34	8	17176	0	5	18	31	84	31	-75	53	-37	9	23390
WHS CB	0	54	33	0	4	28	50	80	31	-94	82	-8	-1	16689	0	5	23	23	88	31	-92	77	-13	0	23397
CAL CB	0	55	7	0	4	28	50	83	31	117	83	7	-3	16686	0	5	23	57	90	31	161	86	1	-4	23397
ANT SB	3	46	52	0	4	28	50	72	32	-63	32	-55	23	18054	0	8	15	42	97	29	-61	5	-84	28	43607
BDA SB	4	45	52	0	4	28	50	73	30	-77	41	-48	10	17677	0	9	14	43	101	27	-61	5	-84	29	48732
MIL SB	5	9	56	0	4	28	50	75	31	-75	55	-34	8	17174	0	9	38	46	101	28	-65	12	-77	25	50344

VEHICLE 1 RADAR TABLE

	TRACKING TIME	STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS MIN SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	5 9 56	0	4	28	50	75	31	-72	52	-36	11	17266	0	9	38	46	101	28	-63	9	-80	26	50508
HAW SB	5 9 56	0	4	28	50	90	32	67	41	46	17	17673	0	9	38	46	104	30	-45	79	-8	8	47768
GYM SB	5 9 56	0	4	28	50	81	32	-37	84	-3	4	16677	0	9	38	46	102	29	-74	37	-52	13	49008
TEX SB	5 9 56	0	4	28	50	78	32	-71	72	-17	6	16804	0	9	38	46	101	28	-70	25	-63	18	49590
GLD DS	5 9 56	0	4	28	50	82	31	147	85	4	3	16674	0	9	38	46	102	28	-83	44	-7	-46	48704
GUM SB	3 7 30	0	6	31	16	103	30	61	5	84	29	33627	0	9	38	46	108	30	62	41	46	21	48830
CNB DS	0 37 40	0	9	1	6	107	33	43	5	-83	43	47565	0	9	38	46	108	33	37	10	-78	37	50441
	18 MAY 69 UPDATE 72.1 MIDCOURSE 80 TO LOI1 IG																						
GBI SB	0 22 3	0	9	38	55	101	28	-63	9	-80	26	50521	0	10	0	57	102	28	-62	5	-84	28	52553
MIL SB	0 38 30	0	9	38	55	101	28	-65	12	-77	25	50357	0	10	17	24	103	27	-61	5	-84	29	53878
TEX SB	1 50 50	0	9	38	55	101	28	-70	25	-63	18	49602	0	11	29	45	105	27	-62	5	-84	28	59497
GYM SB	2 50 8	0	9	38	55	102	29	-74	37	-52	13	49021	0	12	29	3	106	27	-62	5	-84	28	63882
GLD DS	3 37 15	0	9	38	55	102	28	-83	44	-7	-46	48716	0	13	16	10	107	27	-61	5	-80	-60	67242
HAW SB	6 5 12	0	9	38	55	104	30	-45	79	-8	8	47780	0	15	44	7	110	27	-63	5	-84	27	77180
CNB DS	7 6 29	0	9	38	55	108	33	37	10	-78	37	50451	0	16	45	24	111	29	-48	5	-83	-48	81056
GUM SB	9 38 38	0	9	38	55	108	30	62	41	46	21	48840	0	19	17	33	112	27	-64	5	-84	26	90222
CAR SB	9 12 59	0	10	42	60	110	31	52	5	84	37	55894	0	19	55	59	113	28	-56	5	-84	34	92432
MAD DS	14 19 43	0	16	11	46	115	26	60	5	-80	59	78951	1	6	31	29	118	25	-61	5	-80	-61	124793
CYI SB	13 11 16	0	17	34	46	116	26	63	5	84	27	84110	1	6	46	2	117	25	-64	5	-84	26	125456
ASC SB	10 40 38	0	18	47	32	117	28	61	5	84	29	88462	1	5	28	10	117	26	-62	5	-84	27	121861
BDA SB	13 28 57	0	20	46	26	117	26	62	5	84	27	95295	1	10	15	23	119	25	-64	5	-84	26	134715

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
ANT SB	12	21	27	0	21	9	28	118	26	64	5	84	26	96576	1	9	30	55	118	25	-65	5	-84	25	132791
GBI SB	13	1	10	0	21	56	16	118	26	63	5	84	26	99147	1	10	57	26	119	25	-65	5	-84	25	136509
MIL SB	13	9	36	0	22	1	56	118	26	63	5	84	27	99456	1	11	11	32	119	25	-64	5	-84	26	137107
TEX SB	13	4	42	0	23	12	27	118	26	63	5	84	26	103236	1	12	17	9	119	25	-65	5	-84	25	139860
GYM SB	13	5	23	1	0	6	26	119	26	63	5	84	26	106063	1	13	11	50	119	25	-65	5	-84	25	142118
GLD DS	13	40	15	1	0	13	26	118	25	62	5	-79	62	106426	1	13	53	41	120	25	-63	5	-79	-63	143824
HAW SB	12	38	8	1	3	39	19	120	26	64	5	84	26	116703	1	16	17	27	120	25	-65	5	-84	25	149555
GUM SB	12	1	50	1	7	43	11	121	26	65	5	84	25	128035	1	19	45	0	121	25	-66	5	-85	24	157490
CNB DS	8	10	26	1	9	23	29	121	27	52	5	-82	52	132461	1	17	33	56	120	26	-53	5	-82	-53	152515
CAR SB	9	20	11	1	11	10	46	122	26	58	5	84	32	137066	1	20	30	56	121	26	-59	5	-84	31	159190
MAD DS	13	56	28	1	16	46	1	122	24	62	5	-79	62	150673	2	6	42	30	123	24	-63	5	-79	-62	180407
CYI SB	12	55	37	1	18	3	14	123	25	65	5	84	25	153648	2	6	58	50	122	24	-66	5	-84	24	180938
ASC SB	10	39	43	1	19	6	58	123	25	64	5	84	26	156060	2	5	46	40	122	25	-64	5	-84	26	178570
BDA SB	13	14	25	1	21	11	5	123	24	64	5	84	26	160675	2	10	25	30	123	24	-65	5	-84	25	187540
ANT SB	12	12	32	1	21	30	53	123	25	66	5	85	24	161396	2	9	43	25	123	24	-66	5	-85	24	186214
GBI SB	12	49	39	1	22	18	24	123	24	65	5	84	25	163121	2	11	8	3	123	24	-66	5	-85	24	188871
MIL SB	12	57	16	1	22	24	24	123	24	65	5	84	25	163338	2	11	21	40	123	24	-66	5	-84	24	189295
TEX SB	12	53	27	1	23	33	27	124	24	65	5	84	25	165809	2	12	26	54	123	24	-66	5	-85	24	191312
GYM SB	12	54	26	2	0	26	39	124	24	65	5	84	25	167687	2	13	21	5	123	24	-66	5	-85	24	192974
GLD DS	13	27	6	2	0	34	47	124	24	64	5	-79	63	167975	2	14	1	53	123	24	-65	5	-78	-64	194217

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
HAW SB	12	30	51	2	3	55	38	124	24	66	5	85	24	174873	2	16	26	29	124	24	-66	5	-85	23	198595
GUM SB	11	57	9	2	7	55	46	125	24	66	5	85	24	182779	2	19	52	55	124	24	-67	5	-85	23	204653
CNB DS	8	21	32	2	9	27	26	125	25	54	5	-82	54	185701	2	17	48	58	124	25	-55	5	-81	-54	201009
CAR SB	9	26	11	2	11	16	35	125	25	60	5	84	30	189129	2	20	42	46	124	24	-60	5	-84	30	206122
MAD DS	10	40	13	2	16	57	56	125	23	63	5	-79	63	199527	3	3	38	8	124	24	-91	39	1	-51	216958
CYI SB	9	25	10	2	18	12	60	126	24	66	5	85	24	201743	3	3	38	10	124	24	-85	48	-42	4	216564
ASC SB	8	25	17	2	19	12	55	126	24	65	5	84	25	203497	3	3	38	13	124	24	-54	33	-51	30	217233
BDA SB	6	18	35	2	21	19	27	126	23	65	5	85	25	207194	3	3	38	2	125	24	160	81	3	-8	215741
ANT SB	6	0	23	2	21	37	41	126	24	67	5	85	23	207719	3	3	38	4	125	24	3	83	0	7	215725
GBI SB	5	11	49	2	22	26	11	126	23	66	5	85	24	209153	3	3	38	0	125	24	96	74	16	-2	215825
MIL SB	5	5	60	2	22	32	1	126	23	66	5	85	24	209318	3	3	38	0	125	24	100	72	18	-3	215868
TEX SB	3	57	14	2	23	40	44	126	23	66	5	85	24	211346	3	3	37	58	125	24	88	57	33	1	216246
GYM SB	3	5	5	3	0	32	51	126	23	66	5	85	24	212899	3	3	37	56	125	24	83	45	45	5	216689
GLD DS	2	55	48	3	0	42	8	126	23	65	5	-78	64	213179	3	3	37	56	125	24	88	40	-3	50	216895
				18 MAY 69 UPDATE 72.1 LOI1 80 TO LOI2 IG																					
HAW SB	1	24	44	3	4	12	11	125	24	68	8	81	22	218196	3	5	36	54	127	24	74	26	63	15	217169
GLD DS	1	24	45	3	4	12	17	125	24	93	48	2	42	216158	3	5	37	1	126	23	109	64	9	25	215600
GYM SB	1	24	42	3	4	12	18	125	24	87	53	37	2	215956	3	5	37	1	126	24	98	71	19	-3	215439
TEX SB	1	24	45	3	4	12	20	125	24	92	65	25	-1	215589	3	5	37	5	126	24	119	82	7	-4	215283
GBI SB	1	24	44	3	4	12	25	125	24	108	82	7	-2	215296	3	5	37	9	125	24	-103	79	-11	-2	215321
MIL SB	1	24	42	3	4	12	25	125	24	113	79	10	-4	215322	3	5	37	8	126	24	-117	80	-9	-5	215304

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
BDA SB	1	24	41	3	4	12	29	124	24	-148	80	-5	-8	215311	3	5	37	9	125	24	-105	66	-24	-6	215558
ANT SB	1	24	42	3	4	12	30	124	24	-47	79	-8	7	215320	3	5	37	12	125	24	-71	62	-27	9	215649
MAD DS	1	24	38	3	4	12	36	124	24	-85	32	-7	-57	216839	3	5	37	14	125	23	-74	17	-42	-67	217664
CYI SB	1	24	40	3	4	12	37	124	24	-81	40	-49	7	216449	3	5	37	17	125	23	-75	23	-66	14	217341
ASC SB	1	24	41	3	4	12	40	124	24	-58	26	-60	29	217162	3	5	37	21	125	24	-64	9	-80	25	218160
HAW SB	1	24	39	3	6	20	24	126	24	76	36	53	11	216600	3	7	45	3	127	23	80	54	36	6	215802
GLD DS	1	24	40	3	6	20	33	126	24	126	72	11	15	215346	3	7	45	13	127	23	-162	77	12	-4	215243
GYM SB	1	24	40	3	6	20	34	126	24	114	80	9	-4	215226	3	7	45	14	127	23	-113	79	-10	-4	215220
TEX SB	1	24	39	3	6	20	37	125	24	-138	85	-4	-4	215189	3	7	45	16	126	23	-96	68	-22	-2	215415
MIL SB	1	24	41	3	6	20	40	125	24	-100	71	-19	-3	215363	3	7	45	21	126	23	-88	53	-37	1	215857
GBI SB	1	24	41	3	6	20	40	125	24	-93	69	-21	-1	215404	3	7	45	21	126	23	-85	51	-39	3	215942
BDA SB	1	24	39	3	6	20	43	125	24	-96	56	-34	-3	215742	3	7	45	22	126	23	-85	39	-51	4	216425
ANT SB	1	24	39	3	6	20	44	125	24	-73	52	-37	10	215891	3	7	45	23	126	23	-73	33	-55	14	216695
MAD DS	0	25	8	3	6	20	44	125	23	-67	9	-67	-66	218038	3	6	45	53	125	23	-64	5	-79	-63	217081
CYI SB	0	43	48	3	6	20	48	125	23	-70	14	-76	19	217779	3	7	4	36	125	23	-66	5	-85	23	216782
18 MAY 69 UPDATE 72.1 LOI2 BO TO LM SEPARATION																									
HAW SB	1	13	42	3	8	27	52	127	23	82	64	26	4	215467	3	9	41	35	128	23	82	80	10	1	215012
GUM SB	1	11	47	3	8	29	37	128	23	68	11	78	21	217813	3	9	41	23	129	23	71	26	62	17	216855
GLD DS	1	11	44	3	8	29	58	126	23	-127	72	11	-15	215193	3	9	41	42	127	23	-105	59	9	-30	215459
GYM SB	1	11	45	3	8	29	60	126	23	-98	70	-20	-3	215234	3	9	41	45	127	23	-89	54	-36	1	215606
TEX SB	1	11	42	3	8	30	4	126	23	-90	58	-32	0	215544	3	9	41	46	127	23	-83	42	-47	5	216077

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	1	11	39	3	8	30	9	126	23	-81	40	-49	7	216211	3	9	41	48	127	23	-76	25	-64	13	216920
BDA SB	1	11	38	3	8	30	10	126	23	-80	30	-60	9	216740	3	9	41	48	127	23	-73	15	-74	17	217475
MIL SB	1	11	36	3	8	30	11	126	23	-84	43	-47	5	216102	3	9	41	47	127	23	-78	28	-61	11	216782
ANT SB	1	11	37	3	8	30	14	126	23	-71	23	-66	17	217082	3	9	41	52	127	23	-68	8	-82	21	217928
CNB DS	0	8	2	3	9	33	27	128	24	56	5	-81	56	217659	3	9	41	29	128	24	55	6	-79	54	217990
GUM SB	1	11	28	3	10	28	6	128	23	71	37	51	15	216282	3	11	39	33	129	23	69	53	35	12	215553
CNB DS	1	11	30	3	10	28	13	128	24	47	14	-70	45	217521	3	11	39	42	129	24	33	23	-63	30	216943
HAW SB	1	11	31	3	10	28	20	128	23	-53	88	-1	1	214927	3	11	39	51	128	23	-84	73	-17	2	215027
GLD DS	1	11	31	3	10	28	27	127	23	-95	49	5	-41	215745	3	11	39	58	128	23	-86	35	-6	-55	216322
BDA SB	0	5	43	3	10	28	29	127	23	-67	6	-83	23	217972	3	10	34	12	127	23	-66	5	-85	24	217735
GYM SB	1	11	30	3	10	28	29	127	23	-84	44	-46	4	215962	3	11	39	59	128	23	-78	29	-61	10	216640
TEX SB	1	11	28	3	10	28	31	127	23	-79	32	-58	9	216516	3	11	39	60	128	23	-73	17	-72	16	217275
GBI SB	0	51	34	3	10	28	33	127	23	-72	15	-74	18	217434	3	11	20	6	128	23	-67	5	-85	23	217033
MIL SB	1	5	28	3	10	28	33	127	23	-73	18	-71	16	217281	3	11	34	2	128	22	-67	5	-85	23	217697
CAR SB	0	12	26	3	11	27	6	130	23	61	5	84	29	217338	3	11	39	32	130	23	60	7	81	30	217828
CAR SB	1	11	45	3	12	26	8	129	23	54	16	70	35	217291	3	13	37	53	130	23	42	28	52	41	216567
GUM SB	1	11	48	3	12	26	12	129	23	65	64	24	11	215203	3	13	37	59	130	23	41	77	8	10	214857
CNB DS	1	11	43	3	12	26	20	129	24	22	27	-61	20	216670	3	13	38	3	130	23	5	31	-59	4	216423
HAW SB	1	11	40	3	12	26	29	128	23	-83	62	-28	3	215235	3	13	38	9	129	22	-80	46	-43	7	215732
GLD DS	1	11	32	3	12	26	37	128	22	-80	26	-20	-62	216760	3	13	38	8	129	22	-71	12	-56	-68	217479

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GYM SB	1	9	33	3	12	26	38	128	23	-74	19	-70	15	217137	3	13	36	11	129	22	-68	5	-85	22	217806
TEX SB	0	12	19	3	12	26	40	128	22	-69	7	-82	21	217795	3	12	38	59	128	22	-67	5	-85	23	217295
CAR SB	1	11	31	3	14	24	39	130	23	32	35	37	44	216201	3	15	36	10	131	23	14	41	15	47	215840
GUM SB	1	11	34	3	14	24	44	130	23	-17	80	-3	9	214784	3	15	36	19	130	22	-62	69	-19	10	214914
CNB DS	1	11	32	3	14	24	49	130	23	-8	31	-59	-7	216389	3	15	36	21	130	23	-25	27	-61	-22	216536
HAW SB	1	11	32	3	14	24	53	129	22	-77	35	-54	10	216165	3	15	36	25	130	22	-74	20	-69	15	216931
CAR SB	1	11	38	3	16	22	53	131	23	-1	42	-1	48	215743	3	17	34	31	132	23	-22	39	-24	46	215810
GUM SB	1	11	33	3	16	23	2	130	22	-69	58	-30	11	215140	3	17	34	35	131	22	-72	42	-46	13	215687
CNB DS	1	11	33	3	16	23	3	130	23	-36	22	-63	-33	216746	3	17	34	36	131	23	-50	13	-71	-48	217223
HAW SB	0	21	50	3	16	23	7	130	22	-70	10	-80	20	217468	3	16	44	57	130	22	-68	5	-85	21	216667
MAD DS	0	4	13	3	17	29	55	133	21	66	5	-78	66	217466	3	17	34	8	133	21	67	6	-76	66	217637
MAD DS	1	11	27	3	18	20	51	132	21	74	14	-48	69	217117	3	19	32	18	133	21	84	27	-12	63	216330
CAR SB	1	11	37	3	18	21	14	131	23	-34	34	-39	43	215996	3	19	32	50	132	22	-48	25	-58	38	216463
GUM SB	1	11	34	3	18	21	17	131	22	-72	31	-57	15	216153	3	19	32	50	132	21	-71	16	-74	18	216966
CNB DS	0	0	40	3	18	21	19	131	23	-57	5	-81	-57	217619	3	18	21	60	131	23	-58	5	-81	-57	217593
CYI SB	0	50	9	3	18	42	4	133	21	68	5	85	22	216604	3	19	32	14	134	21	73	15	75	16	216993
CYI SB	1	11	37	3	20	18	56	133	21	78	25	65	11	216408	3	21	30	33	134	21	85	40	50	4	215571
MAD DS	1	11	39	3	20	18	57	133	21	92	36	2	54	215852	3	21	30	36	134	21	105	48	13	40	215202
ASC SB	1	11	37	3	20	18	57	134	22	65	14	74	24	216997	3	21	30	35	135	22	60	29	57	26	216074
CAR SB	1	1	1	3	20	19	34	132	22	-56	16	-71	33	216865	3	21	20	35	133	22	-63	5	-84	27	216939

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
ANT SB	1	11	27	3	22	17	14	135	21	70	6	83	20	217362	3	23	28	41	136	21	74	21	68	15	216379
BDA SB	1	11	26	3	22	17	15	134	21	71	9	81	19	217203	3	23	28	41	136	21	79	22	67	10	216324
CYI SB	1	11	32	3	22	17	19	134	21	90	50	40	0	215100	3	23	28	50	135	21	100	65	25	-4	214541
ASC SB	1	11	34	3	22	17	22	134	22	53	39	45	27	215557	3	23	28	55	135	21	39	52	27	29	214956
MAD DS	1	11	30	3	22	17	23	134	21	116	57	16	29	214861	3	23	28	53	135	21	143	67	19	14	214506
GBI SB	0	22	50	3	23	5	51	135	21	69	5	85	21	216275	3	23	28	41	136	21	72	10	80	18	217066
MIL SB	0	15	38	3	23	13	3	135	21	69	5	85	21	216555	3	23	28	41	136	21	71	8	81	19	217153
MIL SB	1	11	35	4	0	15	20	135	21	76	18	71	13	216554	4	1	26	55	137	20	83	33	57	6	215669
GBI SB	1	11	36	4	0	15	20	136	21	76	20	70	13	216459	4	1	26	56	137	20	83	35	55	6	215573
ANT SB	1	11	35	4	0	15	22	135	21	76	32	57	12	215777	4	1	26	57	136	21	78	48	41	8	214961
BDA SB	1	11	35	4	0	15	23	135	21	85	32	57	4	215777	4	1	26	58	136	20	94	47	43	-3	215027
CYI SB	1	11	34	4	0	15	35	135	21	115	75	13	-6	214299	4	1	27	9	136	21	-160	82	-3	-7	214138
MAD DS	1	11	33	4	0	15	37	135	21	173	70	20	2	214388	4	1	27	10	136	20	-144	66	20	-13	214391
ASC SB	1	11	32	4	0	15	40	135	21	23	58	14	29	214697	4	1	27	12	136	21	-8	61	-4	29	214542
TEX SB	1	5	25	4	0	21	27	136	21	69	5	85	21	217001	4	1	26	52	137	20	76	18	72	13	216460
GYM SB	0	7	59	4	1	18	54	137	20	70	5	85	20	216808	4	1	26	53	137	20	71	7	83	19	217119
GLD DS	0	21	39	4	2	13	36	136	20	75	13	-48	70	216695	4	2	35	16	137	20	77	18	-35	69	215385
GYM SB	0	21	39	4	2	13	36	136	20	75	17	73	14	216511	4	2	35	16	137	20	78	21	68	12	215184
TEX SB	0	21	37	4	2	13	39	136	20	81	28	61	8	215871	4	2	35	16	137	20	83	33	57	6	214565
MIL SB	0	21	34	4	2	13	41	136	20	88	43	47	2	215151	4	2	35	16	136	20	90	48	42	0	213890

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	0	21	33	4	2	13	42	136	20	87	45	45	2	215059	4	2	35	16	136	20	89	50	40	0	213803
BDA SB	0	21	31	4	2	13	44	136	20	102	57	33	-7	214627	4	2	35	16	136	20	107	61	28	-8	213429
ANT SB	0	21	31	4	2	13	44	136	21	78	59	30	6	214539	4	2	35	16	136	21	78	64	25	5	213335
CYI SB	0	21	20	4	2	13	56	135	21	-115	75	-14	-6	214180	4	2	35	16	136	20	-107	70	-19	-6	213198
MAD DS	0	21	20	4	2	13	56	135	20	-124	60	18	-25	214519	4	2	35	16	135	20	-117	56	17	-29	213568
ASC SB	0	21	17	4	2	13	58	135	21	-28	57	-17	29	214605	4	2	35	16	136	21	-36	54	-23	28	213638
18 MAY 69 UPDATE 72.1 LM SEPARATION BO TO LM JETTISON IG																									
GYM SB	0	49	42	4	2	35	23	137	20	78	21	68	12	215179	4	3	25	4	138	20	82	31	59	6	215614
GLD DS	0	49	43	4	2	35	23	137	20	77	18	-35	69	215379	4	3	25	5	137	20	84	27	-12	63	215843
TEX SB	0	49	44	4	2	35	23	137	20	83	33	57	6	214559	4	3	25	7	137	20	88	43	47	2	215054
MIL SB	0	49	47	4	2	35	23	136	20	90	48	42	0	213884	4	3	25	10	137	20	97	58	32	-4	214496
GBI SB	0	49	49	4	2	35	23	136	20	89	50	40	0	213798	4	3	25	11	137	20	96	60	30	-3	214423
BDA SB	0	49	52	4	2	35	23	136	20	107	61	28	-8	213424	4	3	25	15	137	20	123	70	17	-11	214187
ANT SB	0	49	53	4	2	35	23	136	21	78	64	25	5	213330	4	3	25	15	137	20	75	75	14	4	214089
MAD DS	0	50	2	4	2	35	23	135	20	-117	56	17	-29	213564	4	3	25	25	136	20	-106	48	14	-40	214867
CYI SB	0	50	3	4	2	35	23	136	20	-107	70	-19	-6	213194	4	3	25	26	136	20	-98	60	-30	-4	214443
ASC SB	0	50	6	4	2	35	23	136	21	-36	54	-23	28	213635	4	3	25	28	136	21	-48	47	-35	27	214918
GLD DS	1	11	34	4	4	11	49	137	20	90	37	0	53	215326	4	5	23	22	138	20	102	50	10	39	214637
GYM SB	1	11	33	4	4	11	50	137	20	87	42	48	2	215087	4	5	23	23	138	20	96	57	33	-3	214410
TEX SB	1	11	37	4	4	11	51	137	20	93	54	36	-2	214608	4	5	23	28	138	20	107	68	21	-6	214091
GBI SB	1	11	37	4	4	11	56	137	20	105	71	19	-5	214130	4	5	23	33	138	20	160	83	2	-7	213883

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	1	11	37	4	4	11	57	137	20	108	68	21	-6	214185	4	5	23	34	138	20	151	80	5	-9	213907
BDA SB	1	11	36	4	4	11	60	137	20	155	77	6	-12	214030	4	5	23	36	138	20	-139	74	-11	-12	213991
ANT SB	1	11	39	4	4	12	0	137	20	40	86	3	3	213948	4	5	23	39	137	20	-75	76	-13	3	213959
MAD DS	1	11	39	4	4	12	9	136	20	-97	39	8	-51	215197	4	5	23	48	137	19	-86	26	-9	-64	215795
CYI SB	1	11	43	4	4	12	9	136	20	-91	49	-41	-1	214748	4	5	23	52	137	20	-84	34	-56	5	215362
ASC SB	1	11	46	4	4	12	13	136	21	-56	37	-48	26	215273	4	5	23	59	137	20	-64	23	-65	24	215974
HAW SB	0	32	38	4	4	50	36	138	20	71	5	85	19	215705	4	5	23	15	139	20	73	12	78	16	216560
HAW SB	1	11	31	4	6	9	56	138	20	77	22	67	12	215929	4	7	21	27	139	19	82	38	52	6	215026
GLD DS	1	11	33	4	6	10	4	138	20	113	59	13	28	214282	4	7	21	37	139	19	142	70	16	12	213909
GYM SB	1	11	29	4	6	10	8	138	20	106	67	22	-6	214078	4	7	21	38	139	19	144	80	6	-8	213770
TEX SB	1	11	29	4	6	10	12	138	20	128	78	10	-7	213880	4	7	21	41	139	19	-140	80	-7	-8	213773
MIL SB	1	11	29	4	6	10	17	137	20	-143	79	-7	-9	213860	4	7	21	46	138	19	-107	66	-23	-7	214006
GBI SB	1	11	29	4	6	10	18	137	20	-126	79	-9	-6	213862	4	7	21	47	138	19	-101	65	-25	-5	214049
BDA SB	1	11	26	4	6	10	21	137	20	-116	66	-22	-10	214097	4	7	21	47	138	19	-100	52	-38	-6	214449
ANT SB	1	11	29	4	6	10	23	137	20	-79	65	-25	5	214113	4	7	21	52	138	20	-80	49	-41	7	214561
MAD DS	1	7	28	4	6	10	26	137	19	-79	17	-33	-70	216218	4	7	17	54	138	19	-69	5	-76	-69	216647
CYI SB	1	11	22	4	6	10	30	137	20	-79	24	-66	10	215821	4	7	21	53	138	19	-73	9	-80	17	216597
ASC SB	0	31	43	4	6	10	33	137	20	-67	12	-77	22	216493	4	6	42	16	137	20	-69	5	-85	21	215585
HAW SB	1	11	37	4	8	8	15	139	19	85	49	41	3	214521	4	9	19	52	140	19	92	65	25	-1	213911
GLD DS	1	11	46	4	8	8	23	139	19	177	74	16	1	213803	4	9	20	9	139	19	-134	68	16	-15	213838

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GYM SB	1	11	44	4	8	8	25	138	19	-148	80	-5	-8	213721	4	9	20	9	139	19	-108	67	-22	-7	213854
TEX SB	1	11	43	4	8	8	30	138	19	-111	71	-18	-7	213857	4	9	20	12	139	19	-97	56	-34	-4	214184
GBI SB	1	11	48	4	8	8	31	138	19	-93	54	-36	-2	214314	4	9	20	19	139	19	-86	39	-51	3	214882
MIL SB	1	11	46	4	8	8	32	138	19	-97	56	-34	-4	214245	4	9	20	17	139	19	-89	41	-49	1	214776
BDA SB	1	11	45	4	8	8	33	138	19	-92	42	-48	-2	214801	4	9	20	17	139	19	-84	27	-63	5	215451
ANT SB	1	11	49	4	8	8	34	138	20	-78	38	-52	9	214982	4	9	20	24	139	19	-76	22	-68	13	215743
GUM SB	0	25	11	4	8	54	28	140	19	71	5	85	18	215559	4	9	19	40	141	19	73	11	79	17	216358
GUM SB	1	11	30	4	10	6	23	140	19	74	22	68	14	215692	4	11	17	52	141	19	76	38	52	11	214754
CNB DS	1	11	27	4	10	6	31	140	20	60	6	-78	60	216594	4	11	17	58	141	20	49	17	-64	46	215817
HAW SB	1	11	30	4	10	6	36	140	19	99	76	14	-2	213636	4	11	18	6	141	19	-150	86	-2	-3	213445
GLD DS	1	11	28	4	10	6	45	139	19	-116	60	14	-27	213973	4	11	18	13	140	19	-101	47	10	-42	214369
GYM SB	1	11	28	4	10	6	48	139	19	-98	57	-33	-4	214062	4	11	18	16	140	19	-90	42	-48	0	214570
TEX SB	1	11	26	4	10	6	51	139	19	-90	45	-45	0	214501	4	11	18	17	140	19	-84	30	-60	6	215143
MIL SB	1	11	23	4	10	6	53	139	19	-84	30	-59	5	215194	4	11	18	16	140	19	-77	16	-74	12	215936
BDA SB	1	3	20	4	10	6	53	139	19	-78	17	-72	11	215911	4	11	10	13	140	18	-71	5	-85	19	216156
GBI SB	1	11	23	4	10	6	54	139	19	-82	28	-62	7	215319	4	11	18	17	140	19	-76	13	-76	14	216086
ANT SB	0	27	2	4	10	6	58	139	19	-73	11	-79	16	216278	4	10	34	0	139	19	-72	5	-85	18	215393
CAR SB	0	4	48	4	12	4	36	141	19	66	6	84	24	216463	4	12	9	24	141	19	65	7	83	25	216153
GUM SB	0	4	48	4	12	4	36	141	19	76	49	40	9	214235	4	12	9	24	141	19	76	50	39	9	213940
CNB DS	0	4	41	4	12	4	43	141	20	40	24	-60	36	215400	4	12	9	24	141	20	39	25	-60	34	215122

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
HAW SB	0	4	34	4	12	4	50	140	19	-102	76	-13	-3	213480	4	12	9	24	140	19	-100	75	-14	-3	213255
GLD DS	0	4	30	4	12	4	54	140	19	-93	37	4	-53	214738	4	12	9	24	140	19	-92	36	3	-54	214545
GYM SB	0	4	29	4	12	4	55	140	19	-84	32	-58	5	215008	4	12	9	24	140	19	-84	31	-59	5	214822
MIL SB	0	3	2	4	12	4	56	140	18	-72	6	-84	18	216462	4	12	7	58	140	18	-72	5	-85	18	216340
TEX SB	0	4	27	4	12	4	57	140	19	-79	20	-70	11	215641	4	12	9	24	140	19	-78	19	-71	11	215461
18 MAY 69 UPDATE 72.1 LM JETTISON BD TO TEI IG																									
CAR SB	1	6	42	4	12	9	29	141	19	65	7	83	25	216147	4	13	16	11	142	19	57	19	67	31	215554
GUM SB	1	6	48	4	12	9	29	141	19	76	50	39	9	213934	4	13	16	17	142	19	74	65	24	6	213607
CNB DS	1	6	57	4	12	9	29	141	20	38	25	-60	34	215116	4	13	16	26	142	19	23	32	-56	20	214906
HAW SB	1	7	3	4	12	9	29	140	19	-100	75	-14	-3	213251	4	13	16	32	141	18	-92	61	-29	-1	213741
GLD DS	1	7	8	4	12	9	29	140	19	-92	36	3	-54	214541	4	13	16	38	141	18	-84	23	-15	-66	215389
GYM SB	1	7	10	4	12	9	29	140	19	-84	31	-59	5	214818	4	13	16	39	141	18	-78	17	-73	12	215751
TEX SB	1	7	11	4	12	9	29	140	19	-78	19	-71	11	215457	4	13	16	41	141	18	-72	5	-85	18	216429
CAR SB	1	11	33	4	14	2	54	142	19	49	28	55	35	215038	4	15	14	28	143	19	34	39	35	40	214407
GUM SB	1	11	34	4	14	2	59	142	19	66	76	13	6	213337	4	15	14	33	143	18	-36	84	-4	5	213161
CNB DS	1	11	30	4	14	3	7	142	19	10	35	-55	8	214697	4	15	14	37	142	19	-9	35	-55	-8	214587
HAW SB	1	11	29	4	14	3	14	141	18	-87	50	-40	2	214039	4	15	14	43	142	18	-83	34	-56	6	214664
GLD DS	0	44	51	4	14	3	15	141	18	-77	13	-43	-72	215845	4	14	48	6	141	18	-72	5	-74	-71	215097
GYM SB	0	6	46	4	14	3	19	141	18	-73	6	-83	17	216255	4	14	10	5	141	18	-72	5	-85	18	215977
CAR SB	1	11	43	4	16	1	12	143	19	21	44	20	42	214131	4	17	12	55	143	18	-2	47	-2	43	213917
GUM SB	1	11	47	4	16	1	16	142	18	-70	74	-15	5	213215	4	17	13	3	143	18	-78	58	-31	7	213521

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
CNB DS	1	11	46	4	16	1	20	142	19	-23	32	-56	-19	214656	4	17	13	6	143	18	-39	25	-58	-35	214939
HAW SB	1	11	43	4	16	1	24	142	18	-79	23	-67	10	215163	4	17	13	8	143	17	-74	7	-82	16	215984
CAR SB	1	11	28	4	17	59	35	143	18	-18	45	-17	42	213918	4	19	11	3	144	18	-38	38	-38	39	214142
GUM SB	1	11	25	4	17	59	41	143	18	-78	47	-43	8	213843	4	19	11	6	144	17	-78	30	-59	11	214518
CNB DS	1	11	25	4	17	59	43	143	18	-49	19	-63	-46	215218	4	19	11	8	144	18	-61	8	-74	-60	215786
MAD DS	0	40	22	4	18	30	14	145	17	72	5	-74	71	214723	4	19	10	36	145	17	78	12	-45	73	215528
CYI SB	1	11	34	4	19	57	19	145	17	76	9	81	14	215655	4	21	8	53	146	17	83	24	66	6	214692
MAD DS	1	11	33	4	19	57	23	145	17	85	21	-13	69	214982	4	21	8	56	146	17	97	33	10	56	214187
CAR SB	1	11	48	4	19	57	49	144	18	-48	30	-52	35	214434	4	21	9	37	145	17	-60	18	-69	28	215028
GUM SB	1	3	26	4	19	57	49	143	17	-76	19	-70	13	215052	4	21	1	16	144	17	-74	5	-85	16	215386
ASC SB	0	50	38	4	20	18	19	146	17	72	5	85	18	214839	4	21	8	57	146	17	69	16	73	20	215117
CYI SB	1	11	30	4	21	55	35	146	17	88	34	56	2	214104	4	23	7	5	147	16	97	49	41	-5	213316
ASC SB	1	11	29	4	21	55	38	146	17	66	27	61	21	214465	4	23	7	7	147	17	59	42	43	23	213604
MAD DS	1	11	28	4	21	55	39	146	17	106	42	17	45	213720	4	23	7	7	147	16	123	54	22	30	213141
CAR SB	0	17	51	4	21	56	12	145	17	-66	9	-81	24	215483	4	22	14	3	145	17	-68	5	-85	22	214772
BDA SB	0	10	11	4	22	56	48	147	16	74	5	85	16	215086	4	23	6	59	147	16	75	7	83	15	215482
ANT SB	0	2	31	4	23	4	28	147	16	74	5	85	16	215476	4	23	6	58	147	16	75	6	84	15	215566
BDA SB	1	11	41	4	23	53	42	147	16	81	17	73	8	214878	5	1	5	23	148	16	90	31	59	0	213978
ANT SB	1	11	39	4	23	53	42	147	16	77	17	73	12	214889	5	1	5	22	148	16	81	32	57	7	213898
CYI SB	1	11	46	4	23	53	48	147	16	105	60	30	-8	212916	5	1	5	35	148	16	131	73	13	-11	212484

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
ASC SB	1	11	52	4	23	53	51	147	17	49	52	31	24	213172	5	1	5	43	148	17	26	63	13	24	212716
MAD DS	1	11	44	4	23	53	52	147	16	140	61	23	18	212877	5	1	5	36	147	16	176	65	25	2	212644
GBI SB	1	6	57	4	23	58	23	147	16	74	5	85	16	215321	5	1	5	20	148	16	81	19	71	8	214643
MIL SB	0	59	9	5	0	6	11	147	16	74	5	85	16	214904	5	1	5	20	148	16	81	17	73	9	214749
GBI SB	1	11	27	5	1	52	1	148	16	86	29	61	4	214018	5	3	3	27	149	16	94	44	46	-3	213170
TEX SB	1	11	24	5	1	52	1	148	16	78	12	77	11	214955	5	3	3	24	149	15	86	27	63	4	213997
MIL SB	1	11	24	5	1	52	1	148	16	86	27	63	4	214125	5	3	3	25	149	15	94	42	48	-3	213270
BDA SB	1	11	26	5	1	52	2	148	16	97	41	49	-5	213441	5	3	3	29	149	15	110	55	34	-12	212765
ANT SB	1	11	28	5	1	52	3	148	16	84	44	46	4	213316	5	3	3	31	149	16	88	60	30	1	212599
CYI SB	1	11	27	5	1	52	14	147	16	173	78	1	-12	212332	5	3	3	41	148	16	-127	71	-15	-11	212335
MAD DS	1	11	26	5	1	52	16	147	16	-157	64	24	-10	212605	5	3	3	43	148	15	-129	56	23	-26	212747
ASC SB	1	11	26	5	1	52	21	147	17	0	65	0	25	212559	5	3	3	46	148	16	-35	61	-18	24	212591
GYM SB	0	51	29	5	2	11	51	148	16	75	5	85	15	214380	5	3	3	21	149	15	80	15	75	9	214649
GLD DS	0	34	44	5	2	28	38	149	15	75	5	-72	74	214009	5	3	3	22	149	15	79	11	-43	74	214876
GLD DS	1	11	41	5	3	50	5	149	15	86	21	-11	69	214291	5	5	1	46	150	15	96	35	9	55	213438
GYM SB	1	11	44	5	3	50	6	149	15	85	26	64	4	214033	5	5	1	49	150	15	94	41	49	-3	213161
TEX SB	1	11	46	5	3	50	7	149	16	91	38	52	-1	213430	5	5	1	53	150	15	101	52	37	-7	212679
MIL SB	1	13	42	5	3	50	9	149	16	102	52	37	-7	212811	5	5	3	52	150	15	120	67	20	-12	212347
GBI SB	1	11	47	5	3	50	11	149	16	101	55	35	-6	212720	5	5	1	58	150	15	119	69	18	-10	212204
BDA SB	1	11	51	5	3	50	12	148	16	125	64	22	-15	212448	5	5	2	3	149	15	164	72	5	-17	212143

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
ANT SB	1	11	50	5	3	50	13	148	16	91	71	19	0	212274	5	5	2	3	149	15	130	87	2	-2	211983
MAD DS	1	11	46	5	3	50	24	148	15	-115	48	21	-37	212968	5	5	2	10	149	15	-101	35	15	-53	213428
CYI SB	1	11	47	5	3	50	25	148	16	-110	62	-27	-9	212494	5	5	2	11	149	15	-97	47	-43	-5	212909
ASC SB	1	11	51	5	3	50	26	148	16	-50	53	-30	23	212786	5	5	2	16	149	16	-63	39	-48	21	213268
HAW SB	1	11	24	5	5	48	23	150	15	76	6	83	14	214949	5	6	59	47	151	15	82	22	68	7	213925
GLD DS	1	11	25	5	5	48	27	150	15	104	44	14	44	212941	5	6	59	52	151	15	121	57	19	28	212334
GYM SB	1	11	23	5	5	48	30	150	15	101	51	38	-7	212665	5	6	59	53	151	15	117	65	22	-11	212097
TEX SB	1	11	25	5	5	48	32	150	15	112	63	26	-10	212288	5	6	59	58	150	15	145	75	9	-13	211908
MIL SB	1	11	24	5	5	48	37	149	15	145	74	9	-13	212034	5	7	0	1	150	15	-151	74	-8	-14	211912
GBI SB	1	11	24	5	5	48	38	149	15	150	77	7	-11	211992	5	7	0	3	150	15	-139	75	-10	-11	211909
BDA SB	1	11	25	5	5	48	41	149	15	-158	72	-7	-17	212074	5	7	0	6	150	15	-123	62	-24	-15	212193
ANT SB	1	11	24	5	5	48	44	149	15	-99	80	-10	-1	211948	5	7	0	8	150	15	-91	64	-26	0	212139
MAD DS	1	11	23	5	5	48	48	148	15	-92	26	5	-64	213799	5	7	0	12	149	14	-82	13	-31	-75	214438
CYI SB	1	11	25	5	5	48	51	148	15	-91	36	-54	-1	213285	5	7	0	15	149	15	-84	21	-69	5	213984
ASC SB	1	11	25	5	5	48	56	148	16	-68	28	-60	20	213701	5	7	0	21	149	15	-73	12	-77	17	214495
HAW SB	1	11	47	5	7	46	29	151	15	86	33	57	3	213306	5	8	58	16	152	14	93	48	42	-2	212460
GYM SB	1	11	50	5	7	46	37	150	15	141	73	11	-13	211874	5	8	58	27	151	14	-155	75	-6	-13	211725
GLD DS	1	11	46	5	7	46	38	150	15	139	64	20	16	212068	5	8	58	23	151	14	-179	69	21	0	211835
TEX SB	1	11	47	5	7	46	42	150	15	-168	77	-3	-13	211819	5	8	58	28	151	14	-122	67	-20	-12	211880
MIL SB	1	11	47	5	7	46	44	150	15	-123	67	-20	-12	211996	5	8	58	31	151	14	-105	53	-36	-9	212299

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	1	11	45	5	7	46	47	150	15	-115	66	-22	-10	212018	5	8	58	31	151	14	-101	51	-38	-7	212363
BDA SB	1	11	46	5	7	46	48	150	15	-110	53	-36	-12	212416	5	8	58	33	151	14	-98	39	-51	-6	212900
ANT SB	1	11	45	5	7	46	49	149	15	-88	52	-38	1	212427	5	8	58	34	150	14	-84	36	-54	5	213015
CYI SB	0	27	18	5	7	46	53	149	15	-79	11	-79	11	214502	5	8	14	10	150	14	-76	5	-85	14	213574
GUM SB	1	11	22	5	9	44	46	152	14	77	6	84	13	214616	5	10	56	8	153	14	80	22	68	9	213540
HAW SB	1	11	28	5	9	44	55	151	14	99	59	30	-5	212010	5	10	56	23	152	14	119	74	14	-8	211538
GLD DS	1	11	24	5	9	45	5	151	14	-150	66	21	-12	211817	5	10	56	28	152	14	-122	56	20	-28	211996
GYM SB	1	11	26	5	9	45	6	151	14	-125	68	-18	-12	211774	5	10	56	32	152	14	-106	54	-35	-9	212063
TEX SB	1	11	23	5	9	45	12	151	14	-108	57	-31	-9	212058	5	10	56	35	151	14	-97	42	-47	-5	212527
MIL SB	1	11	23	5	9	45	13	150	14	-97	43	-47	-5	212619	5	10	56	36	151	14	-89	28	-62	1	213252
BDA SB	1	11	20	5	9	45	16	150	14	-91	28	-62	-1	213303	5	10	56	36	151	14	-83	14	-76	7	214009
GBI SB	1	11	22	5	9	45	16	150	14	-94	41	-49	-3	212707	5	10	56	38	151	14	-87	25	-65	3	213375
ANT SB	1	11	21	5	9	45	19	150	14	-82	25	-65	8	213498	5	10	56	41	151	14	-78	9	-81	12	214321
CNB DS	0	27	6	5	10	29	9	152	15	68	5	-77	67	213352	5	10	56	15	153	15	64	10	-68	62	214225
GUM SB	1	11	49	5	11	42	51	153	14	82	33	56	7	212898	5	12	54	40	154	14	85	50	40	4	212024
CNB DS	1	11	47	5	11	42	58	153	15	56	18	-60	52	213693	5	12	54	45	153	14	42	29	-53	36	212971
HAW SB	1	11	52	5	11	43	1	152	14	166	82	2	-8	211390	5	12	54	53	153	14	-118	73	-15	-8	211372
GLD DS	1	11	47	5	11	43	9	151	14	-110	47	17	-40	212253	5	12	54	56	152	13	-97	33	11	-56	212763
GYM SB	1	11	47	5	11	43	12	151	14	-98	44	-46	-6	212393	5	12	54	58	152	13	-89	29	-61	0	213013
MIL SB	0	58	50	5	11	43	12	151	14	-83	17	-73	6	213750	5	12	42	1	152	13	-78	5	-85	12	213705

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	0	46	32	5	11	43	13	151	14	-82	15	-75	8	213888	5	12	29	45	152	13	-77	5	-85	12	213223
TEX SB	1	11	46	5	11	43	13	151	14	-90	32	-58	0	212950	5	12	54	59	152	13	-83	17	-73	6	213667
CAR SB	0	20	2	5	12	34	36	154	14	72	5	85	18	213379	5	12	54	38	154	14	70	9	80	20	214083
CAR SB	1	11	24	5	13	41	17	154	14	64	19	69	25	213445	5	14	52	40	155	14	53	32	51	31	212590
GUM SB	1	11	24	5	13	41	20	153	14	86	61	29	2	211565	5	14	52	44	154	13	89	78	12	0	211093
CNB DS	1	11	25	5	13	41	25	153	14	30	35	-51	24	212604	5	14	52	50	154	14	10	40	-50	8	212236
HAW SB	1	11	21	5	13	41	35	152	14	-104	63	-26	-6	211509	5	14	52	57	153	13	-95	47	-43	-3	211936
GLD DS	1	11	21	5	13	41	38	152	13	-90	24	1	-66	213173	5	14	52	59	153	13	-81	10	-42	-77	213870
GYM SB	1	2	33	5	13	41	39	152	13	-84	18	-72	6	213487	5	14	44	12	153	13	-78	5	-85	12	213703
TEX SB	0	5	60	5	13	41	41	152	13	-78	6	-84	12	214174	5	13	47	41	152	13	-78	5	-85	12	213925
CNB DS	1	13	41	5	15	37	37	154	14	-4	40	-50	-3	212239	5	16	51	18	155	13	-26	37	-50	-21	212181
CAR SB	1	11	50	5	15	39	21	154	14	42	40	38	34	212155	5	16	51	11	155	13	22	49	18	37	211650
GUM SB	1	11	49	5	15	39	25	154	13	98	90	0	0	210960	5	16	51	14	155	13	-90	74	-16	0	210968
HAW SB	1	11	46	5	15	39	34	153	13	-90	36	-54	0	212341	5	16	51	21	154	13	-84	20	-70	5	213067
				18 MAY 69 UPDATE 72.1 TEI BO TO ENTRY																						
CAR SB	5	26	14	5	17	29	19	155	13	7	51	6	38	211764	5	22	55	33	154	13	-73	5	-85	17	198194
GUM SB	4	0	55	5	17	29	21	154	13	-88	64	-26	1	211370	5	21	30	16	154	13	-78	5	-85	12	202185
CNB DS	2	48	36	5	17	29	22	154	14	-37	33	-51	-30	212576	5	20	17	58	154	13	-70	5	-76	-69	205544
HAW SB	0	26	40	5	17	29	23	154	13	-81	11	-79	9	213771	5	17	56	3	154	13	-78	5	-85	12	212648
MAD DS	12	25	27	5	19	25	41	155	12	78	5	-67	77	208078	6	7	51	8	155	12	-79	5	-66	-78	172962
CYI SB	12	0	38	5	20	24	36	155	12	79	5	85	11	205254	6	8	25	14	155	12	-79	5	-85	11	171307

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
ASC SB	10	57	41	5	20	51	35	156	13	76	5	85	14	203970	6	7	49	16	155	13	-77	5	-85	13	173050
BDA SB	12	8	26	5	23	37	23	156	12	79	5	85	11	196246	6	11	45	49	155	12	-80	5	-85	10	161413
ANT SB	11	42	6	5	23	39	18	156	12	78	5	85	12	196163	6	11	21	25	155	12	-79	5	-85	11	162631
GBI SB	11	58	7	6	0	37	18	156	12	79	5	85	11	193459	6	12	35	25	155	12	-80	5	-85	10	158921
MIL SB	12	1	45	6	0	45	6	156	12	79	5	85	11	193127	6	12	46	51	155	12	-80	5	-85	10	158344
TEX SB	11	59	43	6	1	53	23	156	12	79	5	85	11	189916	6	13	53	6	155	11	-80	5	-85	10	154978
GYM SB	11	59	48	6	2	47	8	156	12	79	5	85	11	187371	6	14	46	56	156	11	-80	5	-85	10	152217
GLD DS	12	13	29	6	3	4	23	156	12	79	5	-66	78	186623	6	15	17	52	156	11	-80	5	-64	-79	150618
HAW SB	11	50	7	6	6	8	50	157	12	79	5	85	11	177885	6	17	58	57	156	11	-80	5	-85	10	142148
GUM SB	11	35	49	6	10	0	28	157	12	79	5	85	11	166644	6	21	36	17	157	11	-80	5	-85	10	130291
CNB DS	9	51	17	6	10	37	9	157	13	70	5	-76	70	164827	6	20	28	26	157	12	-71	5	-75	-70	134047
CAR SB	10	24	17	6	12	42	46	157	13	74	5	85	16	158546	6	23	7	2	157	12	-74	5	-85	15	125171
MAD DS	12	14	7	6	19	41	29	159	11	80	5	-63	79	136621	7	7	55	37	160	8	-83	5	-54	-82	92809
CYI SB	11	55	35	6	20	38	48	159	11	80	5	85	10	133480	7	8	34	23	160	9	-83	5	-85	7	90215
ASC SB	11	4	14	6	21	1	41	159	12	77	5	85	12	132213	7	8	5	55	159	10	-79	5	-85	11	92121
ANT SB	11	41	38	6	23	54	52	160	11	80	5	85	10	122434	7	11	36	29	161	8	-83	5	-85	7	77484
BDA SB	12	0	24	6	23	55	31	160	10	81	5	85	9	122396	7	11	55	55	161	7	-84	5	-85	6	76065
GBI SB	11	53	19	7	0	55	22	160	10	81	5	85	9	118921	7	12	48	42	162	7	-84	5	-85	6	72141
MIL SB	11	55	27	7	1	4	5	160	10	81	5	85	9	118410	7	12	59	32	162	7	-85	5	-85	5	71322
TEX SB	11	54	23	7	2	13	8	161	10	81	5	85	9	114325	7	14	7	31	163	7	-85	5	-85	5	66074

VEHICLE 1 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GYM SB	11	54	39	7	3	7	47	161	10	82	5	85	8	111039	7	15	2	26	163	6	-86	5	-85	4	61679
GLD DS	12	2	0	7	3	27	56	161	10	82	5	-58	80	109814	7	15	29	56	164	5	-87	5	-31	-84	59421
HAW SB	11	51	26	7	6	33	45	163	9	82	5	85	8	98167	7	18	25	11	167	3	-88	5	-85	2	43866
GUM SB	12	22	50	7	10	30	57	165	9	82	5	85	8	82178	7	22	53	47	-177	-13	-105	5	-85	-15	11861
CNB DS	12	51	39	7	10	56	42	165	11	73	5	-73	73	80348	7	23	48	21	-18	28	50	5	-82	50	912
CAR SB	10	34	44	7	13	10	4	167	10	77	5	85	13	70519	7	23	44	48	-23	-13	102	5	85	-12	1758
CAR CB	2	28	14	7	21	16	34	176	4	-52	47	-36	25	23400	7	23	44	48	-23	-13	102	5	85	-12	1758
TAN TM	2	13	32	7	21	17	51	-175	3	66	43	44	17	23400	7	23	31	23	-94	-14	103	5	85	-13	4818
PRE CB	1	57	46	7	21	25	5	-173	4	73	24	65	15	23400	7	23	22	51	-117	-7	96	5	85	-6	6588

TABLE 2.0-VIII. - MISSION RADAR TIMELINE - Continued

(e) LM acquisition and termination - 0° minimum elevation

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	0	9	60	4	2	35	23	136	20	90	48	42	0	213884	4	2	45	23	137	20	92	50	40	-1	213547
GBI SB	0	9	60	4	2	35	23	136	20	89	50	40	0	213798	4	2	45	23	137	20	90	52	38	0	213462
BDA SB	0	9	60	4	2	35	23	136	20	107	61	28	-8	213424	4	2	45	23	136	20	109	63	26	-9	213114
ANT SB	0	9	60	4	2	35	23	136	21	78	64	25	5	213330	4	2	45	23	136	21	77	67	23	5	213018
CYI SB	0	9	60	4	2	35	23	136	20	-107	70	-19	-6	213194	4	2	45	23	136	20	-105	68	-21	-5	212978
ASC SB	0	9	60	4	2	35	23	136	21	-36	54	-23	28	213634	4	2	45	23	136	21	-38	53	-25	28	213424
GYM SB	0	9	60	4	2	35	23	137	20	78	21	68	12	215178	4	2	45	23	137	20	79	23	67	11	214811
TEX SB	0	9	60	4	2	35	23	137	20	83	33	57	6	214559	4	2	45	23	137	20	84	35	55	5	214201
MAD DS	0	9	60	4	2	35	23	135	20	-117	56	17	-29	213564	4	2	45	23	136	20	-115	58	17	-32	213361
GLD DS	0	9	60	4	2	35	23	137	20	77	18	-35	69	215379	4	2	45	23	137	20	79	19	-29	68	215018
RENDEZVOUS RADAR TRACKING PRIOR TO DOI *																									
MIL SB	0	38	29	4	2	45	23	137	20	92	50	40	-1	213547	4	3	23	51	137	20	97	58	32	-4	214440
GBI SB	0	38	29	4	2	45	23	137	20	90	52	38	0	213462	4	3	23	51	137	20	96	60	30	-3	214366
BDA SB	0	38	29	4	2	45	23	136	20	109	63	26	-9	213114	4	3	23	51	137	20	122	70	17	-11	214123
ANT SB	0	38	29	4	2	45	23	136	21	77	67	23	5	213018	4	3	23	51	137	20	75	75	14	4	214025
CYI SB	0	38	29	4	2	45	23	136	20	-105	68	-21	-5	212978	4	3	23	51	136	20	-98	60	-29	-4	214356
ASC SB	0	38	29	4	2	45	23	136	21	-38	53	-25	28	213424	4	3	23	51	136	21	-48	47	-35	27	214827
GYM SB	0	38	29	4	2	45	23	137	20	79	23	67	11	214811	4	3	23	51	137	20	82	31	69	7	215567
TEX SB	0	38	29	4	2	45	23	137	20	84	35	55	5	214201	4	3	23	51	137	20	87	43	47	2	215004
MAD DS	0	38	29	4	2	45	23	136	20	-115	56	17	-32	213361	4	3	23	51	136	20	-106	48	14	-40	214779
GLD DS	0	38	29	4	2	45	23	137	20	79	19	-29	68	215018	4	3	23	51	137	20	84	27	-13	63	215794
COAST TO DOI BURN *																									

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GLD DS	0	1	14	4	3	23	51	137	20	84	27	-13	63	215794	4	3	25	5	137	20	84	27	-12	63	215841
GYM SB	0	1	14	4	3	23	51	137	20	82	31	59	7	215567	4	3	25	5	138	20	82	31	59	6	215613
TEX SB	0	1	16	4	3	23	51	137	20	87	43	47	2	215004	4	3	25	6	137	20	88	43	47	2	215052
MIL SB	0	1	20	4	3	23	51	137	20	97	58	32	-4	214440	4	3	25	11	137	20	97	58	32	-4	214495
GBI SB	0	1	21	4	3	23	51	137	20	96	60	30	-3	214366	4	3	25	12	137	20	96	60	30	-3	214422
BDA SB	0	1	22	4	3	23	51	137	20	122	70	17	-11	214123	4	3	25	14	137	20	123	70	17	-11	214184
ANT SB	0	1	26	4	3	23	51	137	20	75	75	14	4	214025	4	3	25	17	137	20	75	75	14	4	214088
CYI SB	0	1	33	4	3	23	51	136	20	-98	60	-29	-4	214356	4	3	25	25	136	20	-98	60	-30	-4	214440
MAD DS	0	1	35	4	3	23	51	136	20	-106	98	14	-40	214779	4	3	25	26	136	20	-106	98	14	-40	214866
ASC SB	0	1	40	4	3	23	51	136	21	-48	47	-35	27	214827	4	3	25	31	136	21	-48	47	-35	27	214919

ULLAGE FOR DOI BURN

DOI BURN

RENDEZVOUS RADAR TRACKING PRIOR TO PHASING •

TEX SB	0	21	57	4	4	14	16	137	20	94	54	36	-2	214417	4	4	36	13	137	20	97	59	31	-3	213239
GLD DS	0	21	56	4	4	14	17	137	20	91	37	1	53	215127	4	4	36	13	138	20	94	41	4	49	213905
GYM SB	0	21	56	4	4	14	18	137	20	88	92	48	2	214888	4	4	36	13	138	20	90	97	43	0	213660
GBI SB	0	21	51	4	4	14	22	137	20	106	71	18	-5	213946	4	4	36	13	137	20	114	76	13	-6	212851
MIL SB	0	21	51	4	4	14	23	137	20	108	69	20	-7	213999	4	4	36	13	137	20	116	73	15	-7	212896
BDA SB	0	21	47	4	4	14	27	137	20	158	77	5	-12	213852	4	4	36	13	137	20	180	78	0	-12	212829
ANT SB	0	21	44	4	4	14	30	137	20	33	86	2	3	213769	4	4	36	13	137	20	-39	86	-3	3	212755
MAD DS	0	21	41	4	4	14	33	136	20	-96	38	8	-51	215044	4	4	36	13	136	20	-93	34	4	-55	214223
ASC SB	0	21	35	4	4	14	38	136	21	-57	37	-48	26	215121	4	4	36	13	136	21	-59	32	-54	25	214325
CYI SB	0	21	35	4	4	14	39	136	20	-91	49	-41	0	214591	4	4	36	13	136	20	-88	44	-46	1	213772

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
HAW SB	0	10	41	4	4	25	32	138	20	68	0	90	22	216582	4	4	36	13	138	20	69	2	88	21	216036
COAST TO PHASING BURN •																									
MIL SB	0	9	60	4	4	36	13	137	20	116	73	15	-7	212696	4	4	46	13	137	20	120	75	13	-8	212751
GBI SB	0	9	60	4	4	36	13	137	20	114	76	13	-6	212851	4	4	46	13	137	20	119	78	11	-6	212710
BDA SB	0	9	60	4	4	36	13	137	20	180	78	0	-12	212824	4	4	46	13	137	20	-170	77	-2	-12	212711
ANT SB	0	9	60	4	4	36	13	137	20	-39	86	-3	3	212755	4	4	46	13	137	20	-56	84	-5	3	212648
CYI SB	0	9	60	4	4	36	13	136	20	-88	44	-46	1	213772	4	4	46	13	136	20	-88	42	-48	2	213745
ASC SB	0	9	60	4	4	36	13	136	21	-59	32	-54	25	214325	4	4	46	13	136	20	-61	30	-56	25	214308
HAW SB	0	9	60	4	4	36	13	138	20	69	2	88	21	216036	4	4	46	13	138	20	70	4	86	20	215802
GYM SB	0	9	60	4	4	36	13	138	20	90	47	43	0	213668	4	4	46	13	138	20	91	49	41	-1	213471
TEX SB	0	9	60	4	4	36	13	137	20	97	59	31	-3	213239	4	4	46	13	138	20	98	61	29	-4	213063
MAD DS	0	9	60	4	4	36	13	136	20	-93	34	4	-55	214223	4	4	46	13	137	20	-91	33	2	-57	214195
GLD DS	0	9	60	4	4	36	13	138	20	94	41	4	49	213905	4	4	46	13	138	20	95	43	6	47	213708
ULLAGE FOR PHASING BURN																									
MIL SB	0	0	8	4	4	46	13	137	20	120	75	13	-8	212751	4	4	46	21	137	20	121	75	13	-8	212751
GBI SB	0	0	8	4	4	46	13	137	20	119	78	11	-6	212710	4	4	46	21	137	20	120	78	11	-6	212710
BDA SB	0	0	8	4	4	46	13	137	20	-170	77	-2	-12	212711	4	4	46	21	137	20	-170	77	-2	-12	212711
ANT SB	0	0	8	4	4	46	13	137	20	-56	84	-5	3	212648	4	4	46	21	137	20	-56	84	-5	3	212648
CYI SB	0	0	8	4	4	46	13	136	20	-88	42	-46	2	213745	4	4	46	21	136	20	-88	42	-48	2	213746
ASC SB	0	0	8	4	4	46	13	136	20	-61	30	-56	25	214308	4	4	46	21	136	20	-61	30	-56	25	214309
HAW SB	0	0	8	4	4	46	13	138	20	70	4	86	20	215802	4	4	46	21	138	20	70	4	86	20	215801
GYM SB	0	0	8	4	4	46	13	138	20	91	49	41	-1	213471	4	4	46	21	138	20	91	49	41	-1	213470

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
TEX SB	0	0	8	4	4	46	13	138	20	98	61	29	-4	213063	4	4	46	21	138	20	98	61	29	-4	213063
MAD DS	0	0	8	4	4	46	13	137	20	-91	33	2	-57	214196	4	4	46	21	137	20	-91	33	2	-57	214197
GLD DS	0	0	8	4	4	46	13	138	20	95	43	6	47	213708	4	4	46	21	138	20	95	43	6	47	213707
PHASING BURN																									
MIL SB	0	0	42	4	4	46	21	137	20	121	75	13	-8	212751	4	4	47	3	137	20	121	75	13	-8	212752
GBI SB	0	0	42	4	4	46	21	137	20	120	78	11	-6	212710	4	4	47	3	137	20	120	78	11	-6	212712
BDA SB	0	0	42	4	4	46	21	137	20	-170	77	-2	-12	212711	4	4	47	3	137	20	-170	77	-2	-12	212715
ANT SB	0	0	42	4	4	46	21	137	20	-56	84	-5	3	212648	4	4	47	3	137	20	-57	84	-5	3	212652
CYI SB	0	0	42	4	4	46	21	136	20	-88	42	-48	2	213746	4	4	47	3	137	20	-87	42	-48	2	213756
ASC SB	0	0	42	4	4	46	21	136	20	-61	30	-56	25	214309	4	4	47	3	136	20	-61	30	-56	25	214320
HAW SB	0	0	42	4	4	46	21	138	20	70	4	86	20	215801	4	4	47	3	138	20	70	4	86	20	215797
GYM SB	0	0	42	4	4	46	21	138	20	91	49	41	-1	213970	4	4	47	3	138	20	91	49	41	-1	213968
TEX SB	0	0	42	4	4	46	21	138	20	98	61	29	-4	213063	4	4	47	3	138	20	99	61	29	-4	213062
MAD DS	0	0	42	4	4	46	21	137	20	-91	33	2	-57	214197	4	4	47	3	137	20	-91	33	2	-57	214207
GLD DS	0	0	42	4	4	46	21	138	20	95	43	6	47	213707	4	4	47	3	138	20	96	43	6	46	213705
COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO INSERTION																									
MIL SB	0	7	60	4	4	47	3	137	20	121	75	13	-8	212752	4	4	55	3	138	20	125	76	11	-8	212868
GBI SB	0	7	60	4	4	47	3	137	20	120	78	11	-6	212712	4	4	55	3	138	20	125	79	9	-6	212831
BDA SB	0	7	60	4	4	47	3	137	20	-170	77	-2	-12	212715	4	4	55	3	137	20	-162	77	-4	-12	212856
ANT SB	0	7	60	4	4	47	3	137	20	-57	84	-5	3	212652	4	4	55	3	137	20	-64	82	-7	3	212798
CYI SB	0	7	60	4	4	47	3	137	20	-87	42	-48	2	213756	4	4	55	3	137	20	-87	40	-50	2	213965
ASC SB	0	7	60	4	4	47	3	136	20	-61	30	-56	25	214320	4	4	55	3	137	20	-61	29	-58	25	214537

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
HAW SB	0	7	60	4	4	47	3	138	20	70	4	85	20	215797	4	4	55	3	138	20	71	6	84	19	215837
GYM SB	0	7	60	4	4	47	3	138	20	91	49	41	-1	213468	4	4	55	3	138	20	92	51	39	-1	213541
TEX SB	0	7	60	4	4	47	3	138	20	99	61	29	-4	213062	4	4	55	3	138	20	100	63	27	-5	213152
MAD DS	0	7	60	4	4	47	3	137	20	-91	33	2	-57	214207	4	4	55	3	137	20	-90	31	0	-59	214415
GLD DS	0	7	60	4	4	47	3	138	20	96	43	6	46	213705	4	4	55	3	138	20	97	45	7	45	213777
COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO INSERTION •																									
HAW SB	0	30	10	4	4	55	3	138	20	71	6	84	19	215837	4	5	25	13	139	20	74	12	77	16	216787
GLD DS	0	30	19	4	4	55	3	138	20	97	45	7	45	213777	4	5	25	22	138	20	102	50	10	38	214874
GYM SB	0	30	20	4	4	55	3	138	20	92	51	39	-1	213541	4	5	25	23	138	20	97	57	33	-4	214648
TEX SB	0	30	25	4	4	55	3	138	20	100	63	27	-5	213152	4	5	25	28	138	20	107	69	20	-6	214332
GBI SB	0	30	30	4	4	55	3	138	20	125	79	9	-6	212831	4	5	25	33	138	20	164	83	2	-7	214132
MIL SB	0	30	31	4	4	55	3	138	20	125	76	11	-8	212868	4	5	25	34	138	20	153	80	4	-9	214155
BDA SB	0	30	34	4	4	55	3	137	20	-162	77	-4	-12	212856	4	5	25	37	138	20	-138	74	-11	-12	214247
ANT SB	0	30	38	4	4	55	3	137	20	-64	82	-7	3	212798	4	5	25	41	138	20	-76	76	-14	3	214216
MAD DS	0	30	44	4	4	55	3	137	20	-90	31	0	-59	214415	4	5	25	47	137	19	-85	25	-10	-64	216062
CYI SB	0	30	47	4	4	55	3	137	20	-87	40	-50	2	213965	4	5	25	50	137	20	-84	34	-56	5	215627
ASC SB	0	30	53	4	4	55	3	137	20	-61	29	-58	25	214537	4	5	25	56	137	20	-64	22	-66	24	216241
HAW SB	0	19	15	4	6	14	3	138	20	77	23	66	12	216003	4	6	33	19	139	20	79	27	62	10	214775
GLD DS	0	18	59	4	6	14	19	138	20	114	60	13	27	214376	4	6	33	19	138	20	120	64	14	23	213295
GYM SB	0	18	58	4	6	14	21	138	20	107	68	21	-6	214178	4	6	33	19	138	20	113	72	17	-7	213113
TEX SB	0	18	54	4	6	14	25	138	20	132	79	9	-8	213991	4	6	33	19	138	20	152	81	4	-8	212982

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	0	18	45	4	6	14	33	137	20	-123	78	-10	-6	213989	4	6	33	19	138	20	-113	75	-14	-6	213063
MIL SB	0	18	44	4	6	14	34	138	20	-138	79	-8	-8	213983	4	6	33	19	138	20	-125	76	-12	-8	213048
BDA SB	0	18	40	4	6	14	38	137	20	-114	65	-23	-10	214233	4	6	33	19	137	20	-109	61	-27	-9	213358
ANT SB	0	18	37	4	6	14	41	137	20	-79	64	-26	5	214253	4	6	33	19	137	20	-80	60	-30	5	213409
MAD DS	0	18	30	4	6	14	48	137	19	-78	16	-36	-70	216375	4	6	33	19	137	19	-75	13	-49	-71	215606
CYI SB	0	18	27	4	6	14	51	137	20	-79	23	-67	10	215985	4	6	33	19	137	20	-77	19	-71	12	215241
ASC SB	0	18	21	4	6	14	58	137	20	-68	11	-78	22	216661	4	6	33	19	137	20	-69	7	-83	21	215946
POSIGRADE BURN FOR LM DESCENT STAGING •																									
MIL SB	0	0	9	4	6	33	19	138	20	-125	76	-12	-8	213048	4	6	33	28	138	20	-125	76	-12	-8	213041
GBI SB	0	0	9	4	6	33	19	138	20	-113	75	-14	-6	213063	4	6	33	28	138	20	-113	75	-14	-6	213057
BDA SB	0	0	9	4	6	33	19	137	20	-109	61	-27	-9	213358	4	6	33	28	137	20	-109	61	-27	-9	213352
ANT SB	0	0	9	4	6	33	19	137	20	-80	60	-30	5	213404	4	6	33	28	137	20	-80	60	-30	5	213397
CYI SB	0	0	9	4	6	33	19	137	20	-77	19	-71	12	215241	4	6	33	28	137	20	-77	19	-71	12	215236
ASC SB	0	0	9	4	6	33	19	137	20	-69	7	-83	21	215946	4	6	33	28	137	20	-69	7	-83	21	215940
HAW SB	0	0	9	4	6	33	19	139	20	79	27	62	10	214775	4	6	33	28	139	20	79	28	62	10	214766
GYM SB	0	0	9	4	6	33	19	138	20	113	72	17	-7	213113	4	6	33	28	138	20	113	72	17	-7	213105
TEX SB	0	0	9	4	6	33	19	138	20	152	81	4	-8	212982	4	6	33	28	138	20	152	81	4	-8	212974
MAD DS	0	0	9	4	6	33	19	137	19	-75	13	-49	-71	215606	4	6	33	28	137	19	-75	13	-49	-71	215600
GLD DS	0	0	9	4	6	33	19	138	20	120	64	14	23	213295	4	6	33	28	138	20	120	64	14	23	213287
RETROGRADE BURN FOR LM ASCENT SEPARATION •																									
MIL SB	0	0	3	4	6	33	28	138	20	-125	76	-12	-8	213041	4	6	33	31	138	20	-125	76	-12	-8	213039
GBI SB	0	0	3	4	6	33	28	138	20	-113	75	-14	-6	213057	4	6	33	31	138	20	-113	75	-14	-6	213055

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
BDA SB	0	0	3	4	6	33	26	137	20	-109	61	+27	-9	213352	4	6	33	31	137	20	-109	61	-27	-9	213350
ANI SB	0	0	3	4	6	33	28	137	20	-80	60	+30	5	213397	4	6	33	31	137	20	-80	60	+30	5	213396
CYI SB	0	0	3	4	6	33	28	137	20	-77	19	-71	12	215236	4	6	33	31	137	20	-77	19	-71	12	215234
ASC SB	0	0	3	4	6	33	28	137	20	-69	7	-83	21	215940	4	6	33	31	137	20	-69	7	-83	21	215939
HAW SB	0	0	3	4	6	33	28	139	20	79	28	62	10	214766	4	6	33	31	139	20	79	28	62	10	214763
GYM SB	0	0	3	4	6	33	28	138	20	113	72	17	-7	213105	4	6	33	31	138	20	113	72	17	-7	213103
TEX SB	0	0	3	4	6	33	28	138	20	152	81	4	-8	212974	4	6	33	31	138	20	152	81	4	-8	212972
MAD DS	0	0	3	4	6	33	28	137	19	-75	13	-49	-71	215600	4	6	33	31	137	19	-75	13	-49	-71	215598
GLD DS	0	0	3	4	6	33	28	138	20	120	64	14	23	213287	4	6	33	31	138	20	120	64	14	23	213285
				COAST TO INSERTION •																					
MIL SB	0	9	44	4	6	33	31	138	20	-125	76	+12	-8	213039	4	6	43	14	138	20	-120	74	-14	-8	212716
GBI SB	0	9	44	4	6	33	31	138	20	-113	75	-14	-6	213056	4	6	43	14	138	20	-110	73	-16	-6	212737
BDA SB	0	9	44	4	6	33	31	137	20	-109	61	+27	-9	213350	4	6	43	14	138	20	-107	59	-29	-9	213054
ANT SB	0	9	44	4	6	33	31	137	20	-80	60	-30	5	213396	4	6	43	14	137	20	-80	58	-32	6	213112
CYI SB	0	9	44	4	6	33	31	137	20	-77	19	-71	12	215234	4	6	43	14	137	19	-76	17	-73	13	214997
ASC SB	0	9	44	4	6	33	31	137	20	-69	7	-83	21	215939	4	6	43	14	137	20	-69	5	-85	21	215712
HAW SB	0	9	44	4	6	33	31	139	20	79	28	62	10	214763	4	6	43	14	139	20	79	30	60	9	214306
GYM SB	0	9	44	4	6	33	31	138	20	113	72	17	-7	213103	4	6	43	14	138	20	117	74	15	-7	212721
TEX SB	0	9	44	4	6	33	31	138	20	152	81	4	-8	212972	4	6	43	14	138	20	166	82	2	-8	212616
MAD DS	0	9	44	4	6	33	31	137	19	-75	13	-49	-71	215598	4	6	43	14	137	19	-74	11	-55	-71	215348
GLD DS	0	9	44	4	6	33	31	138	20	120	64	14	23	213285	4	6	43	14	138	20	124	65	14	20	212896
				ULLAGE FOR INSERTION BURN																					

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	0	0	4	4	6	43	14	138	20	-120	74	14	-8	212716	4	6	43	18	138	20	-120	74	-14	-8	212715
GBI SB	0	0	4	4	6	43	14	138	20	-110	73	-16	-6	212737	4	6	43	18	138	20	-110	73	-16	-6	212736
BDA SB	0	0	4	4	6	43	14	138	20	-107	59	-29	-9	213054	4	6	43	18	138	20	-107	59	-30	-9	213053
ANT SB	0	0	4	4	6	43	14	137	20	-80	58	-32	6	213112	4	6	43	18	137	20	-80	58	-32	6	213111
CYI SB	0	0	4	4	6	43	14	137	19	-76	17	-73	13	214997	4	6	43	18	137	19	-76	17	-73	13	214996
ASC SB	0	0	4	4	6	43	14	137	20	-69	5	-85	21	215712	4	6	43	18	137	20	-69	5	-85	21	215712
HAW SB	0	0	4	4	6	43	14	139	20	79	30	60	9	214306	4	6	43	18	139	20	79	30	60	9	214304
GYM SB	0	0	4	4	6	43	14	138	20	117	74	15	-7	212721	4	6	43	18	138	20	117	74	15	-7	212720
TEX SB	0	0	4	4	6	43	14	138	20	166	82	2	-8	212616	4	6	43	18	138	20	166	82	2	-8	212615
MAD DS	0	0	4	4	6	43	14	137	19	-74	11	-55	-71	215348	4	6	43	18	137	19	-74	11	-55	-71	215347
GLD DS	0	0	4	4	6	43	14	138	20	124	65	19	20	212896	4	6	43	18	138	20	129	68	19	20	212899
INSERTION BURN																									
MIL SB	0	0	15	4	6	43	18	138	20	-120	74	-14	-8	212715	4	6	43	33	138	20	-120	74	-14	-8	212710
GBI SB	0	0	15	4	6	43	18	138	20	-110	73	-16	-6	212736	4	6	43	33	138	20	-110	73	-16	-6	212731
BDA SB	0	0	15	4	6	43	18	138	20	-107	59	-30	-9	213053	4	6	43	33	138	20	-107	59	-30	-8	213049
ANT SB	0	0	15	4	6	43	18	137	20	-80	58	-32	6	213111	4	6	43	33	137	20	-80	57	-32	6	213107
CYI SB	0	0	15	4	6	43	18	137	19	-76	17	-73	13	214996	4	6	43	33	137	19	-76	17	-73	13	214993
ASC SB	0	0	15	4	6	43	18	137	20	-69	5	-85	21	215712	4	6	43	33	137	20	-69	5	-85	21	215709
HAW SB	0	0	15	4	6	43	18	139	20	79	30	60	9	214304	4	6	43	33	139	20	79	30	60	9	214296
GYM SB	0	0	15	4	6	43	18	138	20	117	74	15	-7	212720	4	6	43	33	138	20	117	74	15	-7	212713
TEX SB	0	0	15	4	6	43	18	138	20	166	82	2	-8	212615	4	6	43	33	138	20	167	82	2	-8	212609

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MAD DS	0	0	15	4	6	43	18	137	19	-74	11	-55	-71	215347	4	6	43	33	137	19	-74	11	-55	-71	215344
GLD DS	0	0	15	4	6	43	18	138	20	124	65	14	20	212894	4	6	43	33	138	20	124	65	14	20	212887
COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO CSI •																									
MIL SB	0	18	0	4	6	43	33	138	20	-120	74	-14	-8	212710	4	7	1	33	138	20	-113	70	-18	-8	212846
GBI SB	0	18	0	4	6	43	33	138	20	-110	73	-16	-6	212731	4	7	1	33	138	20	-105	69	-20	-5	212876
BDA SB	0	18	0	4	6	43	33	138	20	-107	59	-30	-8	213049	4	7	1	33	138	19	-103	56	-33	-7	213234
ANT SB	0	18	0	4	6	43	33	137	20	-80	57	-32	6	213107	4	7	1	33	138	20	-80	54	-36	6	213313
CYI SB	0	18	0	4	6	43	33	137	19	-76	17	-73	13	214993	4	7	1	33	138	19	-75	13	-76	15	215275
ASC SB	0	18	0	4	6	43	33	137	20	+69	5	-85	21	215709	4	7	1	33	137	20	-70	1	-89	20	216011
HAW SB	0	18	0	4	6	43	33	139	20	79	30	60	9	214296	4	7	1	33	139	20	81	33	56	8	214180
GYM SB	0	18	0	4	6	43	33	138	20	117	74	15	-7	212713	4	7	1	33	139	20	126	77	11	-8	212741
TEX SB	0	18	0	4	6	43	33	138	20	167	82	2	-8	212609	4	7	1	33	138	20	-166	82	-2	-8	212685
MAD DS	0	18	0	4	6	43	33	137	19	-74	11	-55	-71	215344	4	7	1	33	138	19	-71	8	-67	-70	215600
GLD DS	0	18	0	4	6	43	33	138	20	124	65	14	20	212887	4	7	1	33	139	19	131	68	15	17	212900
RENDEZVOUS RADAR TRACKING PRIOR TO CSI •																									
ASC SB	0	4	12	4	7	1	33	137	20	-70	1	+89	20	216011	4	7	5	45	138	20	-70	0	-90	20	216206
HAW SB	0	21	60	4	7	1	33	139	20	81	33	56	8	214180	4	7	23	33	139	19	82	38	52	6	214957
MIL SB	0	22	13	4	7	1	33	138	20	-113	70	-18	-8	212846	4	7	23	46	138	19	-107	66	-23	-7	213966
GBI SB	0	22	13	4	7	1	33	138	20	-105	69	-20	-5	212876	4	7	23	46	138	19	-100	64	-25	-5	214008
BDA SB	0	22	13	4	7	1	33	138	19	-103	56	-33	-7	213234	4	7	23	46	138	19	-100	51	-38	-6	214413
ANT SB	0	22	13	4	7	1	33	138	20	-80	54	-36	6	213313	4	7	23	46	138	20	-79	49	-41	7	214522
CYI SB	0	22	13	4	7	1	33	138	19	-75	13	-76	15	215275	4	7	23	46	138	19	-73	9	-81	17	216565

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GYM SB	0	22	13	4	7	1	33	139	20	126	77	11	-8	212741	4	7	23	46	139	19	146	80	6	-8	213723
TEX SB	0	22	13	4	7	1	33	138	20	-166	82	-2	-8	212685	4	7	23	46	139	19	-138	79	-7	-8	213730
MAD DS	0	22	13	4	7	1	33	138	19	-71	8	-67	-70	215600	4	7	23	46	138	19	-68	4	-79	-68	216852
GLD DS	0	22	13	4	7	1	33	139	19	131	68	15	17	212900	4	7	23	46	139	19	143	71	16	12	213860
				COAST TO CSI																					
GLD DS	0	0	1	4	7	23	46	139	19	143	71	16	12	213860	4	7	23	47	139	19	143	71	16	12	213858
GYM SB	0	0	3	4	7	23	46	139	19	146	80	6	-8	213723	4	7	23	49	139	19	146	80	6	-8	213722
TEX SB	0	0	5	4	7	23	46	139	19	-138	79	-7	-8	213730	4	7	23	50	139	19	-138	79	-7	-8	213730
MIL SB	0	0	8	4	7	23	46	138	19	-107	66	-23	-7	213966	4	7	23	54	138	19	-107	66	-23	-7	213969
GBI SB	0	0	8	4	7	23	46	138	19	-100	64	-25	-5	214008	4	7	23	54	138	19	-100	64	-25	-5	214012
BDA SB	0	0	10	4	7	23	46	138	19	-100	51	-38	-6	214413	4	7	23	56	138	19	-100	51	-38	-6	214418
ANT SB	0	0	12	4	7	23	46	138	20	-79	49	-41	7	214522	4	7	23	58	138	20	-80	49	-41	7	214530
MAD DS	0	0	13	4	7	23	46	138	19	-68	4	-79	-68	216852	4	7	23	59	138	19	-68	4	-79	-68	216861
CYI SB	0	0	14	4	7	23	46	138	19	-73	9	-81	17	216565	4	7	23	60	138	19	-73	9	-81	17	216574
				CSI BURN																					
				COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO CDH *																					
				RENDEZVOUS RADAR TRACKING PRIOR TO CDH *																					
HAW SB	0	12	40	4	8	11	3	139	19	85	49	41	3	214441	4	8	23	42	139	19	86	52	38	2	213663
GLD DS	0	12	27	4	8	11	15	139	19	180	74	16	0	213743	4	8	23	42	139	19	-170	74	16	-3	213087
GYM SB	0	12	24	4	8	11	18	139	19	-145	80	-6	-8	213663	4	8	23	42	139	19	-133	78	-9	-8	213027
TEX SB	0	12	20	4	8	11	23	138	19	-110	70	-19	-7	213808	4	8	23	42	138	19	-107	68	-22	-6	213209
GBI SB	0	12	14	4	8	11	28	138	19	-93	53	-37	-2	214272	4	8	23	42	138	19	-91	51	-39	-1	213722
MIL SB	0	12	14	4	8	11	29	138	19	-97	55	-34	-4	214202	4	8	23	42	138	19	-95	53	-37	-3	213645
BDA SB	0	12	13	4	8	11	29	138	19	-92	41	-49	-1	214764	4	8	23	42	138	19	-90	39	-51	0	214232

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
ANT SB	0	12	9	4	8	11	33	136	20	-78	37	-52	9	214948	4	8	23	42	138	19	-78	34	-55	10	214438
				COAST TO CDH •																					
MIL SB	0	7	60	4	8	23	42	138	19	-95	53	-37	-3	213645	4	8	31	42	138	19	-94	51	-39	-3	213351
GBI SB	0	7	60	4	8	23	42	138	19	-91	51	-39	-1	213722	4	8	31	42	138	19	-91	49	-41	0	213432
BDA SB	0	7	60	4	8	23	42	138	19	-90	39	-51	0	214232	4	8	31	42	138	19	-89	37	-53	0	213952
ANT SB	0	7	60	4	8	23	42	138	19	-76	34	-55	10	214438	4	8	31	42	138	19	-77	33	-57	11	214171
HAW SB	0	7	60	4	8	23	42	139	19	86	52	38	2	213663	4	8	31	42	139	19	87	54	36	2	213245
GYM SB	0	7	60	4	8	23	42	139	19	-133	78	-9	-8	213027	4	8	31	42	139	19	-128	77	-11	-8	212688
TEX SB	0	7	60	4	8	23	42	138	19	-107	68	-22	-6	213209	4	8	31	42	138	19	-105	66	-23	-6	212892
GLD DS	0	7	60	4	8	23	42	139	19	-170	74	16	-3	213087	4	8	31	42	139	19	-164	73	16	-5	212738
GUM SB	0	1	11	4	8	30	31	140	19	70	0	90	20	216059	4	8	31	42	140	19	70	0	90	20	215999
				CDH BURN •																					
MIL SB	0	0	2	4	8	31	42	138	19	-94	51	-39	-3	213351	4	8	31	45	138	19	-94	51	-39	-3	213350
GBI SB	0	0	2	4	8	31	42	138	19	-91	49	-41	0	213432	4	8	31	45	138	19	-91	49	-41	0	213431
BDA SB	0	0	2	4	8	31	42	138	19	-89	37	-53	0	213952	4	8	31	45	138	19	-89	37	-53	0	213951
ANT SB	0	0	2	4	8	31	42	138	19	-77	33	-57	11	214171	4	8	31	45	138	19	-77	33	-57	11	214170
GUM SB	0	0	2	4	8	31	42	140	19	70	0	90	20	215999	4	8	31	45	140	19	70	0	90	20	215997
HAW SB	0	0	2	4	8	31	42	139	19	87	54	36	2	213245	4	8	31	45	139	19	87	54	36	2	213244
GYM SB	0	0	2	4	8	31	42	139	19	-126	77	-11	-6	212688	4	8	31	45	139	19	-128	77	-11	-8	212687
TEX SB	0	0	2	4	8	31	42	138	19	-105	66	-23	-6	212892	4	8	31	45	138	19	-105	66	-23	-6	212890
GLD DS	0	0	2	4	8	31	42	139	19	-164	73	16	-5	212738	4	8	31	45	139	19	-164	73	16	-5	212737
				COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO TPI •																					
MIL SB	0	3	60	4	8	31	45	138	19	-94	51	-39	-3	213350	4	8	35	45	138	19	-94	50	-40	-2	213251

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	0	3	60	4	8	31	45	138	19	-91	49	+41	0	213431	4	8	35	45	138	19	-90	48	-42	0	213334
BDA SB	0	3	60	4	8	31	45	138	19	-89	37	+53	0	213951	4	8	35	45	138	19	-89	36	-54	1	213859
ANT SB	0	3	60	4	8	31	45	138	19	-77	33	-57	11	214170	4	8	35	45	138	19	-77	32	-58	11	214084
GUM SB	0	3	60	4	8	31	45	140	19	70	0	90	20	215997	4	8	35	45	140	19	70	1	89	20	215817
HAW SB	0	3	60	4	8	31	45	139	19	87	54	36	2	213244	4	8	35	45	139	19	87	55	35	2	213084
GYM SB	0	3	60	4	8	31	45	139	19	-128	77	+11	-8	212687	4	8	35	45	139	19	-125	76	-12	-8	212566
TEX SB	0	3	60	4	8	31	45	138	19	-105	66	-23	-6	212890	4	8	35	45	139	19	-104	65	-24	-6	212780
GLD DS	0	3	60	4	8	31	45	139	19	-164	73	16	-5	212737	4	8	35	45	139	19	-161	73	16	-6	212611
RENDEZVOUS RADAR TRACKING PRIOR TO TPI •																									
MIL SB	0	18	60	4	8	35	45	138	19	-94	50	-40	-2	213251	4	8	54	45	139	19	-92	46	-44	-1	213380
GBI SB	0	18	60	4	8	35	45	138	19	-90	48	-42	0	213334	4	8	54	45	139	19	-89	44	-46	1	213472
BDA SB	0	18	60	4	8	35	45	138	19	-89	36	-54	1	213859	4	8	54	45	139	19	-87	32	-58	3	214019
ANT SB	0	18	60	4	8	35	45	138	19	-77	32	-58	11	214084	4	8	54	45	138	19	-77	28	-62	12	214271
GUM SB	0	18	60	4	8	35	45	140	19	70	1	89	20	215817	4	8	54	45	140	19	71	5	85	18	215563
HAW SB	0	18	60	4	8	35	45	139	19	87	55	35	2	213084	4	8	54	45	140	19	89	59	31	0	212927
GYM SB	0	18	60	4	8	35	45	139	19	-125	76	+12	-8	212566	4	8	54	45	139	19	-116	73	-16	-8	212596
TEX SB	0	18	60	4	8	35	45	139	19	-104	65	+24	-6	212780	4	8	54	45	139	19	-101	61	-28	-5	212858
GLD DS	0	18	60	4	8	35	45	139	19	-161	73	16	-6	212611	4	8	54	45	139	19	-148	71	16	-10	212616
COAST TO TPI •																									
MIL SB	0	14	12	4	8	54	45	139	19	-92	46	-44	-1	213380	4	9	8	57	139	19	-90	43	-47	0	214068
GBI SB	0	14	12	4	8	54	45	139	19	-89	44	-46	1	213472	4	9	8	57	139	19	-87	41	-49	2	214167
BDA SB	0	14	12	4	8	54	45	139	19	-87	32	-58	3	214019	4	9	8	57	139	19	-85	30	-60	4	214728

VEHICLE 2 RADAR TABLE

	TRACKING TIME	STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS MIN SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
ANT SB	0 14 12	4	8	54	45	138	19	-77	28	+62	12	214271	4	9	8	57	139	19	-76	24	-65	12	215001
GUM SB	0 14 12	4	8	54	45	140	19	71	5	85	18	215553	4	9	8	57	141	19	72	8	81	18	215932
HAW SB	0 14 12	4	8	54	45	140	19	89	59	31	0	212927	4	9	8	57	140	19	90	62	28	0	213398
GYM SB	0 14 12	4	8	54	45	139	19	-116	73	-16	-6	212596	4	9	8	57	139	19	-112	70	-19	-7	213211
TEX SB	0 14 12	4	8	54	45	139	19	-101	61	-28	-5	212858	4	9	8	57	139	19	-98	58	-31	-4	213510
GLD DS	0 14 12	4	8	54	45	139	19	-148	71	16	-10	212616	4	9	8	57	139	19	-140	70	16	-13	213212
		TPI BURN																					
MIL SB	0 0 16	4	9	8	57	139	19	-90	43	+47	0	214068	4	9	9	13	139	19	-90	43	-47	0	214084
GBI SB	0 0 16	4	9	8	57	139	19	-87	41	-49	2	214167	4	9	9	13	139	19	-87	41	-49	2	214183
BDA SB	0 0 16	4	9	8	57	139	19	-85	30	-60	4	214728	4	9	9	13	139	19	-85	30	-60	4	214744
ANT SB	0 0 16	4	9	8	57	139	19	-76	24	-65	12	215001	4	9	9	13	139	19	-76	24	-65	13	215018
GUM SB	0 0 16	4	9	8	57	141	19	72	8	81	18	215932	4	9	9	13	141	19	72	8	81	18	215942
HAW SB	0 0 16	4	9	8	57	140	19	90	62	28	0	213398	4	9	9	13	140	19	91	62	28	0	213410
GYM SB	0 0 16	4	9	8	57	139	19	-112	70	-19	-7	213211	4	9	9	13	139	19	-111	70	-19	-7	213226
TEX SB	0 0 16	4	9	8	57	139	19	-98	58	-31	-4	213510	4	9	9	13	139	19	-98	58	-32	-4	213525
GLD DS	0 0 16	4	9	8	57	139	19	-140	70	16	-13	213212	4	9	9	13	139	19	-140	70	16	-13	213226
		COAST TO 1ST BRAKING GATE																					
GUM SB	0 9 54	4	9	9	13	141	19	72	8	81	18	215942	4	9	19	8	141	19	73	10	79	17	216320
HAW SB	0 10 7	4	9	9	13	140	19	91	62	28	0	213410	4	9	19	20	140	19	92	64	26	-1	213869
GYM SB	0 10 19	4	9	9	13	139	19	-111	70	-19	-7	213226	4	9	19	32	139	19	-108	68	-21	-7	213802
GLD DS	0 10 19	4	9	9	13	139	19	-140	70	16	-13	213226	4	9	19	32	139	19	-135	68	16	-15	213786
TEX SB	0 10 23	4	9	9	13	139	19	-98	58	-32	-4	213525	4	9	19	36	139	19	-97	56	-34	-4	214131

VEHICLE 2 RADAR TABLE

	TRACKING TIME HRS	MIN	SEC	STATION ACQUISITION DATA DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	STATION TERMINATION DATA DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	0	10	24	4	9	9	13	139	19	-90	43	-47	0	214084	4	9	19	38	139	19	-89	41	-49	1	214718
BDA SB	0	10	28	4	9	9	13	139	19	-85	30	-60	4	214744	4	9	19	41	139	19	-84	27	-63	5	215396
GBI SB	0	10	29	4	9	9	13	139	19	-87	41	-49	2	214183	4	9	19	42	139	19	-86	39	-51	3	214827
ANT SB	0	10	32	4	9	9	13	139	19	-76	24	-65	13	215018	4	9	19	46	139	19	-76	22	-67	13	215691

COAST TO 2ND BRAKING GATE •

1ST BRAKING MANEUVER •

COAST TO 3RD BRAKING GATE •

2ND BRAKING MANEUVER

COAST TO 4TH BRAKING GATE •

3RD BRAKING MANEUVER •

COAST TO 5TH BRAKING GATE •

4TH BRAKING MANEUVER •

COAST TO DOCKING •

TABLE 2.0-VIII. - MISSION RADAR TIMELINE - Concluded

(f) LM acquisition and termination - 5° minimum elevation

VEHICLE 2 RADAR TABLE																									
	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	0	9	60	4	2	35	23	136	20	90	48	42	0	213884	4	2	45	23	137	20	92	50	40	-1	213547
GBI SB	0	9	60	4	2	35	23	136	20	89	50	40	0	213798	4	2	45	23	137	20	90	52	38	0	213462
BDA SB	0	9	60	4	2	35	23	136	20	107	61	28	-8	213424	4	2	45	23	136	20	109	63	26	-9	213114
ANT SB	0	9	60	4	2	35	23	136	21	78	64	25	5	213330	4	2	45	23	136	21	77	67	23	5	213018
CYI SB	0	9	60	4	2	35	23	136	20	-107	70	-19	-6	213194	4	2	45	23	136	20	-105	68	-21	-5	212978
ASC SB	0	9	60	4	2	35	23	136	21	-36	54	-23	28	213634	4	2	45	23	136	21	-38	53	-28	28	213424
GYM SB	0	9	60	4	2	35	23	137	20	78	21	68	12	215178	4	2	45	23	137	20	79	23	67	11	214811
TEX SB	0	9	60	4	2	35	23	137	20	83	33	57	6	214559	4	2	45	23	137	20	84	35	55	5	214201
MAD DS	0	9	60	4	2	35	23	135	20	-117	56	17	-29	213564	4	2	45	23	136	20	-115	55	17	-32	213361
GLD DS	0	9	60	4	2	35	23	137	20	77	18	-35	69	215379	4	2	45	23	137	20	79	19	-29	68	215018
RENDEZVOUS RADAR TRACKING PRIOR TO DOI •																									
MIL SB	0	38	29	4	2	45	23	137	20	92	50	40	-1	213547	4	3	23	51	137	20	97	58	32	-4	214440
GBI SB	0	38	29	4	2	45	23	137	20	90	52	38	0	213462	4	3	23	51	137	20	96	60	30	-3	214366
BDA SB	0	38	29	4	2	45	23	136	20	109	63	26	-9	213114	4	3	23	51	137	20	122	70	17	-11	214123
ANT SB	0	38	29	4	2	45	23	136	21	77	67	23	5	213018	4	3	23	51	137	20	75	75	14	4	214025
CYI SB	0	38	29	4	2	45	23	136	20	-105	68	-21	-5	212978	4	3	23	51	136	20	-98	60	-29	-4	214366
ASC SB	0	38	29	4	2	45	23	136	21	-38	53	-25	28	213424	4	3	23	51	136	21	-48	47	-38	27	214027
GYM SB	0	38	29	4	2	45	23	137	20	79	23	67	11	214811	4	3	23	51	137	20	82	31	59	7	215567
TEX SB	0	38	29	4	2	45	23	137	20	84	35	55	5	214201	4	3	23	51	137	20	87	43	47	2	215004
MAD DS	0	38	29	4	2	45	23	136	20	-115	55	17	-32	213361	4	3	23	51	136	20	-106	48	14	-40	214779
GLD DS	0	38	29	4	2	45	23	137	20	79	19	-29	68	215018	4	3	23	51	137	20	84	27	-13	63	215794
COAST TO DOI BURN •																									

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GLD DS	0	1	14	4	3	23	51	137	20	84	27	-13	63	215794	4	3	25	5	137	20	84	27	-12	63	215841
GYM SB	0	1	14	4	3	23	51	137	20	82	31	59	7	215567	4	3	25	5	138	20	82	31	59	6	215613
TEX SB	0	1	15	4	3	23	51	137	20	87	43	47	2	215004	4	3	25	6	137	20	88	43	47	2	215052
MIL SB	0	1	20	4	3	23	51	137	20	97	58	32	-4	214440	4	3	25	11	137	20	97	58	32	-4	214498
GBI SB	0	1	21	4	3	23	51	137	20	96	60	30	-3	214366	4	3	25	12	137	20	96	60	30	-3	214422
BDA SB	0	1	22	4	3	23	51	137	20	122	70	17	-11	214123	4	3	25	14	137	20	123	70	17	-11	214184
ANT SB	0	1	25	4	3	23	51	137	20	75	75	14	4	214025	4	3	25	17	137	20	75	75	14	4	214088
CYI SB	0	1	33	4	3	23	51	136	20	-98	60	-29	-4	214356	4	3	25	25	136	20	-98	60	-30	-4	214440
MAD DS	0	1	36	4	3	23	51	136	20	-106	48	14	-40	214779	4	3	25	26	136	20	-106	48	14	-40	214866
ASC SB	0	1	40	4	3	23	51	136	21	-98	47	-35	27	214827	4	3	25	31	136	21	-98	47	-35	27	214919

ULLAGE FOR DOI BURN.

DOI BURN

RENDEZVOUS RADAR TRACKING PRIOR TO PHASING .

TEX SB	0	21	57	4	4	14	16	137	20	94	54	36	-2	214417	4	4	36	13	137	20	97	59	31	-3	213239
GLD DS	0	21	56	4	4	14	17	137	20	91	37	1	53	215127	4	4	36	13	138	20	94	41	4	49	213905
GYM SB	0	21	56	4	4	14	18	137	20	88	42	48	2	214888	4	4	36	13	138	20	90	47	43	0	213668
GBI SB	0	21	51	4	4	14	22	137	20	106	71	18	-5	213946	4	4	36	13	137	20	114	76	13	-6	212851
MIL SB	0	21	51	4	4	14	23	137	20	108	69	20	-7	213999	4	4	36	13	137	20	116	73	15	-7	212896
BDA SB	0	21	47	4	4	14	27	137	20	158	77	5	-12	213852	4	4	36	13	137	20	180	78	0	-12	212824
ANT SB	0	21	44	4	4	14	30	137	20	33	86	2	3	213769	4	4	36	13	137	20	-39	86	-3	3	212785
MAD DS	0	21	41	4	4	14	33	136	20	-96	38	8	-51	215044	4	4	36	13	136	20	-93	34	4	-55	214223
ASC SB	0	21	35	4	4	14	38	136	21	-57	37	-48	26	215121	4	4	36	13	136	21	-59	32	-54	25	214325
CYI SB	0	21	35	4	4	14	39	136	20	-91	49	-41	0	214691	4	4	36	13	136	20	-88	44	-46	1	213772

COAST TO PHASING BURN .

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	0	9	60	4	4	36	13	137	20	116	73	15	-7	212896	4	4	46	13	137	20	120	75	13	-8	212751
GBI SB	0	9	60	4	4	36	13	137	20	114	76	13	-6	212851	4	4	46	13	137	20	119	78	11	-6	212710
BDA SB	0	9	60	4	4	36	13	137	20	180	78	0	-12	212824	4	4	46	13	137	20	-170	77	-2	-12	212711
ANT SB	0	9	60	4	4	36	13	137	20	-39	86	-3	3	212755	4	4	46	13	137	20	-56	84	-5	3	212648
CYI SB	0	9	60	4	4	36	13	136	20	-88	44	-46	1	213772	4	4	46	13	136	20	-88	42	-48	2	213745
ASC SB	0	9	60	4	4	36	13	136	21	-59	32	-54	25	214325	4	4	46	13	136	20	-61	30	-56	25	214308
GYM SB	0	9	60	4	4	36	13	138	20	90	47	43	0	213668	4	4	46	13	138	20	91	49	41	-1	213471
TEX SB	0	9	60	4	4	36	13	137	20	97	59	31	-3	213239	4	4	46	13	138	20	98	61	29	-4	213063
MAD DS	0	9	60	4	4	36	13	136	20	-93	34	4	-55	214223	4	4	46	13	137	20	-91	33	2	-57	214195
GLD DS	0	9	60	4	4	36	13	138	20	94	41	4	49	213905	4	4	46	13	138	20	95	43	6	47	213708
				ULLAGE FOR PHASING BURN																					
MIL SB	0	0	8	4	4	46	13	137	20	120	75	13	-8	212751	4	4	46	21	137	20	121	75	13	-8	212751
GBI SB	0	0	8	4	4	46	13	137	20	119	78	11	-6	212710	4	4	46	21	137	20	120	78	11	-6	212710
BDA SB	0	0	8	4	4	46	13	137	20	-170	77	-2	-12	212711	4	4	46	21	137	20	-170	77	-2	-12	212711
ANT SB	0	0	8	4	4	46	13	137	20	-56	84	-5	3	212648	4	4	46	21	137	20	-56	84	-5	3	212648
CYI SB	0	0	8	4	4	46	13	136	20	-88	42	-48	2	213745	4	4	46	21	136	20	-88	42	-48	2	213746
ASC SB	0	0	8	4	4	46	13	136	20	-61	30	-56	25	214308	4	4	46	21	136	20	-61	30	-56	25	214309
GYM SB	0	0	8	4	4	46	13	138	20	91	49	41	-1	213471	4	4	46	21	138	20	91	49	41	-1	213470
TEX SB	0	0	8	4	4	46	13	138	20	98	61	29	-4	213063	4	4	46	21	138	20	98	61	29	-4	213063
MAD DS	0	0	8	4	4	46	13	137	20	-91	33	2	-57	214195	4	4	46	21	137	20	-91	33	2	-57	214197
GLD DS	0	0	8	4	4	46	13	138	20	95	43	6	47	213708	4	4	46	21	138	20	95	43	6	47	213707
				PHASING BURN																					

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	0	0	42	4	4	46	21	137	20	121	75	13	-8	212751	4	4	47	3	137	20	121	75	13	-8	212752
GBI SB	0	0	42	4	4	46	21	137	20	120	78	11	-6	212710	4	4	47	3	137	20	120	78	11	-6	212712
BDA SB	0	0	42	4	4	46	21	137	20	-170	77	-2	-12	212711	4	4	47	3	137	20	-170	77	-2	-12	212715
ANT SB	0	0	42	4	4	46	21	137	20	-56	84	-5	3	212648	4	4	47	3	137	20	-57	84	-5	3	212652
CYI SB	0	0	42	4	4	46	21	136	20	-88	42	-48	2	213746	4	4	47	3	137	20	-87	42	-48	2	213756
ASC SB	0	0	42	4	4	46	21	136	20	-61	30	-56	25	214309	4	4	47	3	136	20	-61	30	-56	25	214320
GYM SB	0	0	42	4	4	46	21	138	20	91	49	41	-1	213470	4	4	47	3	138	20	91	49	41	-1	213468
TEX SB	0	0	42	4	4	46	21	138	20	98	61	29	-4	213063	4	4	47	3	138	20	99	61	29	-4	213062
MAD DS	0	0	42	4	4	46	21	137	20	-91	33	2	-57	214197	4	4	47	3	137	20	-91	33	2	-57	214207
GLD DS	0	0	42	4	4	46	21	138	20	95	43	6	47	213707	4	4	47	3	138	20	96	43	6	46	213705
COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO INSERTION •																									
MIL SB	0	7	60	4	4	47	3	137	20	121	75	13	-8	212752	4	4	55	3	138	20	125	76	11	-8	212868
GBI SB	0	7	60	4	4	47	3	137	20	120	78	11	-6	212718	4	4	55	3	138	20	125	79	9	-6	212831
BDA SB	0	7	60	4	4	47	3	137	20	-170	77	-2	-12	212715	4	4	55	3	137	20	-162	77	-3	-12	212856
ANT SB	0	7	60	4	4	47	3	137	20	-57	84	-5	3	212652	4	4	55	3	137	20	-64	82	-7	3	212798
CYI SB	0	7	60	4	4	47	3	137	20	-87	42	-48	2	213756	4	4	55	3	137	20	-87	40	-50	2	213965
ASC SB	0	7	60	4	4	47	3	136	20	-61	30	-56	25	214320	4	4	55	3	137	20	-61	29	-58	25	214537
GYM SB	0	7	60	4	4	47	3	138	20	91	49	41	-1	213468	4	4	55	3	138	20	92	51	39	-1	213841
TEX SB	0	7	60	4	4	47	3	138	20	99	61	29	-4	213062	4	4	55	3	138	20	100	63	27	-5	213152
MAD DS	0	7	60	4	4	47	3	137	20	-91	33	2	-57	214207	4	4	55	3	137	20	-90	31	0	-59	214915
GLD DS	0	7	60	4	4	47	3	138	20	96	43	6	46	213705	4	4	55	3	138	20	97	45	7	45	213777

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
HAW SB	0	4	2	4	4	51	1	138	20	71	5	85	19	215793	4	4	55	3	138	20	71	6	84	19	215837
COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO INSERTION																									
HAW SB	0	30	10	4	4	55	3	138	20	71	6	84	19	215837	4	5	25	13	139	20	74	12	77	16	216787
GLD DS	0	30	19	4	4	55	3	138	20	97	45	7	46	213777	4	5	25	22	138	20	102	50	10	38	214874
GYM SB	0	30	20	4	4	55	3	138	20	92	51	39	-1	213541	4	5	25	23	138	20	97	57	33	-4	214648
TEX SB	0	30	25	4	4	55	3	138	20	100	63	27	-5	213152	4	5	25	28	138	20	107	69	20	-6	214332
GBI SB	0	30	30	4	4	55	3	138	20	126	79	9	-6	212831	4	5	25	33	138	20	164	83	2	-7	214132
MIL SB	0	30	31	4	4	55	3	138	20	128	76	11	-8	212868	4	5	25	34	138	20	153	80	4	-9	214155
BDA SB	0	30	34	4	4	55	3	137	20	-162	77	-4	-12	212856	4	5	25	37	138	20	-138	79	-11	-12	214247
ANT SB	0	30	38	4	4	55	3	137	20	-64	82	-7	3	212798	4	5	25	41	138	20	-76	76	-14	3	214216
MAD DS	0	30	44	4	4	55	3	137	20	-90	31	0	-59	214415	4	5	25	47	137	19	-85	25	-10	-64	216062
CYI SB	0	30	47	4	4	55	3	137	20	-87	40	-50	2	213965	4	5	25	50	137	20	-84	34	-56	5	215627
ASC SB	0	30	53	4	4	55	3	137	20	-61	29	-58	25	214537	4	5	25	56	137	20	-64	22	-66	24	216241
HAW SB	0	19	15	4	6	14	3	138	20	77	23	66	12	216003	4	6	33	19	139	20	79	27	62	10	214775
GLD DS	0	18	59	4	6	14	19	138	20	114	60	13	27	214376	4	6	33	19	138	20	120	64	14	23	213295
GYM SB	0	18	58	4	6	14	21	138	20	107	68	21	-6	214178	4	6	33	19	138	20	113	72	17	-7	213113
TEX SB	0	18	54	4	6	14	25	138	20	132	79	9	-8	213991	4	6	33	19	138	20	152	81	4	-8	212982
GBI SB	0	18	45	4	6	14	33	137	20	-123	78	-10	-6	213989	4	6	33	19	138	20	-113	75	-14	-6	213063
MIL SB	0	18	44	4	6	14	34	138	20	-138	79	-8	-8	213983	4	6	33	19	138	20	-125	76	-12	-8	213048
BDA SB	0	18	40	4	6	14	38	137	20	-114	65	-23	-10	214233	4	6	33	19	137	20	-109	61	-27	-9	213358
ANT SB	0	18	37	4	6	14	41	137	20	-79	64	-26	5	214253	4	6	33	19	137	20	-80	60	-30	5	213404

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MAD DS	0	18	30	4	6	14	48	137	19	-78	16	-36	-70	216375	4	6	33	19	137	19	-75	13	-49	-71	215606
CYI SB	0	18	27	4	6	14	51	137	20	-79	23	-67	10	215985	4	6	33	19	137	20	-77	19	-71	12	215241
ASC SB	0	18	21	4	6	14	58	137	20	-68	11	-78	22	216661	4	6	33	19	137	20	-69	7	-83	21	215946
POSIGRADE BURN FOR LM DESCENT STAGING *																									
MIL SB	0	0	9	4	6	33	19	138	20	-128	76	-12	-8	213048	4	6	33	28	138	20	-125	76	-12	-8	213041
GBI SB	0	0	9	4	6	33	19	138	20	-113	75	-14	-6	213063	4	6	33	28	138	20	-113	75	-14	-6	213057
BDA SB	0	0	9	4	6	33	19	137	20	-109	61	-27	-9	213358	4	6	33	28	137	20	-109	61	-27	-9	213352
ANT SB	0	0	9	4	6	33	19	137	20	-80	60	-30	5	213404	4	6	33	28	137	20	-80	60	-30	5	213397
CYI SB	0	0	9	4	6	33	19	137	20	-77	19	-71	12	215241	4	6	33	28	137	20	-77	19	-71	12	215236
ASC SB	0	0	9	4	6	33	19	137	20	-69	7	-83	21	215946	4	6	33	28	137	20	-69	7	-83	21	215940
HAW SB	0	0	9	4	6	33	19	139	20	79	27	62	10	214775	4	6	33	28	139	20	79	28	62	10	214766
GYM SB	0	0	9	4	6	33	19	138	20	113	72	17	-7	213113	4	6	33	28	138	20	113	72	17	-7	213108
TEX SB	0	0	9	4	6	33	19	138	20	152	81	4	-8	212982	4	6	33	28	138	20	152	81	4	-8	212974
MAD DS	0	0	9	4	6	33	19	137	19	-75	13	-49	-71	215606	4	6	33	28	137	19	-75	13	-49	-71	215600
GLD DS	0	0	9	4	6	33	19	138	20	120	69	14	23	213295	4	6	33	28	138	20	120	69	14	23	213287
RETROGRADE BURN FOR LM ASCENT SEPARATION *																									
MIL SB	0	0	3	4	6	33	28	138	20	-126	76	-12	-8	213041	4	6	33	31	138	20	-125	76	-12	-8	213039
GBI SB	0	0	3	4	6	33	28	138	20	-113	75	-14	-6	213057	4	6	33	31	138	20	-113	75	-14	-6	213055
BDA SB	0	0	3	4	6	33	28	137	20	-109	61	-27	-9	213352	4	6	33	31	137	20	-109	61	-27	-9	213350
ANT SB	0	0	3	4	6	33	28	137	20	-80	60	-30	5	213397	4	6	33	31	137	20	-80	60	-30	5	213396
CYI SB	0	0	3	4	6	33	28	137	20	-77	19	-71	12	215236	4	6	33	31	137	20	-77	19	-71	12	215234
ASC SB	0	0	3	4	6	33	28	137	20	-69	7	-83	21	215940	4	6	33	31	137	20	-69	7	-83	21	215939

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
HAW SB	0	0	3	4	6	33	28	139	20	79	28	62	10	214766	4	6	33	31	139	20	79	28	62	10	214763
GYM SB	0	0	3	4	6	33	28	138	20	113	72	17	-7	213105	4	6	33	31	138	20	113	72	17	-7	213103
TEX SB	0	0	3	4	6	33	28	138	20	152	81	4	-8	212974	4	6	33	31	138	20	152	81	4	-8	212972
MAD DS	0	0	3	4	6	33	28	137	19	-75	13	-49	-71	215600	4	6	33	31	137	19	-75	13	-49	-71	215598
GLD DS	0	0	3	4	6	33	28	138	20	120	64	14	23	213287	4	6	33	31	138	20	120	64	14	23	213285
COAST TO INSERTION *																									
ASC SB	0	8	31	4	6	33	31	137	20	-69	7	-83	21	215939	4	6	42	1	137	20	-69	5	-85	21	215726
MIL SB	0	9	44	4	6	33	31	138	20	-125	76	-12	-8	213039	4	6	43	14	138	20	-120	74	-14	-8	212716
GBI SB	0	9	44	4	6	33	31	138	20	-113	75	-14	-6	213055	4	6	43	14	138	20	-110	73	-16	-6	212737
BDA SB	0	9	44	4	6	33	31	137	20	-109	61	-27	-9	213350	4	6	43	14	138	20	-107	59	-29	-9	213054
ANT SB	0	9	44	4	6	33	31	137	20	-80	60	-30	5	213396	4	6	43	14	137	20	-80	58	-32	6	213112
CYI SB	0	9	44	4	6	33	31	137	20	-77	19	-71	12	215234	4	6	43	14	137	19	-76	17	-73	13	214997
HAW SB	0	9	44	4	6	33	31	139	20	79	28	62	10	214763	4	6	43	14	139	20	79	30	60	9	214306
GYM SB	0	9	44	4	6	33	31	138	20	113	72	17	-7	213103	4	6	43	14	138	20	117	74	15	-7	212721
TEX SB	0	9	44	4	6	33	31	138	20	152	81	4	-8	212972	4	6	43	14	138	20	166	82	2	-8	212616
MAD DS	0	9	44	4	6	33	31	137	19	-75	13	-49	-71	215598	4	6	43	14	137	19	-74	11	-58	-71	215348
GLD DS	0	9	44	4	6	33	31	138	20	120	64	14	23	213285	4	6	43	14	138	20	124	65	14	20	212896
ULLAGE FOR INSERTION BURN																									
MIL SB	0	0	4	4	6	43	14	138	20	-120	74	-14	-8	212716	4	6	43	18	138	20	-120	74	-14	-8	212715
GBI SB	0	0	4	4	6	43	14	138	20	-110	73	-16	-6	212737	4	6	43	18	138	20	-110	73	-16	-6	212736
BDA SB	0	0	4	4	6	43	14	138	20	-107	59	-29	-9	213054	4	6	43	18	138	20	-107	59	-30	-9	213053
ANT SB	0	0	4	4	6	43	14	137	20	-80	58	-32	6	213112	4	6	43	18	137	20	-80	58	-32	6	213111

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
CYI SB	0	0	4	4	6	43	14	137	19	-76	17	-73	13	214997	4	6	43	18	137	19	-76	17	-73	13	214996
HAW SB	0	0	4	4	6	43	14	139	20	79	30	60	9	214306	4	6	43	18	139	20	79	30	60	9	214304
GYM SB	0	0	4	4	6	43	14	138	20	117	74	15	-7	212721	4	6	43	18	138	20	117	74	15	-7	212720
TEX SB	0	0	4	4	6	43	14	138	20	166	82	2	-8	212616	4	6	43	18	138	20	166	82	2	-8	212615
MAD DS	0	0	4	4	6	43	14	137	19	-74	11	-55	-71	215348	4	6	43	18	137	19	-74	11	-55	-71	215347
GLD DS	0	0	4	4	6	43	14	138	20	124	65	14	20	212894	4	6	43	18	138	20	124	65	14	20	212894
				INSERTION BURN																					
MIL SB	0	0	15	4	6	43	18	138	20	-120	74	-14	-8	212715	4	6	43	33	138	20	-120	74	-14	-8	212710
GBI SB	0	0	15	4	6	43	18	138	20	-110	73	-16	-6	212736	4	6	43	33	138	20	-110	73	-16	-6	212731
BDA SB	0	0	15	4	6	43	18	138	20	-107	59	-30	-9	213053	4	6	43	33	138	20	-107	59	-30	-8	213049
ANT SB	0	0	15	4	6	43	18	137	20	-80	58	-32	6	213111	4	6	43	33	137	20	-80	57	-32	6	213107
CYI SB	0	0	15	4	6	43	18	137	19	-76	17	-73	13	214996	4	6	43	33	137	19	-76	17	-73	13	214993
HAW SB	0	0	15	4	6	43	18	139	20	79	30	60	9	214304	4	6	43	33	139	20	79	30	60	9	214296
GYM SB	0	0	15	4	6	43	18	138	20	117	74	15	-7	212720	4	6	43	33	138	20	117	74	15	-7	212713
TEX SB	0	0	15	4	6	43	18	138	20	166	82	2	-8	212615	4	6	43	33	138	20	167	82	2	-8	212609
MAD DS	0	0	15	4	6	43	18	137	19	-74	11	-55	-71	215347	4	6	43	33	137	19	-74	11	-55	-71	215344
GLD DS	0	0	15	4	6	43	18	138	20	124	65	14	20	212894	4	6	43	33	138	20	124	65	14	20	212887
				COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO CSI *																					
MIL SB	0	18	0	4	6	43	33	138	20	-120	74	-14	-8	212710	4	7	1	33	138	20	-113	70	-18	-8	212846
GBI SB	0	18	0	4	6	43	33	138	20	-110	73	-16	-6	212731	4	7	1	33	138	20	-105	69	-20	-5	212876
BDA SB	0	18	0	4	6	43	33	138	20	-107	59	-30	-8	213049	4	7	1	33	138	19	-103	56	-33	-7	213234
ANT SB	0	18	0	4	6	43	33	137	20	-80	57	-32	6	213107	4	7	1	33	138	20	-80	54	-36	6	213313

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
CYI SB	0	18	0	4	6	43	33	137	19	-76	17	-73	13	214993	4	7	1	33	138	19	-75	13	-76	15	215275
HAW SB	0	18	0	4	6	43	33	139	20	79	30	60	9	214296	4	7	1	33	139	20	81	33	56	8	214180
GYM SB	0	18	0	4	6	43	33	138	20	117	74	15	-7	212713	4	7	1	33	139	20	126	77	11	-8	212741
TEX SB	0	18	0	4	6	43	33	138	20	167	82	2	-8	212609	4	7	1	33	138	20	-166	82	-2	-8	212685
MAD DS	0	18	0	4	6	43	33	137	19	-74	11	-55	-71	215344	4	7	1	33	138	19	-71	8	-67	-70	215600
GLD DS	0	18	0	4	6	43	33	138	20	124	65	14	20	212887	4	7	1	33	139	19	131	68	16	17	212900
				RENDEZVOUS RADAR TRACKING PRIOR TO CSI •																					
MAD DS	0	16	21	4	7	1	33	138	19	-71	8	-67	-70	215600	4	7	17	54	138	19	-69	5	-76	-69	216487
HAW SB	0	21	60	4	7	1	33	139	20	81	33	56	8	214180	4	7	23	33	139	19	82	38	52	6	214957
MIL SB	0	22	13	4	7	1	33	138	20	-113	70	-18	-8	212846	4	7	23	46	138	19	-107	66	-23	-7	213966
GBI SB	0	22	13	4	7	1	33	138	20	-105	69	-20	-5	212876	4	7	23	46	138	19	-100	64	-25	-5	214008
BDA SB	0	22	13	4	7	1	33	138	19	-103	56	-33	-7	213234	4	7	23	46	138	19	-100	51	-38	-6	214413
ANT SB	0	22	13	4	7	1	33	138	20	-80	54	-36	6	213313	4	7	23	46	138	20	-79	49	-41	7	214522
CYI SB	0	22	13	4	7	1	33	138	19	-75	13	-76	15	215275	4	7	23	46	138	19	-73	9	-81	17	216565
GYM SB	0	22	13	4	7	1	33	139	20	126	77	11	-8	212741	4	7	23	46	139	19	146	80	6	-8	213723
TEX SB	0	22	13	4	7	1	33	138	20	-166	82	-2	-8	212685	4	7	23	46	139	19	-138	79	-7	-8	213730
GLD DS	0	22	13	4	7	1	33	139	19	131	68	15	17	212900	4	7	23	46	139	19	143	71	16	12	213860
				COAST TO CSI																					
GLD DS	0	0	1	4	7	23	46	139	19	143	71	16	12	213860	4	7	23	47	139	19	143	71	16	12	213858
GYM SB	0	0	3	4	7	23	46	139	19	146	80	6	-8	213723	4	7	23	49	139	19	146	80	6	-8	213722
TEX SB	0	0	5	4	7	23	46	139	19	-138	79	-7	-8	213730	4	7	23	50	139	19	-138	79	-7	-8	213730
MIL SB	0	0	8	4	7	23	46	138	19	-107	66	-23	-7	213966	4	7	23	54	138	19	-107	66	-23	-7	213969

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GBI SB	0	0	8	4	7	23	46	138	19	-100	64	-25	-5	214008	4	7	23	54	138	19	-100	64	-25	-5	214012
BDA SB	0	0	10	4	7	23	46	138	19	-100	51	-38	-6	214413	4	7	23	56	138	19	-100	51	-38	-6	214418
ANT SB	0	0	12	4	7	23	46	138	20	-79	49	-41	7	214522	4	7	23	58	138	20	-80	49	-41	7	214530
CYI SB	0	0	14	4	7	23	46	138	19	-73	9	-81	17	216565	4	7	23	60	138	19	-73	9	-81	17	216574
				CSI BURN																					
				COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO CDH *																					
				RENDEZVOUS RADAR TRACKING PRIOR TO CDH *																					
HAW SB	0	12	40	4	8	11	3	139	19	85	49	41	3	214441	4	8	23	42	139	19	86	52	38	2	213663
GLD DS	0	12	27	4	8	11	15	139	19	180	74	16	0	213743	4	8	23	42	139	19	-170	74	16	-3	213087
GYM SB	0	12	24	4	8	11	18	139	19	-145	80	-6	-8	213663	4	8	23	42	139	19	-133	78	-9	-8	213027
TEX SB	0	12	20	4	8	11	23	138	19	-110	70	-19	-7	213808	4	8	23	42	138	19	-107	68	-22	-6	213209
GBI SB	0	12	14	4	8	11	28	138	19	-93	53	-37	-2	214272	4	8	23	42	138	19	-91	51	-39	-1	213722
MIL SB	0	12	14	4	8	11	29	138	19	-97	55	-34	-4	214202	4	8	23	42	138	19	-95	53	-37	-3	213645
BDA SB	0	12	13	4	8	11	29	138	19	-92	41	-49	-1	214764	4	8	23	42	138	19	-90	39	-51	0	214232
ANT SB	0	12	9	4	8	11	33	138	20	-78	37	-52	9	214948	4	8	23	42	138	19	-78	34	-55	10	214938
				COAST TO CDH *																					
MIL SB	0	7	60	4	8	23	42	138	19	-96	53	-37	-3	213645	4	8	31	42	138	19	-94	51	-39	-3	213351
GBI SB	0	7	60	4	8	23	42	138	19	-91	51	-39	-1	213722	4	8	31	42	138	19	-91	49	-41	0	213432
BDA SB	0	7	60	4	8	23	42	138	19	-90	39	-51	0	214232	4	8	31	42	138	19	-89	37	-53	0	213952
ANT SB	0	7	60	4	8	23	42	138	19	-78	34	-55	10	214438	4	8	31	42	138	19	-77	33	-57	11	214171
HAW SB	0	7	60	4	8	23	42	139	19	86	52	38	2	213663	4	8	31	42	139	19	87	54	36	2	213245
GYM SB	0	7	60	4	8	23	42	139	19	-133	78	-9	-8	213027	4	8	31	42	139	19	-128	77	-11	-8	212688
TEX SB	0	7	60	4	8	23	42	138	19	-107	68	-22	-6	213209	4	8	31	42	138	19	-105	66	-23	-6	212892
GLD DS	0	7	60	4	8	23	42	139	19	-170	74	16	-3	213087	4	8	31	42	139	19	-164	73	16	-5	212738
				CDH BURN *																					

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA											STATION TERMINATION DATA										
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
MIL SB	0	0	2	4	8	31	42	138	19	-94	51	-39	-3	213351	4	8	31	45	138	19	-94	51	-39	-3	213350
GBI SB	0	0	2	4	8	31	42	138	19	-91	49	-41	0	213432	4	8	31	45	138	19	-91	49	-41	0	213431
BDA SB	0	0	2	4	8	31	42	138	19	-89	37	-53	0	213952	4	8	31	45	138	19	-89	37	-53	0	213951
ANT SB	0	0	2	4	8	31	42	138	19	-77	33	-57	11	214171	4	8	31	45	138	19	-77	33	-57	11	214170
HAW SB	0	0	2	4	8	31	42	139	19	87	54	36	2	213245	4	8	31	45	139	19	87	54	36	2	213244
GYM SB	0	0	2	4	8	31	42	139	19	-128	77	-11	-8	212688	4	8	31	45	139	19	-128	77	-11	-8	212687
TEX SB	0	0	2	4	8	31	42	138	19	-105	66	-23	-6	212892	4	8	31	45	138	19	-105	66	-23	-6	212890
GLD DS	0	0	2	4	8	31	42	139	19	-164	73	16	-5	212738	4	8	31	45	139	19	-164	73	16	-5	212737
COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO TPI *																									
MIL SB	0	3	60	4	8	31	45	138	19	-94	51	-39	-3	213350	4	8	35	45	138	19	-94	50	-40	-2	213251
GBI SB	0	3	60	4	8	31	45	138	19	-91	49	-41	0	213431	4	8	35	45	138	19	-90	48	-42	0	213334
BDA SB	0	3	60	4	8	31	45	138	19	-89	37	-53	0	213951	4	8	35	45	138	19	-89	36	-54	1	213859
ANT SB	0	3	60	4	8	31	45	138	19	-77	33	-57	11	214170	4	8	35	45	138	19	-77	32	-58	11	214084
HAW SB	0	3	60	4	8	31	45	139	19	87	54	36	2	213244	4	8	35	45	139	19	87	55	35	2	213084
GYM SB	0	3	60	4	8	31	45	139	19	-128	77	-11	-8	212687	4	8	35	45	139	19	-125	76	-12	-8	212566
TEX SB	0	3	60	4	8	31	45	138	19	-105	66	-23	-6	212890	4	8	35	45	139	19	-104	65	-24	-6	212780
GLD DS	0	3	60	4	8	31	45	139	19	-164	73	16	-5	212737	4	8	35	45	139	19	-161	73	16	-6	212611
RENDEZVOUS RADAR TRACKING PRIOR TO TPI *																									
MIL SB	0	18	60	4	8	35	45	138	19	-94	50	-40	-2	213251	4	8	54	45	139	19	-92	46	-44	-1	213380
GBI SB	0	18	60	4	8	35	45	138	19	-90	48	-42	0	213334	4	8	54	45	139	19	-89	44	-46	1	213472
BDA SB	0	18	60	4	8	35	45	138	19	-89	36	-54	1	213859	4	8	54	45	139	19	-87	32	-58	3	214019
ANT SB	0	18	60	4	8	35	45	138	19	-77	32	-58	11	214084	4	8	54	45	138	19	-77	28	-62	12	214271

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
HAW SB	0	18	60	4	8	35	45	139	19	87	55	35	2	213084	4	8	54	45	140	19	89	59	31	0	212927
GYM SB	0	18	60	4	8	35	45	139	19	-125	76	-12	-8	212566	4	8	54	45	139	19	-116	73	-16	-8	212596
TEX SB	0	18	60	4	8	35	45	139	19	-104	65	-24	-6	212780	4	8	54	45	139	19	-101	61	-28	-5	212868
GLD DS	0	18	60	4	8	35	45	139	19	-161	73	16	-6	212611	4	8	54	45	139	19	-148	71	16	-10	212616
GUM SB	0	0	20	4	8	54	25	140	19	71	5	85	18	215549	4	8	54	45	140	19	71	5	85	18	215553
				COAST TO TPI																					
MIL SB	0	14	12	4	8	54	45	139	19	-92	46	-44	-1	213380	4	9	8	57	139	19	-90	43	-47	0	214068
GBI SB	0	14	12	4	8	54	45	139	19	-89	44	-46	1	213472	4	9	8	57	139	19	-87	41	-49	2	214167
BDA SB	0	14	12	4	8	54	45	139	19	-87	32	-58	3	214019	4	9	8	57	139	19	-85	30	-60	4	214728
ANT SB	0	14	12	4	8	54	45	138	19	-77	28	-62	12	214271	4	9	8	57	139	19	-76	24	-65	12	215001
GUM SB	0	14	12	4	8	54	45	140	19	71	5	85	18	215553	4	9	8	57	141	19	72	8	81	18	215932
HAW SB	0	14	12	4	8	54	45	140	19	89	59	31	0	212927	4	9	8	57	140	19	90	62	28	0	213398
GYM SB	0	14	12	4	8	54	45	139	19	-116	73	-16	-8	212596	4	9	8	57	139	19	-112	70	-19	-7	213211
TEX SB	0	14	12	4	8	54	45	139	19	-101	61	-28	-5	212868	4	9	8	57	139	19	-98	58	-31	-4	213510
GLD DS	0	14	12	4	8	54	45	139	19	-148	71	16	-10	212616	4	9	8	57	139	19	-140	70	16	-13	213212
				TPI BURN																					
MIL SB	0	0	16	4	9	8	57	139	19	-90	43	-47	0	214068	4	9	9	13	139	19	-90	43	-47	0	214084
GBI SB	0	0	16	4	9	8	57	139	19	-87	41	-49	2	214167	4	9	9	13	139	19	-87	41	-49	2	214183
BDA SB	0	0	16	4	9	8	57	139	19	-85	30	-60	4	214728	4	9	9	13	139	19	-85	30	-60	4	214744
ANT SB	0	0	16	4	9	8	57	139	19	-76	24	-65	12	215001	4	9	9	13	139	19	-76	24	-65	13	215018
GUM SB	0	0	16	4	9	8	57	141	19	72	8	81	18	215932	4	9	9	13	141	19	72	8	81	18	215942
HAW SB	0	0	16	4	9	8	57	140	19	90	62	28	0	213398	4	9	9	13	140	19	91	62	28	0	213410

VEHICLE 2 RADAR TABLE

	TRACKING TIME			STATION ACQUISITION DATA										STATION TERMINATION DATA									
	HRS	MIN	SEC	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE	DAY	HRS	MIN	SEC	RA	DEC	AZ	ELV	X	Y	RANGE
GYM SB	0	0	16	4	9	8	57	139	19	-112	70	-19	-7	213211	4	9	9	13	139	19	-111	70	-19	-7	213226
TEX SB	0	0	16	4	9	8	57	139	19	-98	58	-31	-4	213510	4	9	9	13	139	19	-98	58	-32	-4	213525
GLD DS	0	0	16	4	9	8	57	139	19	-140	70	16	-13	213212	4	9	9	13	139	19	-140	70	16	-13	213226
				COAST TO 1ST BRAKING GATE •																					
GUM SB	0	9	54	4	9	9	13	141	19	72	8	81	18	215942	4	9	19	8	141	19	73	10	79	17	216320
HAW SB	0	10	7	4	9	9	13	140	19	91	62	28	0	213410	4	9	19	20	140	19	92	64	26	-1	213869
GYM SB	0	10	19	4	9	9	13	139	19	-111	70	-19	-7	213226	4	9	19	32	139	19	-108	68	-21	-7	213802
GLD DS	0	10	19	4	9	9	13	139	19	-140	70	16	-13	213226	4	9	19	32	139	19	-135	68	16	-15	213786
TEX SB	0	10	23	4	9	9	13	139	19	-98	58	-32	-4	213525	4	9	19	36	139	19	-97	56	-34	-4	214131
MIL SB	0	10	24	4	9	9	13	139	19	-90	43	-47	0	214084	4	9	19	38	139	19	-89	41	-49	1	214718
BDA SB	0	10	28	4	9	9	13	139	19	-85	30	-60	4	214744	4	9	19	41	139	19	-84	27	-63	5	215396
GBI SB	0	10	29	4	9	9	13	139	19	-87	41	-49	2	214183	4	9	19	42	139	19	-86	39	-51	3	214827
ANT SB	0	10	32	4	9	9	13	139	19	-76	24	-65	13	215018	4	9	19	46	139	19	-76	22	-67	13	215691
				COAST TO 2ND BRAKING GATE •																					
				1ST BRAKING MANEUVER •																					
				COAST TO 3RD BRAKING GATE •																					
				2ND BRAKING MANEUVER																					
				COAST TO 4TH BRAKING GATE •																					
				3RD BRAKING MANEUVER •																					
				COAST TO 5TH BRAKING GATE •																					
				4TH BRAKING MANEUVER •																					
				COAST TO DOCKING •																					

TABLE 2.0-IX - MISSION SHADOW TIMELINE

(a) CSM

LIGHTING CONDITION FOR VEH 1

18 MAY 69 UPDATE 72.1 EOI TO TLI IG

VEH IN SUN LIGHT AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING EARTH PENUMBRA	0	0	31	33.4				
					0	0	0	8.0
VEH ENTERING EARTH UMBRA	0	0	31	41.4				
					0	0	37	12.9
VEH ENTERING EARTH PENUMBRA	0	1	8	54.3				
					0	0	0	8.0
VEH ENTERING SUNLIGHT	0	1	9	2.4				
					0	0	50	38.8
VEH ENTERING EARTH PENUMBRA	0	1	59	41.2				
					0	0	0	8.0
VEH ENTERING EARTH UMBRA	0	1	59	49.2				

18 MAY 69 UPDATE 72.1 TLI BO TO EVASIVE MANEUVER IG

VEH IN SUN LIGHT AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS

18 MAY 69 UPDATE 72.1 EVASIVE MANEUVER BO TO MIDCOURSE IG

VEH IN SUN LIGHT AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS

18 MAY 69 UPDATE 72.1 MIDCOURSE BO TO LOI1 IG

VEH IN SUN LIGHT AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING LUNAR PENUMBRA	3	0	37	43.6				
					0	0	10	4.0
VEH ENTERING LUNAR UMBRA	3	0	47	47.6				
					0	1	50	10.9
VEH ENTERING LUNAR PENUMBRA	3	2	37	58.5				
					0	0	4	41.7
VEH ENTERING SUNLIGHT	3	2	42	40.2				

18 MAY 69 UPDATE 72.1 LOI1 BO TO LOI2 IG

VEH IN SUN LIGHT AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING LUNAR PENUMBRA	3	4	54	49.4				
					0	0	0	14.1
VEH ENTERING LUNAR UMBRA	3	4	55	3.5				
					0	0	46	24.2
VEH ENTERING LUNAR PENUMBRA	3	5	41	27.7				
					0	0	0	12.3
VEH ENTERING SUNLIGHT	3	5	41	40.0				
					0	1	21	39.9
VEH ENTERING LUNAR PENUMBRA	3	7	3	19.9				
					0	0	0	11.4
VEH ENTERING LUNAR UMBRA	3	7	3	31.3				
					0	0	46	36.6
VEH ENTERING LUNAR PENUMBRA	3	7	49	57.9				
					0	0	0	12.3
VEH ENTERING SUNLIGHT	3	7	50	10.2				

LIGHTING CONDITION FOR VEH 1

18 MAY 69 UPDATE 72.1 LOI2 80 TO LM SEPARATION

VEH IN SUN LIGHT AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING LUNAR PENUMBRA	3	9	3	17.6				
					0	0	0	13.4
VEH ENTERING LUNAR UMBRA	3	9	3	31.0				
					0	0	46	8.3
VEH ENTERING LUNAR PENUMBRA	3	9	49	39.3				
					0	0	0	10.9
VEH ENTERING SUNLIGHT	3	9	49	50.2				
					0	1	12	.8
VEH ENTERING LUNAR PENUMBRA	3	11	1	51.0				
					0	0	0	10.9
VEH ENTERING LUNAR UMBRA	3	11	2	1.9				
					0	0	46	12.7
VEH ENTERING LUNAR PENUMBRA	3	11	48	14.6				
					0	0	0	8.3
VEH ENTERING SUNLIGHT	3	11	48	22.9				
					0	1	11	50.8
VEH ENTERING LUNAR PENUMBRA	3	13	0	13.7				
					0	0	0	16.0
VEH ENTERING LUNAR UMBRA	3	13	0	29.7				
					0	0	46	11.2
VEH ENTERING LUNAR PENUMBRA	3	13	46	40.9				
					0	0	0	10.7
VEH ENTERING SUNLIGHT	3	13	46	51.7				
					0	1	12	.9
VEH ENTERING LUNAR PENUMBRA	3	14	58	52.6				
					0	0	0	10.7
VEH ENTERING LUNAR UMBRA	3	14	59	3.2				
					0	0	46	4.9
VEH ENTERING LUNAR PENUMBRA	3	15	45	8.2				
					0	0	0	10.3
VEH ENTERING SUNLIGHT	3	15	45	18.4				
					0	1	12	.8
VEH ENTERING LUNAR PENUMBRA	3	16	57	19.2				
					0	0	0	10.6
VEH ENTERING LUNAR UMBRA	3	16	57	29.8				
					0	0	46	11.8
VEH ENTERING LUNAR PENUMBRA	3	17	43	41.6				
					0	0	0	10.4
VEH ENTERING SUNLIGHT	3	17	43	52.0				
					0	1	11	54.7
VEH ENTERING LUNAR PENUMBRA	3	18	55	46.7				
					0	0	0	13.9
VEH ENTERING LUNAR UMBRA	3	18	56	.5				
					0	0	46	8.1
VEH ENTERING LUNAR PENUMBRA	3	19	42	8.6				
					0	0	0	10.9
VEH ENTERING SUNLIGHT	3	19	42	19.5				

LIGHTING CONDITION FOR VEH 1

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
					0	1	12	.8
VEH ENTERING LUNAR PENUMBRA	3	20	54	20.3				
					0	0	0	10.9
VEH ENTERING LUNAR UMBRA	3	20	54	31.2				
					0	0	46	12.9
VEH ENTERING LUNAR PENUMBRA	3	21	40	44.1				
					0	0	0	8.3
VEH ENTERING SUNLIGHT	3	21	40	52.4				
					0	1	11	50.8
VEH ENTERING LUNAR PENUMBRA	3	22	52	43.2				
					0	0	0	15.9
VEH ENTERING LUNAR UMBRA	3	22	52	59.1				
					0	0	46	11.2
VEH ENTERING LUNAR PENUMBRA	3	23	39	10.2				
					0	0	0	10.7
VEH ENTERING SUNLIGHT	3	23	39	21.0				
					0	1	12	.9
VEH ENTERING LUNAR PENUMBRA	4	0	51	21.9				
					0	0	0	10.7
VEH ENTERING LUNAR UMBRA	4	0	51	32.5				
					0	0	46	5.0
VEH ENTERING LUNAR PENUMBRA	4	1	37	37.5				
					0	0	0	10.3
VEH ENTERING SUNLIGHT	4	1	37	47.7				

18 MAY 69 UPDATE 72.1 LM SEPARATION BO TO LM JETTISON IG

VEH IN SUN LIGHT AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING LUNAR PENUMBRA	4	2	49	50.7				
					0	0	0	10.2
VEH ENTERING LUNAR UMBRA	4	2	50	.9				
					0	0	46	4.1
VEH ENTERING LUNAR PENUMBRA	4	3	36	5.0				
					0	0	0	10.7
VEH ENTERING SUNLIGHT	4	3	36	15.7				
					0	1	12	1.8
VEH ENTERING LUNAR PENUMBRA	4	4	48	17.5				
					0	0	0	10.7
VEH ENTERING LUNAR UMBRA	4	4	48	28.3				
					0	0	46	10.2
VEH ENTERING LUNAR PENUMBRA	4	5	34	38.5				
					0	0	0	15.9
VEH ENTERING SUNLIGHT	4	5	34	54.4				
					0	1	11	51.5
VEH ENTERING LUNAR PENUMBRA	4	6	46	45.9				
					0	0	0	8.3
VEH ENTERING LUNAR UMBRA	4	6	46	54.2				
					0	0	46	12.2
VEH ENTERING LUNAR PENUMBRA	4	7	33	6.4				
					0	0	0	10.8
VEH ENTERING SUNLIGHT	4	7	33	17.3				

LIGHTING CONDITION FOR VEH 1

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
					0	1	12	1.8
VEH ENTERING LUNAR PENUMBRA	4	9	45	19.1				
					0	0	0	10.8
VEH ENTERING LUNAR UMBRA	4	8	45	29.9				
					0	0	46	7.2
VEH ENTERING LUNAR PENUMBRA	4	9	31	37.1				
					0	0	0	13.9
VEH ENTERING SUNLIGHT	4	9	31	50.9				
					0	1	11	55.5
VEH ENTERING LUNAR PENUMBRA	4	10	43	46.5				
					0	0	0	10.4
VEH ENTERING LUNAR UMBRA	4	10	43	56.9				
					0	0	46	10.9
VEH ENTERING LUNAR PENUMBRA	4	11	30	7.8				
					0	0	0	10.6
VEH ENTERING SUNLIGHT	4	11	30	18.4				

18 MAY 69 UPDATE 72.1 LM JETTISON BO TO TEI IG

VEH IN SUN LIGHT AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING LUNAR PENUMBRA	4	12	42	21.9				
					0	0	0	10.7
VEH ENTERING LUNAR UMBRA	4	12	42	32.6				
					0	0	46	4.2
VEH ENTERING LUNAR PENUMBRA	4	13	28	36.8				
					0	0	0	10.2
VEH ENTERING SUNLIGHT	4	13	28	47.0				
					0	1	12	1.6
VEH ENTERING LUNAR PENUMBRA	4	14	40	48.6				
					0	0	0	10.6
VEH ENTERING LUNAR UMBRA	4	14	40	59.1				
					0	0	46	11.0
VEH ENTERING LUNAR PENUMBRA	4	15	27	10.2				
					0	0	0	10.4
VEH ENTERING SUNLIGHT	4	15	27	20.6				
					0	1	11	55.4
VEH ENTERING LUNAR PENUMBRA	4	16	39	16.0				
					0	0	0	13.9
VEH ENTERING LUNAR UMBRA	4	16	39	29.9				
					0	0	46	7.3
VEH ENTERING LUNAR PENUMBRA	4	17	25	37.1				
					0	0	0	10.8
VEH ENTERING SUNLIGHT	4	17	25	48.0				

LIGHTING CONDITION FOR VEH 1

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
					0	1	12	1.7
VEH ENTERING LUNAR PENUMBRA	4	18	37	49.7				
					0	0	0	10.8
VEH ENTERING LUNAR UMBRA	4	18	38	.5				
					0	0	46	12.4
VEH ENTERING LUNAR PENUMBRA	4	19	24	12.8				
					0	0	0	8.3
VEH ENTERING SUNLIGHT	4	19	24	21.2				
					0	1	11	51.4
VEH ENTERING LUNAR PENUMBRA	4	20	36	12.6				
					0	0	0	15.8
VEH ENTERING LUNAR UMBRA	4	20	36	28.4				
					0	0	46	10.4
VEH ENTERING LUNAR PENUMBRA	4	21	22	38.8				
					0	0	0	10.7
VEH ENTERING SUNLIGHT	4	21	22	49.5				
					0	1	12	1.7
VEH ENTERING LUNAR PENUMBRA	4	22	34	51.2				
					0	0	0	10.7
VEH ENTERING LUNAR UMBRA	4	22	35	1.9				
					0	0	46	4.2
VEH ENTERING LUNAR PENUMBRA	4	23	21	6.1				
					0	0	0	10.2
VEH ENTERING SUNLIGHT	4	23	21	16.3				
					0	1	12	1.6
VEH ENTERING LUNAR PENUMBRA	5	0	33	17.9				
					0	0	0	10.6
VEH ENTERING LUNAR UMBRA	5	0	33	28.4				
					0	0	46	11.1
VEH ENTERING LUNAR PENUMBRA	5	1	19	39.5				
					0	0	0	10.4
VEH ENTERING SUNLIGHT	5	1	19	49.9				
					0	1	11	55.2
VEH ENTERING LUNAR PENUMBRA	5	2	31	45.1				
					0	0	0	14.1
VEH ENTERING LUNAR UMBRA	5	2	31	59.2				
					0	0	46	7.2
VEH ENTERING LUNAR PENUMBRA	5	3	18	6.4				
					0	0	0	10.8
VEH ENTERING SUNLIGHT	5	3	18	17.3				
					0	1	12	1.6
VEH ENTERING LUNAR PENUMBRA	5	4	30	18.9				
					0	0	0	10.8
VEH ENTERING LUNAR UMBRA	5	4	30	29.7				
					0	0	46	12.5
VEH ENTERING LUNAR PENUMBRA	5	5	16	42.3				
					0	0	0	8.3
VEH ENTERING SUNLIGHT	5	5	16	50.6				

LIGHTING CONDITION FOR VEH 1

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
					0	1	11	51.4
VEH ENTERING LUNAR PENUMBRA	5	6	28	42.0				
					0	0	0	15.7
VEH ENTERING LUNAR UMBRA	5	6	28	57.7				
					0	0	46	10.4
VEH ENTERING LUNAR PENUMBRA	5	7	15	8.1				
					0	0	0	10.7
VEH ENTERING SUNLIGHT	5	7	15	18.8				
					0	1	12	1.7
VEH ENTERING LUNAR PENUMBRA	5	8	27	20.5				
					0	0	0	10.7
VEH ENTERING LUNAR UMBRA	5	8	27	31.1				
					0	0	46	4.3
VEH ENTERING LUNAR PENUMBRA	5	9	13	35.4				
					0	0	0	10.2
VEH ENTERING SUNLIGHT	5	9	13	45.6				
					0	1	12	1.5
VEH ENTERING LUNAR PENUMBRA	5	10	25	47.1				
					0	0	0	10.6
VEH ENTERING LUNAR UMBRA	5	10	25	57.7				
					0	0	46	11.1
VEH ENTERING LUNAR PENUMBRA	5	11	12	8.8				
					0	0	0	10.4
VEH ENTERING SUNLIGHT	5	11	12	19.2				
					0	1	11	54.9
VEH ENTERING LUNAR PENUMBRA	5	12	24	14.1				
					0	0	0	14.1
VEH ENTERING LUNAR UMBRA	5	12	24	28.2				
					0	0	46	7.5
VEH ENTERING LUNAR PENUMBRA	5	13	10	35.7				
					0	0	0	10.8
VEH ENTERING SUNLIGHT	5	13	10	46.5				
					0	1	12	1.6
VEH ENTERING LUNAR PENUMBRA	5	14	22	48.2				
					0	0	0	10.8
VEH ENTERING LUNAR UMBRA	5	14	22	59.0				
					0	0	46	12.7
VEH ENTERING LUNAR PENUMBRA	5	15	9	11.7				
					0	0	0	9.3
VEH ENTERING SUNLIGHT	5	15	9	20.9				
					0	1	11	51.4
VEH ENTERING LUNAR PENUMBRA	5	16	21	11.4				
					0	0	0	15.6
VEH ENTERING LUNAR UMBRA	5	16	21	27.0				
					0	0	46	10.3
VEH ENTERING LUNAR PENUMBRA	5	17	7	37.3				
					0	0	0	10.7
VEH ENTERING SUNLIGHT	5	17	7	48.0				

LIGHTING CONDITION FOR VEH 1

18 MAY 69 UPDATE 72.1 TEI 80 TO ENTRY

VEH IN SUN LIGHT AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING EARTH PENUMBRA	7	23	21	10.5				
					0	0	0	18.2
VEH ENTERING EARTH UMBRA	7	23	21	28.7				

LIGHTING CONDITION FOR VEH 1

18 MAY 69 APS BURN TO DEPLETION

VEH INLUNAR UMBRA AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING LUNAR PENUMBRA	4	13	28	42.7				
					0	0	0	44.3
VEH ENTERING SUNLIGHT	4	13	29	27.0				

TABLE 2.0-IX. - MISSION SHADOW TIMELINE - Concluded

(b) LM

LIGHTING CONDITION FOR VEH 2

RENDEZVOUS RADAR TRACKING PRIOR TO DOI •

LUNAR PENUMBRA VEH EN AT PHASE INITIATION	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING LUNAR UMBRA	4	2	49	58.7				

LIGHTING CONDITION FOR VEH 2

RENDEZVOUS RADAR TRACKING PRIOR TO PHASING •

LUNAR PENUMBRA VEH EN AT PHASE INITIATION	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING SUNLIGHT	4	3	36	22.6				

LIGHTING CONDITION FOR VEH 2

COAST TO PHASING BURN •

LUNAR PENUMBRA VEH EN AT PHASE INITIATION	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING LUNAR UMBRA	4	4	41	31.1				

LIGHTING CONDITION FOR VEH 2

COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO INSERTION •

LUNAR PENUMBRA VEH EN AT PHASE INITIATION	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING SUNLIGHT	4	5	28	59.4				

LIGHTING CONDITION FOR VEH 2

COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO CSI •

LUNAR PENUMBRA VEH EN AT PHASE INITIATION	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING LUNAR UMBRA	4	6	47	41.3				

LIGHTING CONDITION FOR VEH 2

COAST TO RENDEZVOUS RADAR TRACKING PRIOR TO CDH •

LUNAR PENUMBRA VEH EN AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING SUNLIGHT	4	7	36	52.9				

LIGHTING CONDITION FOR VEH 2

RENDEZVOUS RADAR TRACKING PRIOR TO TPI •

LUNAR PENUMBRA VEH EN AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING LUNAR UMBRA	4	8	45	42.6				

LIGHTING CONDITION FOR VEH 2

COAST TO 1ST BRAKING GATE •

LUNAR PENUMBRA VEH EN AT PHASE INITIATION

	DAYS	HRS	MINS	SECS	TIME SPENT IN REGION DAYS	HRS	MINS	SECS
VEH ENTERING SUNLIGHT	4	9	32	13.3				

TABLE 5.5-I.- SUMMARY OF EVENTS FROM TLI CUTOFF THROUGH LOX DUMP

Time from TLI ignition[a]	Time from TB-7 sec[b]	Event	ΔV, fps	Comments
	0	Hold cutoff attitude		
	20	Command and hold local horizontal		
	900	Initiate maneuver to separation attitude		
	1200	Freeze separation attitude inertially		Latest time for maneuver to be completed
1800	1500	Begin SC separation/SLA jettison	0.8	
1835	1535	Null 0.3 fps separation rate	.3	-X RCS
1840	1540	Pitch 180° (SC)		1.5/deg/sec
1960	1660	Null pitch Start roll 60°		.5 deg/sec
2080	1780	Null 0.5 fps separation rate and initiate 1 fps closing rate	1.5	+X RCS
2230	1930	Null 1 fps closing rate	1	-X RCS
2235	1935	Begin dock		Estimated worst case dock completed by TLI plus 1.5 hr
5700	5400	LM/CSM undock from S-IVB	1.6	Spring ejection and 5 sec -X RCS
5800	5500	Maneuver to evasive maneuver attitude		Pitch down 75° with respect to local horizontal 0.5 deg/sec rates
6300	6600	Begin SPS evasive maneuver	20	SPS between 1:35 and 1:50 after TLI
7500	7200	Receive ground command to start TB-8		Earliest possible time to initiate TB-8
7505	7205	Start maneuver to LOX dump attitude		Local horizontal attitude pitch = 218° yaw = 0° roll = 180°
8220	7920	Initiate LOX dump	120	

[a]The SC maneuver times will be referenced to TLI ignition, the LV maneuvers to TB-7.

[b]The times of the SC maneuvers referenced to TB-7 (column 2) are approximate and based on a 300-second TLI burn time. These times will change as TLI burn time changes.

TABLE 5.5-II.- TARGET LOADS FOR EVASIVE MANEUVER

[Propulsion system: SPS, guidance: external ΔV]

(a) Target

t_{IG}, hr:min:sec, g.e.t.	4:28:47.6
ΔV_x, fps	5.1
ΔV_y, fps	0.0
ΔV_z, fps	19.0
Weight, lb	94 575.6

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} = \begin{bmatrix} -0.80333905 & 0.53013974 & 0.27128992 \\ 0.077586234 & 0.54483762 & -0.83494450 \\ -0.59044622 & -0.64969517 & -0.47882089 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{ MNBY}$$

(c) Gimbal angles at t_{IG}

IGA, deg	163.3
MGA, deg	0.1
OGA, deg	-179.3

TABLE 5.6-I.- TARGET LOADS FOR MIDCOURSE MANEUVER

[Propulsion system: SPS, guidance: external ΔV]

(a) Target

t_{IG}, hr:min:sec, g.e.t.	9:38:46.4
ΔV_x, fps	-42.9
ΔV_y, fps	10.5
ΔV_z, fps	-36.0
Weight, lb	94 391.8

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} = \begin{bmatrix} -0.80333905 & 0.53013974 & 0.27128992 \\ 0.077586234 & 0.54483762 & -0.83494450 \\ -0.59044622 & -0.64969517 & -0.47882089 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{ MNBY}$$

(c) Gimbal angles at t_{IG}

IGA, deg	3.2
MGA, deg	10.5
OGA, deg	7.1

TABLE 5.7-I.- TARGET LOAD FOR LOI-1

[Propulsion system: SPS, guidance: external ΔV]

(a) Target

t_{IG}, hr:min:sec, g.e.t.	75:45:43.2
ΔV_X, fps	-2912.9
ΔV_Y, fps	-587.5
ΔV_Z, fps	-201.0
Weight, lb	92 427.9

(b) REFSMMAT

$$\begin{bmatrix} 0.95054742 & -0.29246010 & -0.10453090 \\ -0.016754900 & -0.38436490 & 0.92302923 \\ -0.31012720 & -0.87563160 & -0.3702572 \end{bmatrix}$$

(c) Gimbal angles at t_{IG}

IGA, deg	-128.4
MGA, deg	-19.5
OGA, deg	-3.7

TABLE 5.8-I.- TARGET LOAD FOR LOI-2

[Propulsion system: SPS, guidance: external ΔV]

(a) Target

t_{IG}, hr:min:sec, g.e.t.	80:10:45.5
ΔV_X, fps	-138.5
ΔV_Y, fps	0.0
ΔV_Z, fps	0.0
Weight, lb	68 821.3

(b) REFSMMAT

$$\begin{bmatrix} 0.95054742 & -0.29246010 & -0.10453090 \\ -0.016754900 & -0.38436490 & 0.92302923 \\ -0.31012720 & -0.87563160 & -0.3702572 \end{bmatrix}$$

(c) Gimbal angles at t_{IG}

IGA, deg	-138.5
MGA, deg	-2.4
OGA, deg	0.1

TABLE 5.10-I.- TARGET LOADS FOR LM SEPARATION MANEUVER

[Propulsion system: SM RCS]

(a) Target

t_{IG}, hr:min:sec, g.e.t.	98:35:15.6
ΔV_x, fps	0.0
ΔV_y, fps	0.0
ΔV_z, fps	2.5
Weight, lb	36 484.4

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} = \begin{bmatrix} 0.95054742 & -0.29246010 & -0.10453090 \\ -0.016754900 & -0.38436490 & 0.92302923 \\ -0.31012720 & -0.87563160 & -0.3702572 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix}_{MNBY}$$

(c) Gimbal angles at t_{IG}

IGA, deg	-165.8
MGA, deg	0.0
OGA, deg	0.0

TABLE 5.11-I.- RENDEZVOUS SEQUENCE OF EVENTS

Event	Time of ignition, hr:min:sec, g.e.t.	Δt from previous maneuver, min	Main propulsion system	ΔV, fps	Burn duration, sec	Yaw from velocity vector, deg	Pitch from local horizontal, deg	RCS thruster usage	h_a/h_p, n. mi.	Longitude of burn ignition, deg E
DOI	99:33:57.0	58.7	DPS 15 sec @ 10% 14.9 sec @ 40%	71.1	29.9	180.0	0.4	+X, 2-jet	59.4/8.2	220.3
Phasing	100:46:21	72.4	DPS 26 sec @ 10% 20 sec @ 92.5%	195.6	45.3	0.0	28.8	+X. 2-jet	194.0/9.1	348.7
LM ascent descent } staging	102:33:19	117.0	RCS	2.0	9.4	0.0	180.0	+X, 2-jet	195.9/9.3	52.8
LM ascent sep } staging	102:33:28	0.2	RCS	2.0	2.6	0.0	180.0	+X, 2-jet	194.4/9.2	52.3
Insertion	102:43:18	9.8	APS	206.9	15.4	180.0	24.3	+X, 2-jet	44.9/8.5	19.0
CSI	103:33:46	50.5	RCS	50.5	32.2	0.0	-0.1	+X, 4-jet	44.9/44.3	218.0
CDH	104:31:42	57.9	RCS	3.4	2.2	0.3	76.9	+Z, 2-jet	44.9/43.8	37.5
TPI	105:08:57	37.3	RCS	25.4	16.1	0.2	26.9	+X, 4-jet	61.8/43.8	281.3
First braking	105:50:14	41.3	RCS	11.9	15.1	-0.4	-149.9	-Z, 2-jet	60.8/49.5	153.9
Second braking	105:51:27	1.2	RCS	9.7	12.3	-0.4	-143.3	-Z, 2-jet	60.4/54.2	150.2
Third braking	105:53:05	1.6	RCS	4.8	6.0	-0.3	-138.5	-Z, 2-jet	60.2/56.7	145.2
Fourth braking	105:54:24	1.3	RCS	4.6	5.9	-0.3	-133.8	-Z, 2-jet	60.1/59.3	141.2

TABLE 5.11-II.- TARGET LOADS FOR DOI MANEUVER

[Propulsion system: LM DPS]

(a) Target

t_{IG}, hr:min:sec, g.e.t.	99:33:56.8
ΔV_x, fps	-71.08
ΔV_y, fps	0.00
ΔV_z, fps	-0.27
Weight, lb	31 302.0

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} = \begin{bmatrix} 0.950547419 & -0.292460099 & -0.104530900 \\ -0.0167548999 & -0.384364899 & 0.923029229 \\ -0.310127199 & -0.875631601 & -0.370257199 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \quad \text{MNBY}$$

(c) Gimbal angles at t_{IG}

IGA, deg	285.7
MGA, deg	0.4
OGA, deg	171.4

TABLE 5.11-III.- TARGET LOADS FOR PHASING MANEUVER

[Propulsion system: LM DPS]

(a) Target

T_{ig}, hr:min:sec, g.e.t.	100:46:20.9
ΔV_x, fps	170.48
ΔV_y, fps	0.02
ΔV_z, fps	-95.80
Weight, lb	31 069.9

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} \begin{bmatrix} 0.950547419 & -0.292460099 & -0.104530900 \\ -0.0167548999 & -0.384364899 & 0.923029229 \\ -0.310127199 & -0.875631601 & -0.370257199 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{MNBY}$$

(c) Gimbal Angles at T_{ig}

IGA, deg	263.9
MGA, deg	3.5
OGA, deg	352.2

TABLE 5.11-IV.- TARGET LOADS FOR INSERTION MANEUVER

[Propulsion system: LM APS]

(a) Target

T_{ig}, hr:min:sec, g.e.t.	102:43:17.8
ΔV_x, fps	-189.27
ΔV_y, fps	0.11
ΔV_z, fps	-83.58
Weight, lb	8416.3

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} \begin{bmatrix} 0.950547419 & -0.292460099 & -0.104530900 \\ -0.0167548999 & -0.384364899 & 0.923029229 \\ -0.310127199 & -0.875631601 & -0.370257199 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{ MNBY}$$

(c) Gimbal Angles at T_{ig}

IGA, deg	62.2
MGA, deg	353.9
OGA, deg	186.0

TABLE 5.11-V.- TARGET LOADS FOR CSI MANEUVER

[Propulsion system: LM RCS]

(a) Target

T_{ig}, hr:min:sec, g.e.t.	103:33:46.0
ΔV_x, fps	50.49
ΔV_y, fps	0.01
ΔV_z, fps	-0.66
Weight, lb	8242.9

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} \begin{bmatrix} 0.950547419 & -0.292460099 & -0.104530900 \\ -0.0167548999 & -0.384364899 & 0.923029229 \\ -0.310127199 & -0.875631601 & -0.370257199 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{MNBY}$$

(c) Gimbal Angles at T_{ig}

IGA, deg	105.9
MGA, deg	359.7
OGA, deg	8.6

TABLE 5.11-VI.- TARGET LOADS FOR CDH MANEUVER

[Propulsion system: LM RCS]

(a) Target

T_{ig}, hr:min:sec, g.e.t.	104:31:42.4
ΔV_x, fps	-.77
ΔV_y, fps	+0.00
ΔV_z, fps	3.35
Weight, lb	8196.9

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} \begin{bmatrix} 0.950547419 & -0.292460099 & -0.104530900 \\ -0.0167548999 & -0.384364899 & 0.923029229 \\ -0.310127199 & -0.875631601 & -0.370257199 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{MNBY}$$

(c) Gimbal Angles at T_{ig}

IGA, deg	2.9
MGA, deg	351.8
OGA, deg	357.5

TABLE 5.11-VII.- TARGET LOADS FOR TPI MANEUVER

[Propulsion system: LM RCS]

(a) Target

T_{ig}, hr:min:sec, g.e.t.	105:08:59.6
ΔV_x, fps	22.12
ΔV_y, fps	0.05
ΔV_z, fps	-11.29
Weight, lb	8193.8

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} \begin{bmatrix} 0.950547419 & -0.292460099 & -0.104530900 \\ -0.0167548999 & -0.384364899 & 0.923029229 \\ -0.310127199 & -0.875631601 & -0.370257199 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{MNBY}$$

(c) Gimbal Angles at T_{ig}

IGA, deg	196.6
MGA, deg	8.7
OGA, deg	0.2

TABLE 5.12-I.- TARGET LOADS FOR SEPARATION MANEUVER FOLLOWING LM JETTISON

[Propulsion system: CSM RCS]

(a) Target

t_{IG}, hr:min:sec, g.e.t.	108:09:23.9
ΔV_x, fps	0.0
ΔV_y, fps	0.0
ΔV_z, fps	-2.0
Weight, lb	36 674.0

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} = \begin{bmatrix} 0.95054742 & -0.29246010 & -0.10453090 \\ -0.016754900 & -0.38436490 & 0.92302923 \\ -0.31012720 & -0.87563160 & -0.3702572 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{ MNBY}$$

(c) Gimbal angles at t_{IG}

IGA, deg	70.3
MGA, deg	0.0
OGA, deg	-180.0

TABLE 5.12-II.- TARGET LOADS FOR APS BURN TO DEPLETION MANEUVER

[Propulsion system: LM APS]

(a) Target

t_{IG}, hr:min:sec, g.e.t.	108:38:56.8
ΔV_x, fps	5000.0
ΔV_y, fps	0.0
ΔV_z, fps	0.0
Weight, lb	7600.0

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} = \begin{bmatrix} 0.95054742 & -0.29246010 & -0.10453090 \\ -0.016754900 & -0.38436490 & 0.92302923 \\ -0.31012720 & -0.87563160 & -0.3702572 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{ MNBY}$$

(c) Gimbal angles at t_{IG}

IGA, deg	-109.3
MGA, deg	0.0
OGA, deg	180.0

TABLE 5.14-I.- TARGET LOAD FOR TEI

[Propulsion system: SPS, guidance: external ΔV]

(a) Target

t_{IG}, hr:min:sec, g.e.t.	137:20:22.4
ΔV_X, fps	3618.1
ΔV_Y, fps	-34.8
ΔV_Z, fps	176.4
Weight, lb	37 858

(b) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} \begin{bmatrix} 0.95054742 & -0.29246011 & -0.10453089 \\ -0.016754881 & -0.38436482 & 0.92302924 \\ -0.31012722 & -0.87563165 & -0.37025712 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{ MNBY}$$

(c) Gimbal angles at t_{IG}

IGA, deg	52.4
MGA, deg	-0.2
OGA, deg	180.0

TABLE 5.16-I.- ENTRY EVENTS SEQUENCE

Event	Time from lift-off, hr:min:sec	Time from 400 000 ft, min:sec
Entry	191:50:32	0:00
Enter S-band communication blackout	191:50:52	0:18
Enter C-band communication blackout, load factor = 0.05 g	191:51:00	0:28
Maximum heating rate	191:51:40	1:08
Guidance initiate at R-DOT = -700 fps	191:51:50	1:18
Maximum load factor (FIRST)	191:51:54	1:22
Exit C-band communication blackout	191:53:28	2:56
Exit S-band communication blackout	191:53:56	3:24
Maximum load factor (SECOND)	191:56:04	5:32
Termination of CMC guidance	191:57:46	7:14
Drogues parachute deployment	191:58:45	8:12
Main parachutes deployment	191:59:32	9:00
Splashdown	192:04:27	13:55

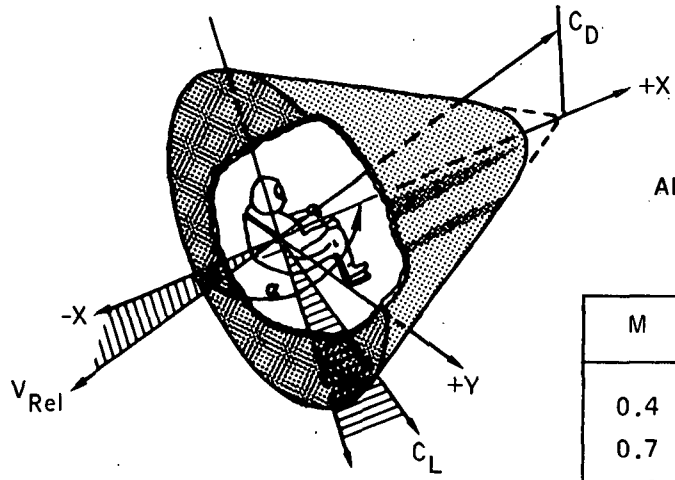
TABLE 5.16-II.- COMMAND MODULE MASS PROPERTIES

CM weight	
Entry, lb	12 123.4
Main chute deployment, lb	11 562.6
Splashdown, lb	10 900.4
Center of gravity in Apollo coordinate system	
X_A, in.	1040.8
Y_A, in.	-0.2
Z_A, in.	5.8
Moment of inertia	
I_{XX}, slug-ft^2	5821
I_{YY}, slug-ft^2	4838
I_{ZZ}, slug-ft^2	4396
Product of inertia	
I_{XY}, slug-ft^2	42
I_{XZ}, slug-ft^2	-422
I_{YZ}, slug-ft^2	6

TABLE 5.16-III.- CONDITIONS AT ENTRY INTERFACE AND TARGET POINT

Elapsed time from launch, hr:min:sec	191:50:32
Inertial velocity, fps	36 309
Inertial flight-path angle, deg	-6.52
Inertial azimuth, deg	73.807
Spacecraft geodetic latitude, deg S	22.70
Spacecraft longitude, deg E	173.82
Altitude, ft	399 817
Target geodetic latitude, deg S	15.11
Target longitude, deg W	165

TABLE 5.16-IV.- COMMAND MODULE AERODYNAMIC COEFFICIENTS



AERODYNAMIC COEFFICIENTS AT TRIM ANGLE OF ATTACK
AS A FUNCTION OF MACH NUMBER

M	α, deg	C_L	C_D	L/D
0.4	167.62	0.23441	0.85474	0.27425
0.7	165.02	0.25614	0.98913	0.25896
0.9	162.34	0.31167	1.0702	0.29122
1.1	155.73	0.48022	1.1799	0.40699
1.2	155.89	0.46668	1.1652	0.40050
1.35	154.74	0.54926	1.2876	0.42657
1.65	153.94	0.54054	1.2747	0.42406
2.0	153.91	0.52543	1.2867	0.40836
2.4	154.45	0.49953	1.2567	0.39749
3.0	154.90	0.47141	1.2329	0.38235
4.0	156.80	0.43384	1.2273	0.35350
10.0	157.43	0.42127	1.2375	0.34044
29.5	160.72	0.37871	1.3017	0.29093

Center of gravity location in body coordinates

X_{cg} = 1040.8 in.

Y_{cg} = -0.2 in.

Z_{cg} = 5.8 in.

TABLE 5.16-V.- ENTRY REFSMMAT AND GIMBAL ANGLES AT EI

(a) REFSMMAT

$$\begin{bmatrix} X_{SM} \\ Y_{SM} \\ Z_{SM} \end{bmatrix} = \begin{bmatrix} .82559312 & .50208553 & .25749975 \\ -.0045019047 & .46219119 & -.88676888 \\ -.56424794 & .73095105 & .38384221 \end{bmatrix} \begin{bmatrix} X_I \\ Y_I \\ Z_I \end{bmatrix} \text{ MNBY}$$

(b) Gimbal angles

IGA, deg	156
MGA, deg	0
OGA, deg	0

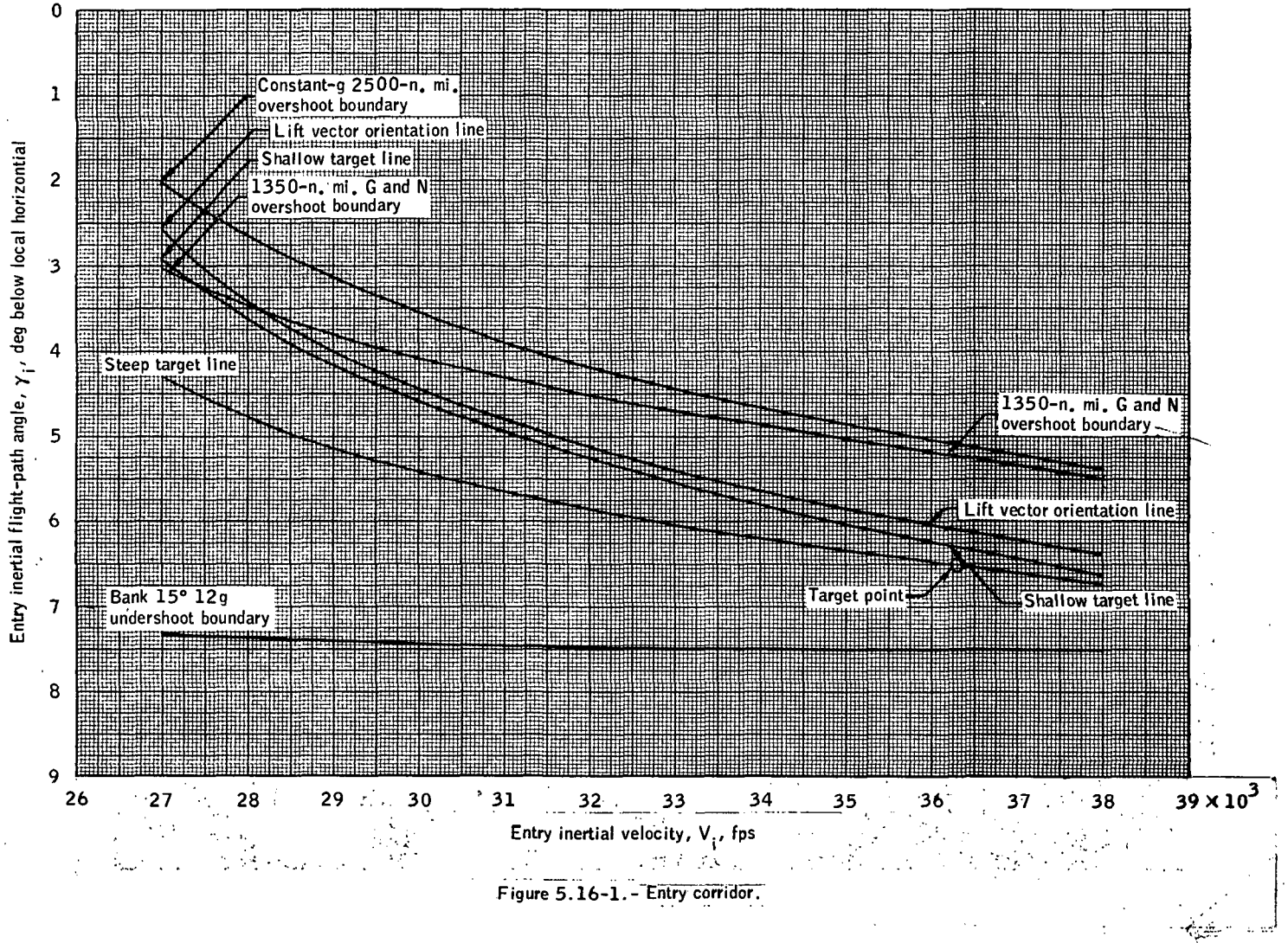


Figure 5.16-1.- Entry corridor.

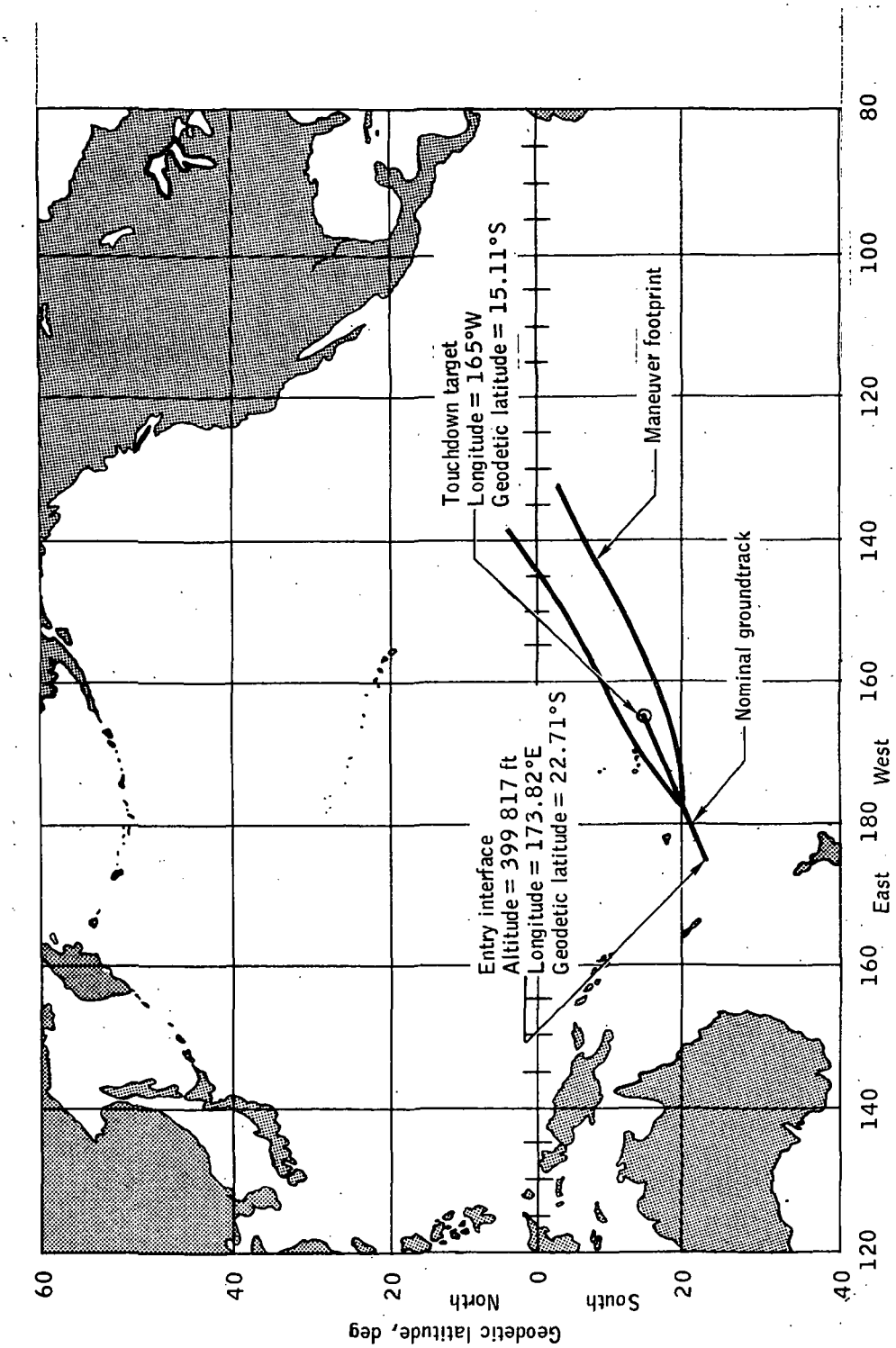


Figure 5.16-2.- Maneuver footprint and nominal ground track.

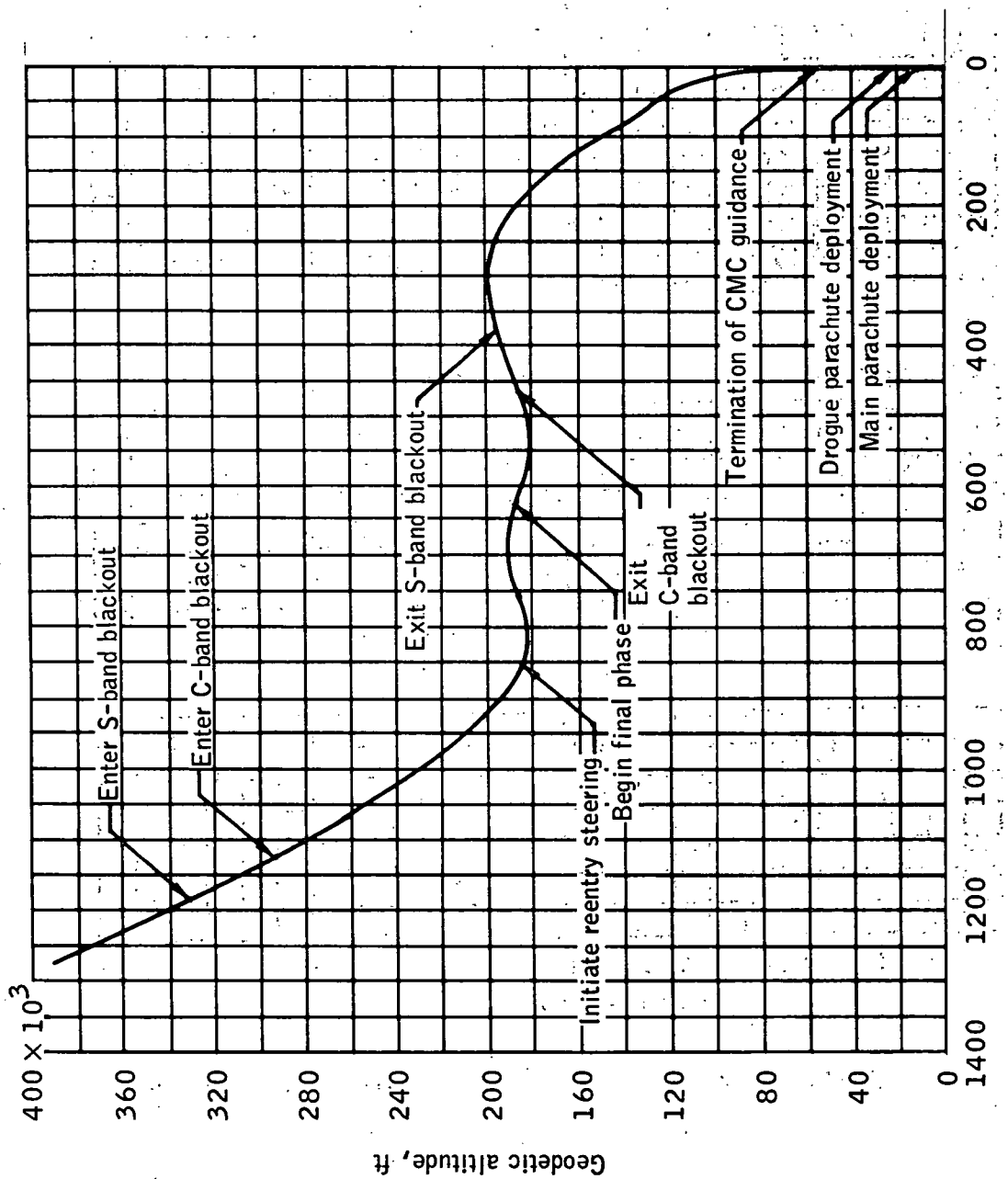


Figure 5.16-3.- Altitude versus range to go.

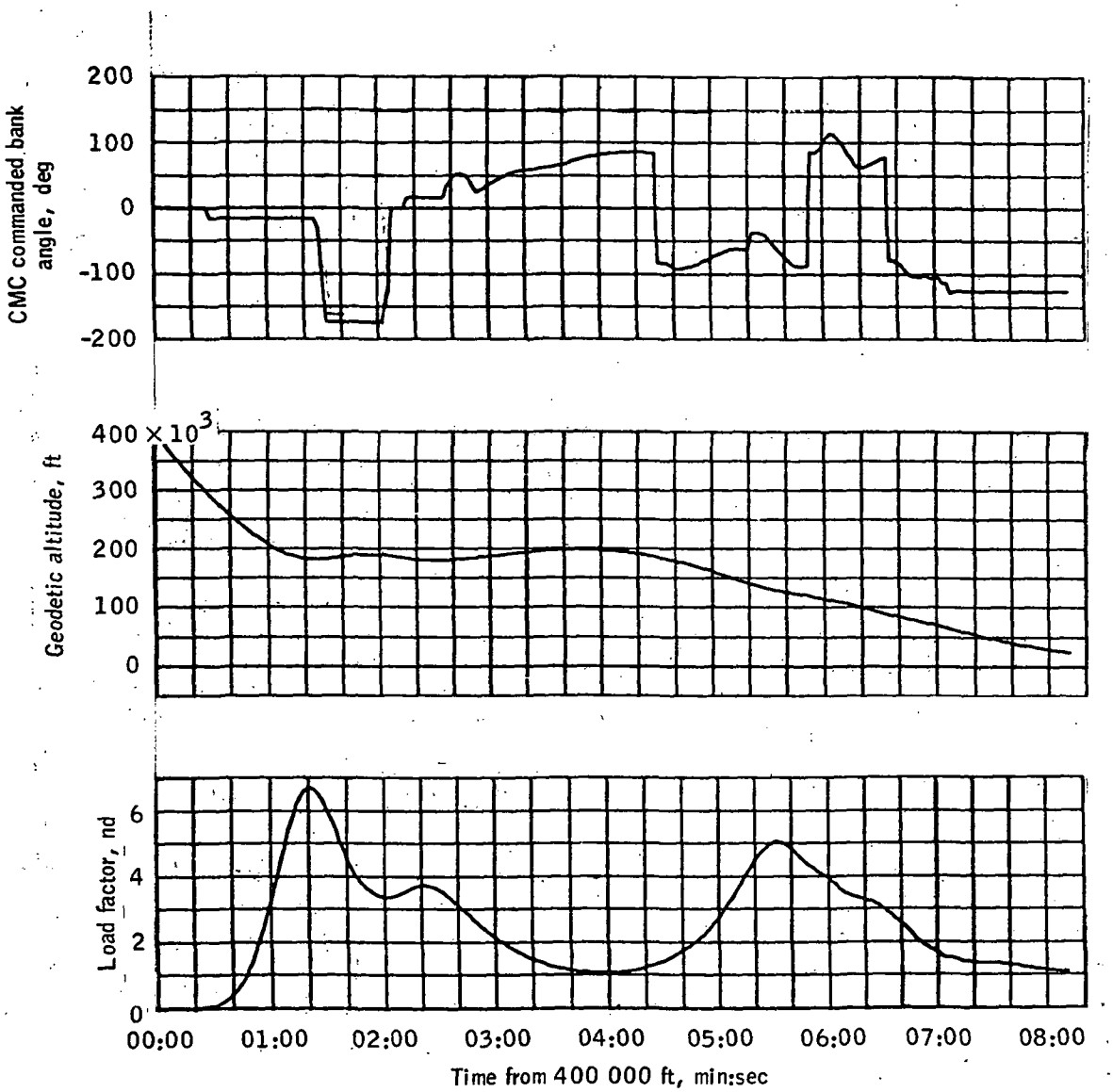


Figure 5.16-4.- CMC commanded bank angle, altitude, and load factor time histories.

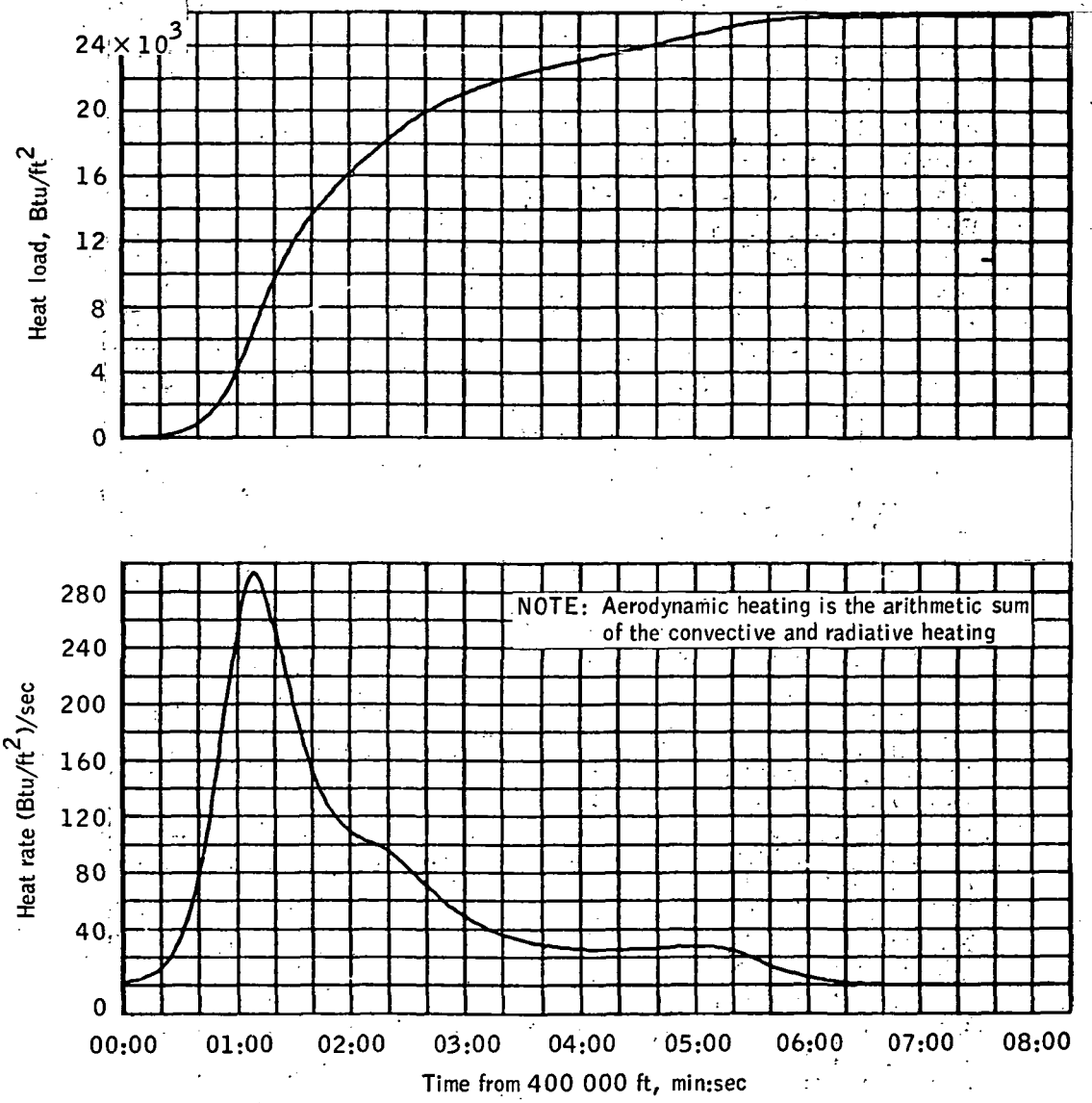
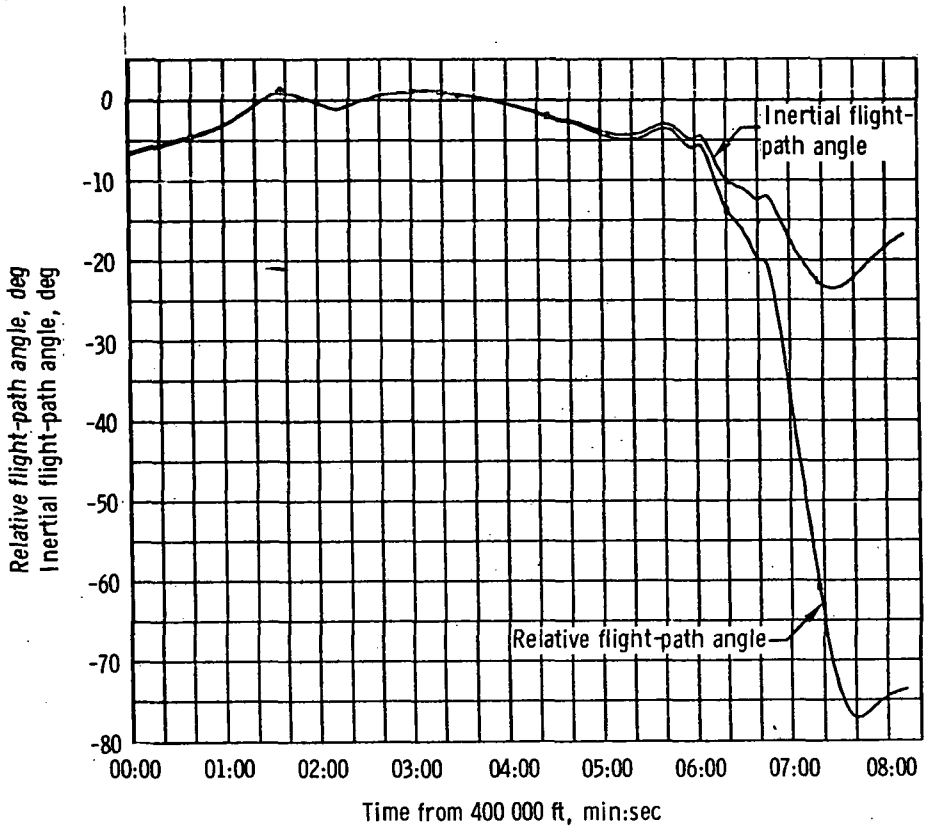
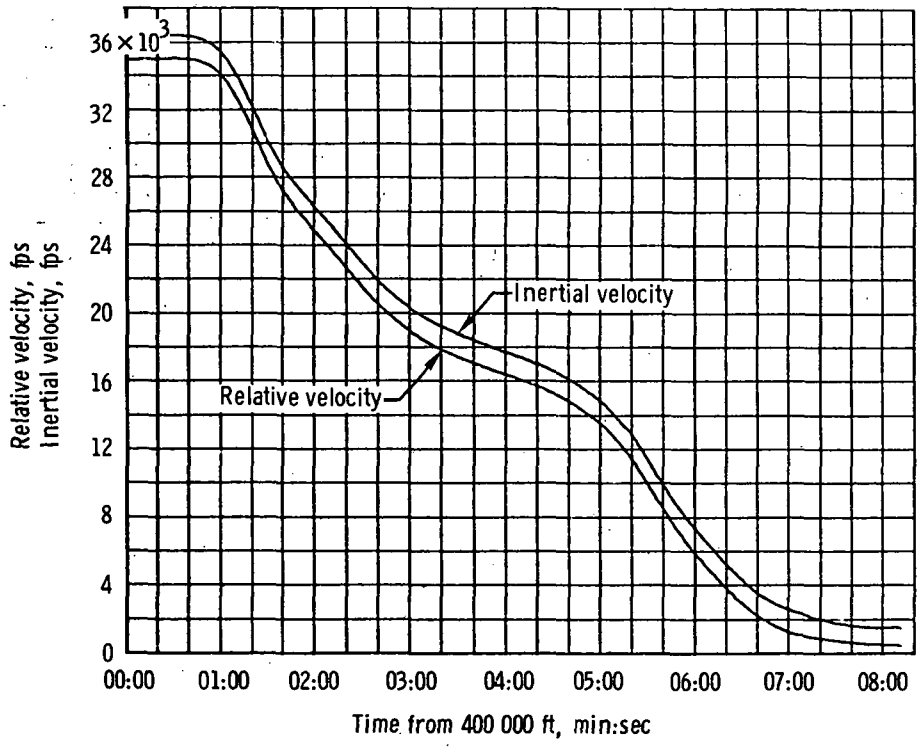


Figure 5.16-5.- Total aerodynamic heating rate and heat load time histories.



(a) Relative and inertial flight-path angle.



(b) Relative and inertial velocity.

Figure 5. 16-6. - Entry velocity and flight-path angle time histories.

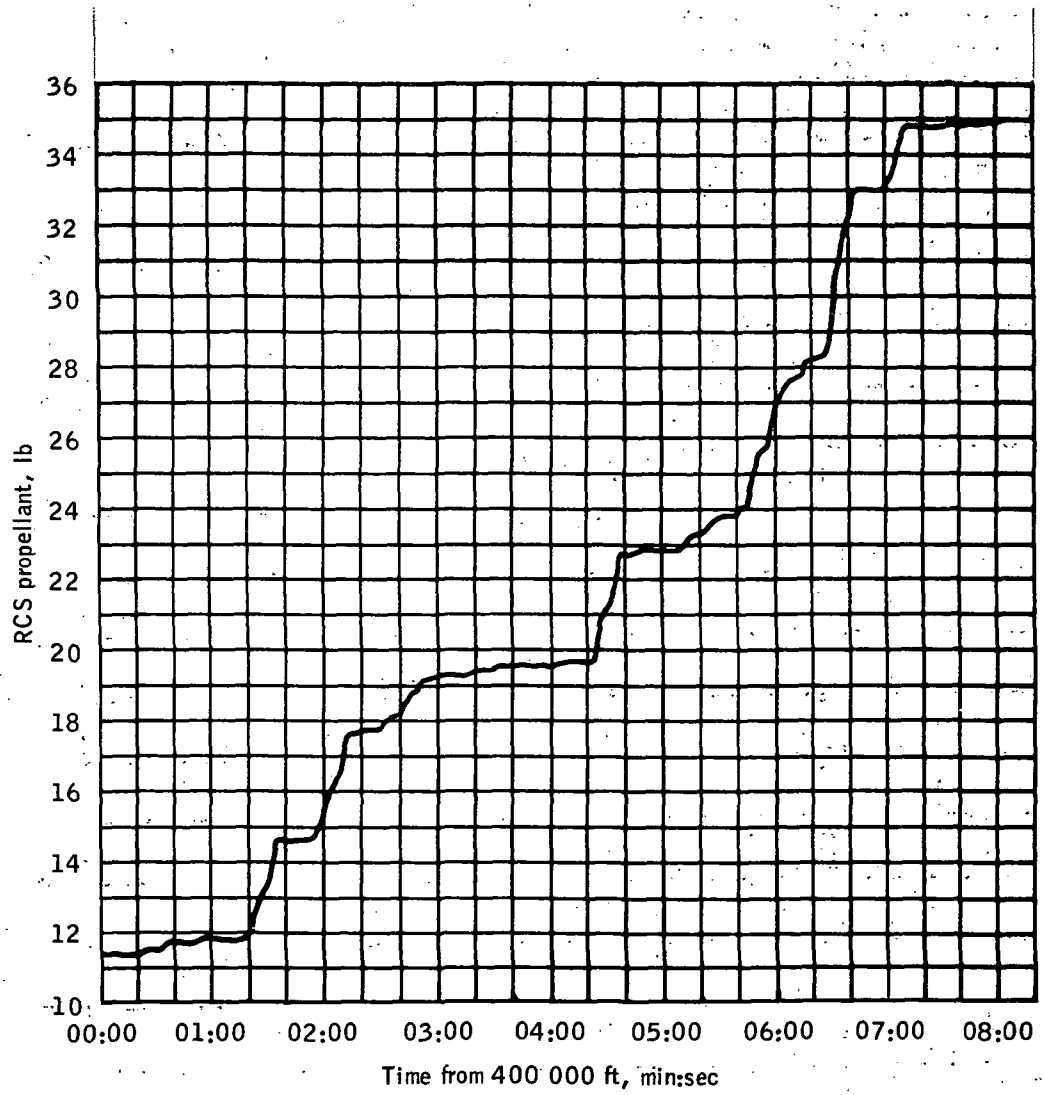


Figure 5.16-7.- Total propellant consumed from separation.

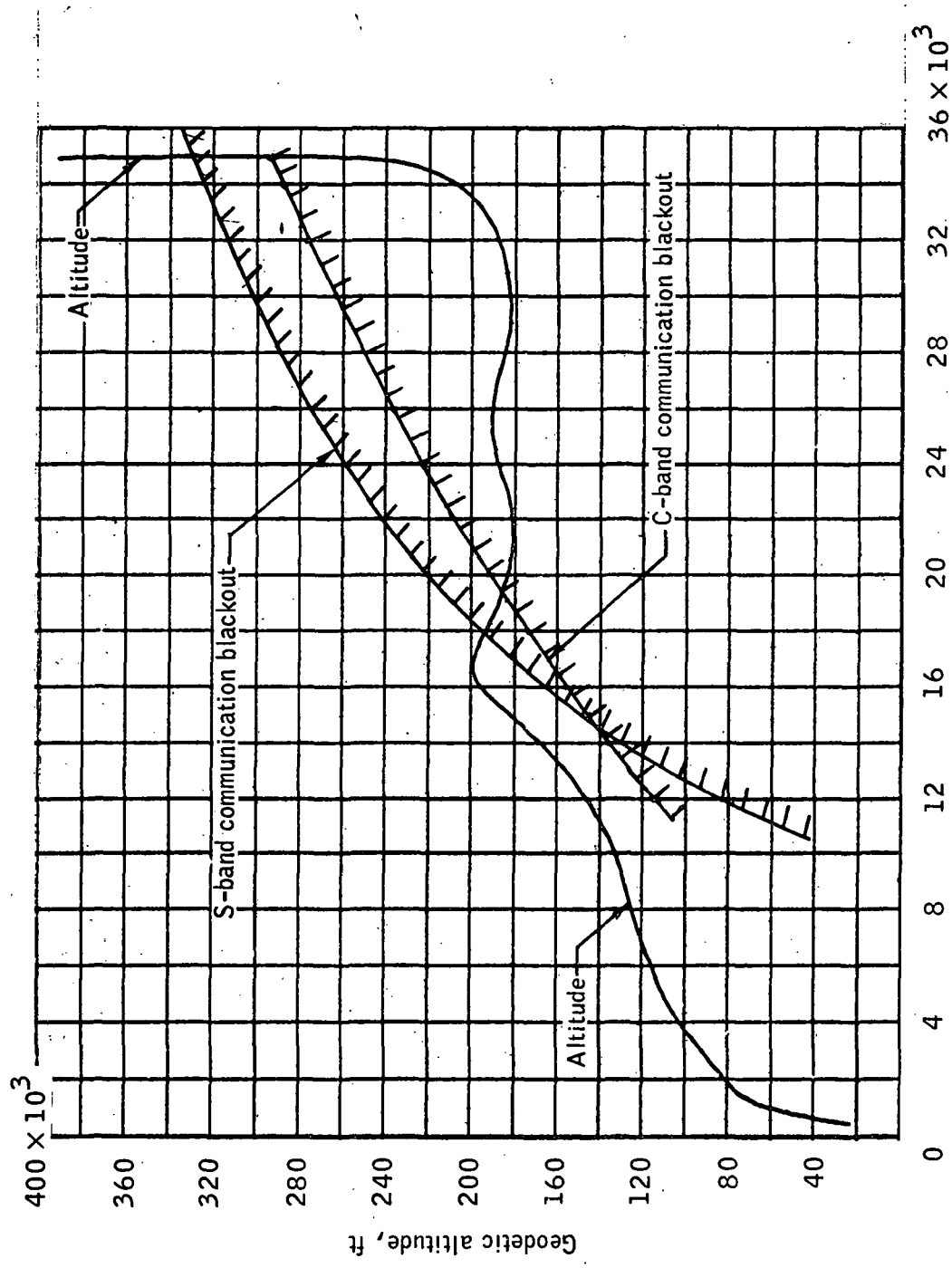


Figure 5.16-8.- Communications blackout.

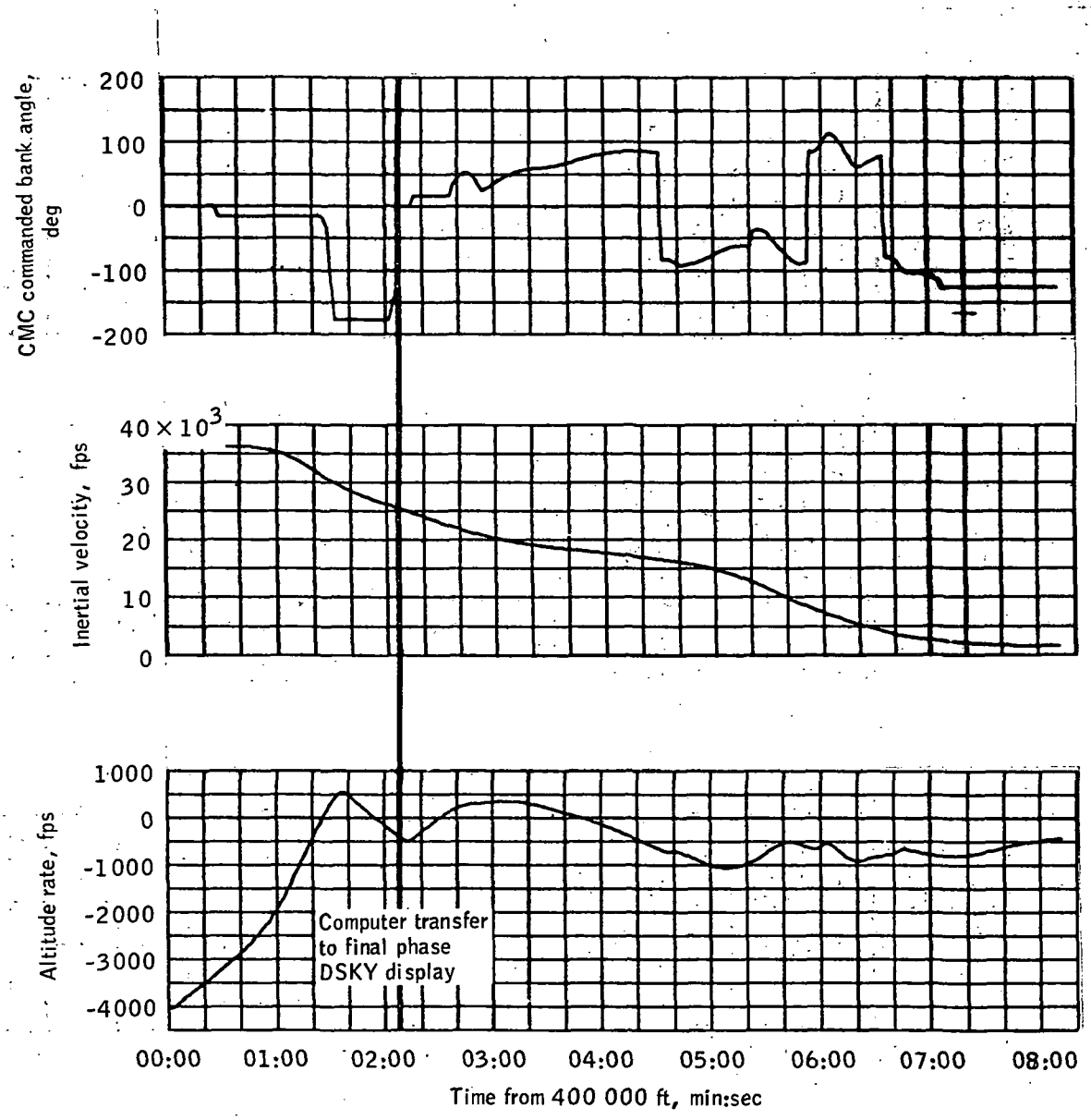


Figure 5.16-9.- Primary DSKY display, VERB 06 NOUN 68.

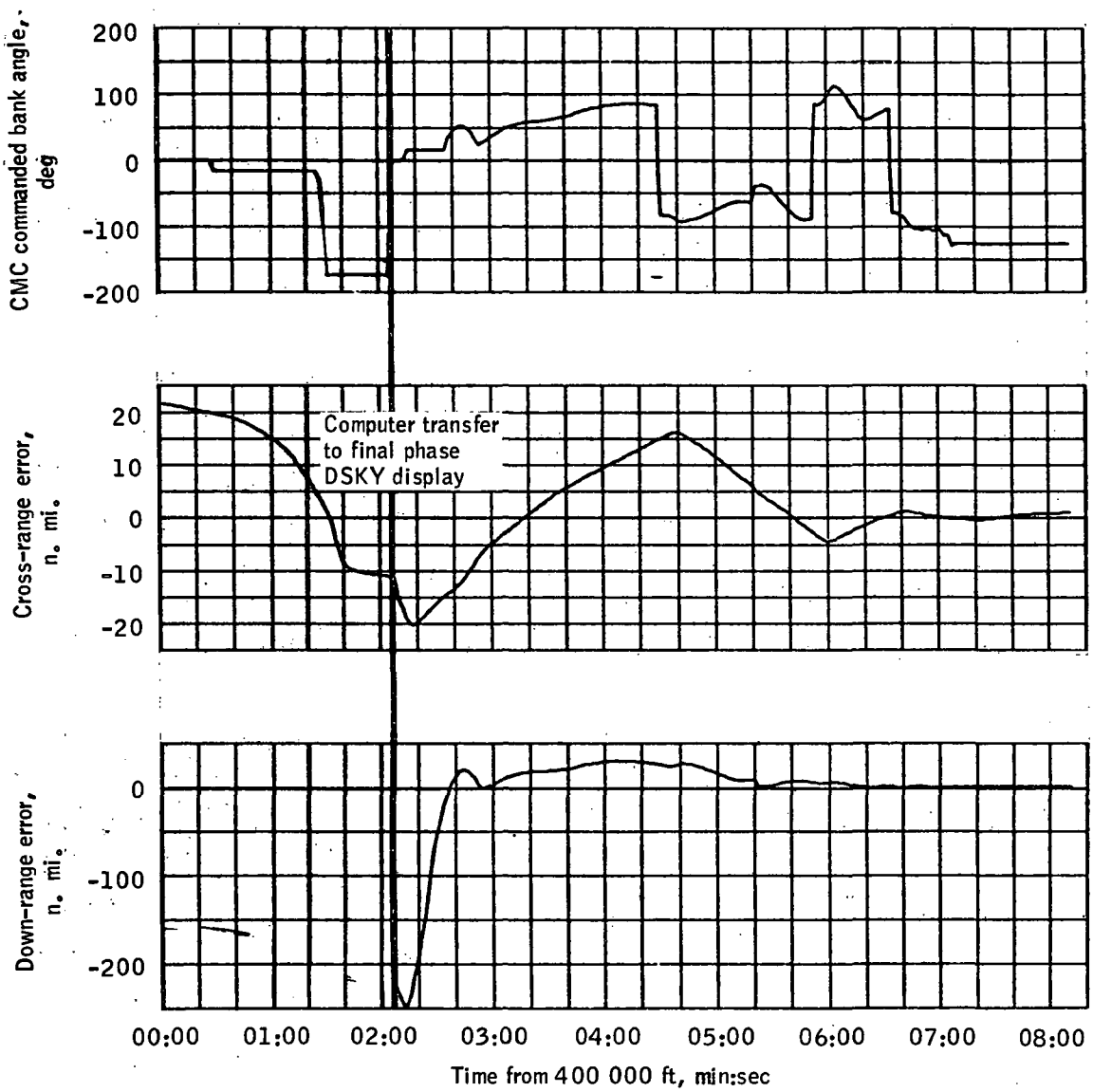


Figure 5.16-10.- DSKY displays (final phase), VERB 06 NOUN 66.

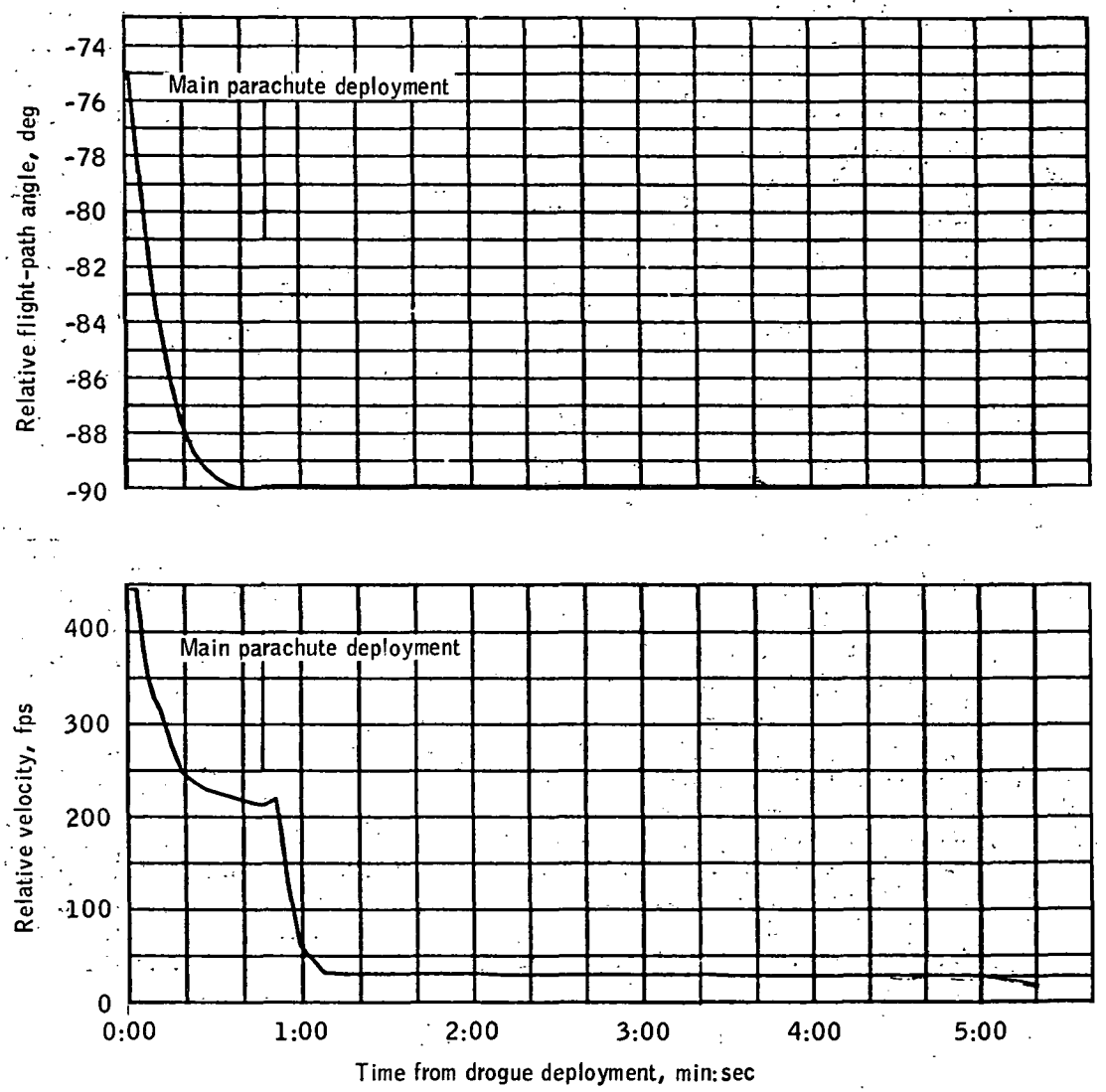


Figure 5.16-11.- Relative velocity and relative flight-path angle time histories from drogue parachute deployment.

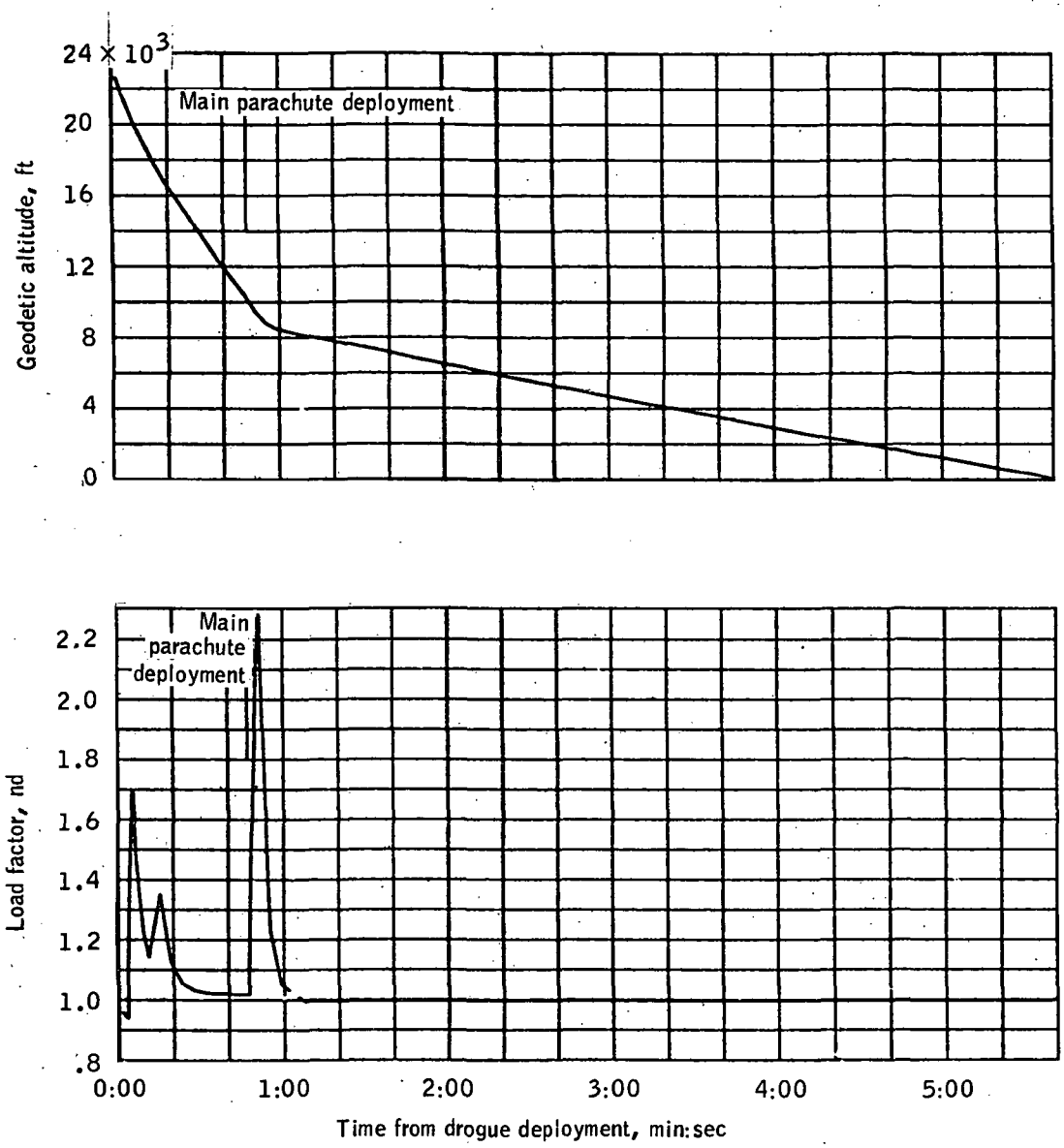
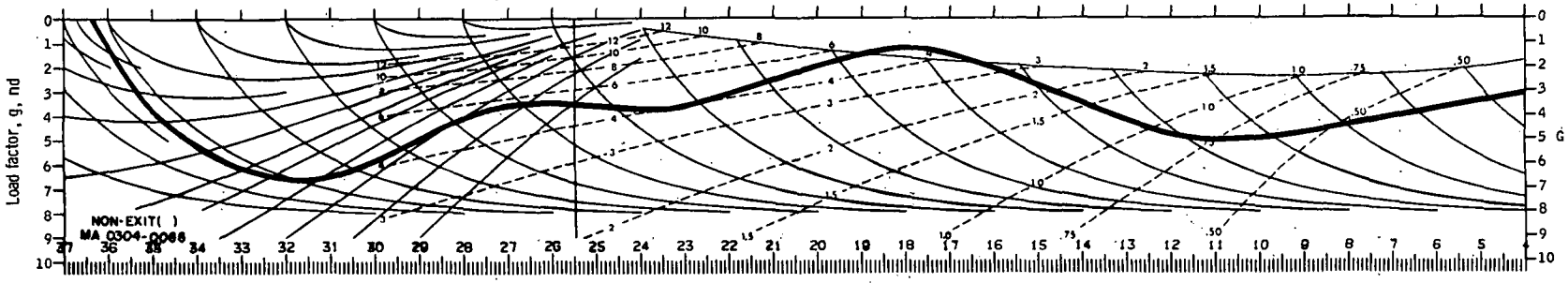
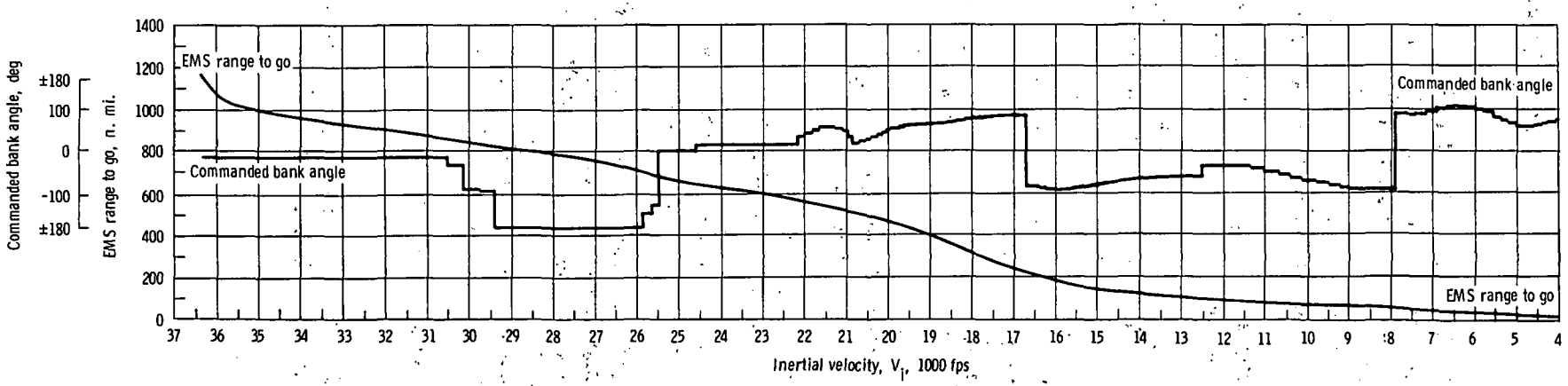


Figure 5.16-12.- Altitude and load factor time histories from drogue parachute deployment.



(a) Load factor versus inertial velocity.



(b) CMC commanded bank angle and EMS range to go versus inertial velocity.

Figure 5.16-13.- EMS parameters.

REFERENCES

1. Brewer, B. A.; and Vick, M. B.: TLI Ship Positioning and Coverage Data for Apollo Mission F Lunar Launch Opportunities for May 1969. MSC IN 69-FM-56, March 5, 1969.

2. Saturn V AS-505 Launch Vehicle Operational Flight Trajectory. Preliminary report 5-9640-H-205, February 17, 1969.

3. Preliminary Apollo 10 (F) Mission Operational Trajectory Simulation Data. MSC memo 69-FM13-45, January 30, 1969.

4. Apollo Mission Techniques Missions F and G Translunar Midcourse Corrections and Lunar Orbit Insertion. S-PA-9T-41, February 17, 1969.

5. F/G Cislunar Midcourse Correction Mission Techniques. 69-PA-T-18A, February 6, 1969.

6. RTCC Requirements: Revised S-Band Communication Blackout Data for Apollo F and Subsequent Missions. MSC memo 69-FM23-43, February 26, 1969.

7. CSM/LM Spacecraft Operational Data Book, Volume I - CSM Data Book. SNA-8-D-027 (Amendments 1-69 and 2-77), January 21, 1969.

8. Ried, Robert C., Jr.: Apollo Command Module Enter Air Radiation Heating Rate. MSC memo ES5/1-2/67, January 9, 1968.

9. Heating Rate Factors for Reentry Studies. MSC memo ES5/9-11/173M, September 14, 1967.

10. MIT: Guidance System Operations Plan for Manned CM Earth Orbital and Lunar Missions Using Program COLOSSUS, Section 5, Guidance Equations, Revision 5. R577, March 1969.

11. Tolin, J. W., Jr.: RTCC Requirements for Missions F and G Reentry Phase. MSC IN 69-FM-28, February 6, 1969.

12. United States Weather Bureau: U. S. Standard Atmosphere, 1962. December 1962.

13. CSM/LM Spacecraft Operational Data Book, Volume III - Mass Properties. SNA-8-D-027 (Amendment 35), January 20, 1969.